Impact of Covid-19 on Stock Markets: Evidence from Global Contagion

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Abstract

We investigate the impact of Covid-19 pandemic and the subsequent government policy responses on international stock market contagion. Local infection and mortality rates increase the likelihood of contagion, mortality rates demonstrating a greater impact. Economic support policies mitigate stock market contagion, yet their effects vary by country in terms of timing and intensity. For developing nations, global infections and deaths have a more substantial effect on the likelihood of contagion, whereas, for advanced nations, local cases exert a stronger influence. Our results guide governments and international policymakers to contain contagion and alleviate the impact of exogenous shocks worldwide.

Keywords: Covid-19, contagion, stock markets

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1. Introduction

We investigate financial contagion during the Covid-19 crisis. Our analysis focuses on the distinct health-related features of the crisis worldwide and their impact on international financial contagion. We examine the relationship between stock market contagion, infection rates, and government policy responses as channels of contagion unique to the Covid-19 pandemic. We demonstrate how policy responses can mitigate financial contagion during the crisis. Our results are important for government reactions at a fast pace during a financial crisis triggered by exogenous, completely non-financial events. In the future, whether it is another virus or another disaster of worldwide impact, policy action is important in reducing contagion and containing impact on home economies.

Covid-19 represents a large-scale crisis that negatively affected the lives of millions of people across the globe. The spread of the Covid-19 virus was global in nature. This is the first instance of witnessing an economic crisis of such a massive scale triggered by a disease outbreak. The global implications of Covid-19 can be assessed by comparing anticipated and actual global output growth for 2020. The International Monetary Fund (IMF) projected global output growth of 3.4% for 2020 prior to Covid-19, while the actual figure turned out to be a negative 3.5% (refer to the World Economic Outlook, 2020 report by the IMF). During the Covid-19 crisis, global stock markets promptly reflected these expectations and encountered negative return shocks. Although the Covid-19 crisis was distinctive compared to other crises, this sudden decline in stock markets was reminiscent of declines seen during past crises. The world has witnessed similar global stock market crashes, including the 1994 Mexican devaluation, the 1997 Asian crisis, and the Global Financial Crisis from 2007 to 2009, among others (Bekaert et al., 2014; Forbes and Rigobon, 2001, 2002; King and Wadhwani, 1990). These global financial crashes have shifted the focus of literature towards understanding and explaining this phenomenon and its transmission mechanisms. Consequently, the term ‘contagion’, typically referring to financial contagion, has become a central point of analysis. Previous literature defines contagion in various ways. Forbes and Rigobon (2001, 2002) and Claessens et al. (2001) describe ‘contagion’ as a significant increase in market linkages between countries following a shock to a country or a group of countries.

Bekaert et al. (2014) assert that any excess co-movement between international stock markets during shocks and crises, which cannot be explained by the links that existed during stable periods, is termed contagion.

The Covid-19 pandemic serves as a recent example of how international stock markets faced sharp declines in returns. As the virus took firm hold in more regions around the world, detrimental consequences manifested globally. In March 2020, the United States stock market triggered its circuit breaker mechanism multiple times, and on March 12, 2020, the FTSE 100 Index—the primary stock market index for the UK—decreased by more than 10%. By March 18, the DAX and Nikkei, Germany's and Japan's broad-based indices, had also declined by 38% and 29% year-to-date, respectively. Although, financial sector helped provide liquidity to the nonfinancial sector (Erel and Inozemtzev, 2024) significant declines were observed in nearly all stock markets globally, suggesting a strong likelihood of financial turmoil contagion.

Previous studies have focused on identifying evidence of contagion during various crises (see Bae et al., 2003; Forbes and Rigobon, 2002; King and Wadhwani, 1990) and the channels through which contagion occurs (e.g., Bekaert et al., 2014; Elliott et al., 2014; K. Forbes, 2012; Gârleanu et al., 2015; Kyle and Xiong, 2001; Yang and Zhou, 2017). Several characteristics distinguish Covid-19 from earlier crises, which may have acted as distinct channels for transmission. The rapid spread of Covid-19 infections and the resultant fatalities were significant aspects of this crisis that plunged the world into turmoil, threatening not only health and life but also triggering economic and financial distress (Goldstein et al., 2021). Various studies indicate a positive correlation between rising Covid-19 infection rates and financial panic (see Ding et al., 2021; Levine et al., 2021).

A key feature that distinguishes Covid-19 is the nature of the government policies introduced to combat the crisis. The measures undertaken during Covid-19 were unprecedented. Government policy responses can be categorised into two main groups: containment and health policies, which encompass travel restrictions, bans on public gatherings, school closures, social welfare initiatives, contact tracing, and various other interventions to prevent the virus from spreading; and policies focused on addressing the economic impact of these containment strategies, such as debt relief and income support (see Hale et al., 2021).[1] There is substantial variation in governments' policy reactions across countries, both in terms of actions taken and the promptness of their implementation (Hale et al., 2021). Several studies find a positive correlation between the introduction of various government policies during Covid-19 and overall investor confidence and liquidity in different financial markets (see Caballero and Simsek, 2021; Ding et al., 2021; Haddad et al., 2021; Kargar et al., 2021). While some studies investigate the local spillovers between SMEs and large firms (Ayyagari et al., 2025) and across companies (Huang et.al., 2022) during the Covid-19 crisis no study, to our knowledge, has examined the relationship between stock market contagion, government policy response, and infection rates while considering these variables as channels of contagion during the Covid-19 pandemic. We aim to analyse how policy responses can mitigate the risk of financial contagion. The premise is that Covid-19 infection rates heightened negative emotions in the markets, while government policies provided a calming effect. Both factors are significant aspects of this crisis, and their impact varies by country in terms of timing and intensity (see Appendices A and B for further details on each variable mentioned). Additionally, we include variables related to fundamentals identified in previous studies to control for pre-crisis variation among countries (e.g. Baele, 2005; Bekaert et al., 2014; Boyer et al., 2006; K. J. Forbes, 2002; Gârleanu et al., 2015).[2]

We first identify whether contagion occurred internationally during the Covid-19 crisis using two distinct methodologies tailored to our purpose. We employ a Generalised Autoregressive Conditional Heteroskedasticity (GARCH) model, drawing upon the work of Bekaert et al. (2005) and Hamao et al. (1990). Specifically, we utilise the Exponential GARCH model introduced by Nelson (1991), an asymmetric model that addresses the volatility bias highlighted by Forbes and Rigobon (2002). We estimate correlations using EGARCH volatility. We compare each country's average bilateral correlations with other countries during the entire sample period and the pre-crisis sub-period to test for contagion. A significantly higher correlation during the full sample period suggests contagion. Additionally, we apply extreme value theory, as utilised by K. H. Bae

[1] See Appendix A for a list of the policies within these response categories.

[2] See Appendix C for the list of control variables.

et al. (2003) and Forbes (2012) in contagion studies, alongside EGARCH volatility, to investigate the presence of contagion within each country. Contagion is illustrated through 'co-exceedances', which occur when at least 30% of the countries experience extreme negative returns on the same day. While the EGARCH model utilises correlations to uncover contagion, extreme value theory identifies instances where at least 20% of the sample countries experienced extreme negative returns. Both methods evaluate contagion from different perspectives. The sample period spans from January 2017 to June 2020, employing daily returns. The Covid-19 period extends from January 2020 to June 2020, while the timeframe from January 2017 to December 2019 serves as the pre-crisis period for this study. The analysis is confined to the initial six months of the Covid-19 crisis due to the significant volatility observed in stock markets at the outset, as illustrated in Figure 1, which showcases the average predicted volatility from January 1997 until November 2024.

Insert Figure 1 here

Our timeframe is influenced by other studies indicating that periods of exceptionally high volatility and substantial declines in stock returns are confined to the onset of the Covid-19 crisis (see Acharya et al., 2024; Ding et al., 2021; Izzeldin et al., 2021; Mamaysky, 2024). We measure the direct effects of the pandemic by examining Covid-19 infection rates, the number of deaths, and the intensity of policy responses. This is accomplished using a logistic regression framework to estimate the probability of contagion, applying extreme value theory EGARCH volatility associated with negative returns daily. Our findings indicate that international stock markets experienced contagion during the Covid-19 crisis. We establish that the global spread of Covid-19 infections, along with mortality and infection rates within a country, significantly increases the likelihood of contagion occurring in that country's stock market. Furthermore, we demonstrate that the economic assistance provided by governments to alleviate the adverse economic effects of the crisis has the opposite impact on the severity of contagion.

Previous studies have analysed the effects of the Covid-19 crisis on stock markets from various perspectives (Acharya et al., 2024; Au et al., 2023; Ding et al., 2021; Hassan et al., 2023; Izzeldin et al., 2021; Kumar et al., 2022; Mamaysky, 2024; Ru et al., 2021; Tosun et al., 2021). Others have investigated how government policy responses during the pandemic impact stock market returns (Ashraf, 2020; Ding et al., 2021). Our work is distinct in several ways. First, as Covid-19 was experienced globally, we analyse the presence of contagion across a sample of 37 countries, further categorising them into developing and developed economies to understand the differences between these groups. Second, to the best of our knowledge, this paper is the first to examine the Covid-19 infection and mortality rates, along with government policy responses, as channels of contagion during the pandemic, which represents our main contribution. Third, we employ various control variables to account for the effects of fundamental-based contagion. This pandemic provides a valuable opportunity to examine policy responses and establish best practices for future financial crises that are triggered by non-financial events, whether they are health-related or other natural causes that have a worldwide impact. Our findings highlight the policies and measures that help reduce contagion risks during the most recent health-related financial crisis, aiming to address a gap in the literature concerning pandemic-specific policies and international contagion. Such a gap was evident in the inconsistent and diverse policies implemented by governments worldwide.

The structure of the paper is as follows: Section 2 reviews the literature, Sections 3 and 4 discuss the data and methodologies, Section 5 presents the results, and Section 6 concludes the paper.

2. Literature and Hypothesis Development

A substantial body of literature explores financial contagion, which encompasses various definitions. Some definitions are stringent, while others are more lenient. King and Wadhwani (1990) define contagion as an increased correlation between international stock markets following a shock to one market. Other researchers characterise it as a notable rise in market linkages between countries after one country or a group of countries undergoes a shock (Claessens et al., 2001; Forbes and Rigobon, 2001, 2002). Boyer et al. (2006) adopt a stricter definition, describing contagion as a significantly higher correlation between a country's accessible stocks and another country's stock returns compared to inaccessible stocks. Bekaert et al. (2014) refer to contagion as excessive comovement between stocks that cannot be elucidated by market fundamentals. Bae et al. (2003) define contagion as extreme negative returns impacting a large percentage of countries in a region, which cannot be accounted for by changes in exchange rates, interest rates, or market volatility, but can be explained by extreme negative returns in another region.

Forbes (2012) argues that the world faces a risk of contagion due to increasing global integration. Karolyi and Stulz (1996) demonstrate that shocks to market indices positively influence the correlation among international stock markets. Richards (1997) suggests that shocks to larger stock markets should be a greater cause for concern, as they can lead to higher levels of cross-border contagion compared to smaller markets. The fact that Covid-19 affected several major stock markets in the initial stages of the crisis supports the notion of global contagion. A body of literature centres on finding evidence of contagion and determining its channels during various crises throughout history (see Bekaert et al., 2005, 2014; K. Forbes, 2012; K. J. Forbes, 2002; K. Forbes and Rigobon, 2002; Kaminsky and Reinhart, 2016; King and Wadhwani, 1990; Yang and Zhou, 2017). This study contributes to this literature by testing for the existence of cross-country contagion during the Covid-19 crisis. Given the unprecedented impact of Covid-19 on economies and financial markets worldwide, it is highly probable that international stock markets experienced contagion during this crisis. Therefore, the first hypothesis of this study is as follows:

H1: International stock markets experienced contagion during the Covid-19 crisis.

Factors such as herd behaviour, loss of investor confidence, and increased risk aversion during shocks can lead to financial contagion (Claessens et al., 2001). These aspects reflect the level of fear among investors. We utilise the Covid-19 infection rate and government policy responses to represent investor fear while controlling for fundamental differences among countries with a variety of control variables (refer to Appendix C for a list of all control variables). The choice of control variables is based on findings from past literature (see Baele, 2005; Bekaert et al., 2014; Boyer et al., 2006; Eun et al., 2015; K. Forbes, 2004, 2012; K. J. Forbes, 2002; Gârleanu et al., 2015; G. Kaminsky and Reinhart 2016).

Although the Covid-19 crisis is recent, there is rapidly expanding literature regarding its impact on stock markets. Ding et al. (2021) demonstrate that government policies promoting social distancing have a positive effect on stock market returns in various countries. Additionally, resilient pre-crisis positions assist in maintaining company stock prices during the Covid-19 crisisPrior exposure to shocks, such as epidemics or terrorist attacks, fortified firms against the Covid-19 situation (Ru et al., 2021; Tosun et al., 2021). Moreover, the findings of Onali and Mascia (2022) indicate that firms with international diversification experienced reduced volatility in daily stock market returns during the Covid-19 crisis. Meanwhile, Kumar et al. (2022) found that high-dividend stocks yielded superior returns during the Covid-19 crisis due to increased demand for dividends among investors. While Covid-19 is primarily a health crisis, its impact on financial markets resembles past financial crises more than health crises (Izzeldin et al., 2021). According to Levine et al. (2021), higher Covid-19 infection rates resulted in heightened public anxiety, which led to increased bank deposits and withdrawals from riskier investments. Au et al. (2023) provide evidence that, in the early phase of the Covid-19 outbreak, mutual fund managers connected to the epicentres sold large stockholdings compared to those not linked to these hotspots. Acharya et al. (2024) find that banks with greater exposure to undrawn credit lines experienced more significant stock declines during the Covid-19 shock. Mamaysky (2023) shows that markets are highly sensitive to news related to Covid-19. We contribute to this body of knowledge by analysing the impact of Covid-19 infection rates and related death rates on stock market contagion. Our second hypothesis is as follows:

H2: High Covid-19 local and global infection rates and Covid-related mortality rates had an impact on stock market contagion.

Government policies related to the Covid-19 pandemic were distinctive. Most important of those was vaccination requirements. Bizjak et al., (2024) show that COVID-19 vaccinations boosted business activity. Various types of policies, characterised by differing levels of stringency, were introduced to curtail the spread of the virus. The response included containment and closure measures, such as travel restrictions, school closures, and lockdowns, as well as policies for debt relief and income support (Hale et al., 2021). Ding et al. (2021) found that government containment policies and fiscal stimulus during Covid-19 positively influenced stock market returns. Haddad et al. (2021) reported that government intervention swiftly stabilised the corporate bond market in the United States. Kargar et al. (2021) indicated that liquidity in the corporate bond market improved following government intervention. According to Caballero and Simsek (2021), large-scale asset purchases by the US government during the Covid-19 crisis lowered levels of market risk tolerance. Divakaruni and Zimmerman (2023) showed that economic impact payments (EIPs) made directly to households during the Covid-19 crisis were linked to increased demand for bitcoins. More recently, Deb et al. (2024) suggest that fiscal policy announcements implemented during COVID-19 have had on average, a significant effect on economic activity. Also see Bredemeier et al., (2022) who show that expansionary fiscal-policy measures promote employment growth disproportionally for pink- and blue-collar jobs. In recent studies, Deb et al. (2024) have posited that fiscal policy announcements enacted during the COVID-19 pandemic have, on average, exerted a substantial impact on economic activity.[3] The policies and measures introduced during Covid-19 were quite unique in nature. Common governmental responses to halt the virus's spread included travel restrictions, prohibiting public gatherings, closing educational institutions, contact tracing, vaccination campaigns, and the suspension of public transport, among other interventions aimed at slowing the virus's transmission. The second type of governmental response focused on policies designed to mitigate the negative economic impacts of the virus containment measures. Economic support comprised income assistance and debt relief for households. The government's policy response was quantified into indices by The Oxford Covid-19 Government Response Tracker (OxCGRT), managed by Hale et al. (2021) at the Blavatnik School of Government, University of Oxford. We utilise these indices to investigate the impact of policy measures on international stock market contagion during the Covid-19 crisis. Thus, the next two hypotheses are as follows:

H3: Containment and Closure polices introduced during Covid-19 crisis had an impact on stock market contagion.

H4: Economic support provided by Government during Covid-19 crisis had an impact on stock market contagion.

3. Descriptive Statistics

The stock market country index data is sourced from Morgan Stanley Capital International (MSCI) for the sample countries (refer to Table 1 for the complete list). The MSCI country indices are

[3] Also see, Bredemeier et al. (2022) who have demonstrated that expansionary fiscal policy measures disproportionately foster employment growth in pink- and blue-collar sectors.

utilised to ensure consistency across equity indices for comparison purposes. To mitigate noise and address the challenges posed by the asynchrony of trade timings across various nations, this study utilizes two-day rolling average returns, drawing on methodologies from Forbes and Rigobon (2002) and Yang and Zhou (2017). The data spans from January 2017 to June 2020. The sample timeframe is based on findings from various studies that indicate the periods of exceptionally high volatility and significant declines in stock returns were confined to the onset of the Covid-19 crisis (Acharya et al., 2024; Ding et al., 2021; Izzeldin et al., 2021; Mamaysky, 2024). Acharya et al. (2024) demonstrate that stocks partially recovered from the shock in the second quarter of 2020. Ding et al. (2021) also indicate that the markets declined in February and March 2020 due to the shock related to Covid-19 but rebounded in April and May 2020.

The country-specific data on confirmed Covid-19 infections and death rates is sourced from the Johns Hopkins University Coronavirus Research Center for each sample country. The daily figures on Covid-19 infections are then utilised to calculate the daily change in Covid-19 infections:

$$\Delta InfectionsLocal_{i,t} = Covid19\ Infections_{c,t} - Covid19\ Infections_{c,t-1} \quad (1)$$

Where Δ Covid-19 $Infections_{c,t}$ are the number of new confirmed infections in a country c during day t, Covid19 $Infections_{c,t}$ are the cumulative Covid-19 infections at the end of day t in country c and Covid19 $Infections_{c,t-1}$ represent the cumulative Covid-19 infections in day t-1 in country c. Similarly, the daily data on Covid-19 related deaths retrieved from Johns Hopkins University Coronavirus Research Centre is used to measure daily new confirmed deaths:

$$\Delta Deaths_{c,t} = Covid19\ Deaths_{c,t} - Covid19\ Deaths_{c,t-1} \quad (2)$$

where Δ Covid19 $Deaths_{c,t}$ are the additional deaths that occurred in day t in country c, Covid19 $Deaths_{c,t}$ are the cumulative death in country c, at the end of day t and Covid19 $Deaths_{c,t-1}$ are the cumulative deaths in country c, at the end of day t-1. The variable $\Delta InfectionsGlobal_{i,t}$ is a total of Covid-19 infections for all sample countries at time t less the local infections of country i at time t. This is a control variable for controlling the impact of global Covid-19 infection rates.

The data regarding government policy responses related to the Containment and Health Index (CHI) and the Economic Support Index (ESI) are sourced from the Oxford COVID-19 Government Response Tracker (OxCGRT), managed by Hale et al. (2021) at the Blavatnik School of Government, University of Oxford. The Containment and Health Index (CHI) is a compilation of various closure and health-related measures governments implemented to mitigate the spread of the virus.[4] Conversely, the Economic Support Index (ESI) encompasses two primary policy measures enacted by governments to mitigate the adverse impacts of the virus: income support for the public and measures favouring households with debt obligations, such as the prohibition of evictions. Each country's financial openness score is derived from the index developed by Chinn and Ito (2006). The KOF Globalisation Index is used to calculate the globalisation score (Gygli et al., 2019). Other macroeconomic variables, such as GDP per capita, GDP, the current account balance, and the trade openness index (indicated by the ratio of exports plus imports to GDP), are obtained from the World Bank database. Inflation data is sourced from the World Bank and the Centre for Economic Policy Research (CEPR). The International Labour Force database is used for the unemployment rate (see Appendix C for details on the control variables). Efforts were made to include a wide range of countries with varying development statuses to enable a meaningful comparison between the groups. The final sample comprises the G7 nations, 19 developed economies (excluding G7 countries), and 11 developing economies, totalling 37 countries (refer to Table 1 for the complete list of sample countries). Countries that did not report any confirmed Covid-19 cases by the end of February 2020 are excluded from the sample to avoid bias in the results. Furthermore, countries with no containment or health-related policies implemented by the end of March 2020 are also excluded from the samples.

Insert Table 1 here

Table 1 reports descriptive statistics for daily stock returns from all 37 sample countries, with 962 observations for each country. The mean returns show a wide range of values, with the highest mean for China and the lowest for Pakistan. The average standard deviation of returns is 0.01, with Greece exhibiting the highest standard deviation at 0.015, while Switzerland has the lowest. The

[4] see Appendix A for the list of measures included in the Containment and Health Index.

lowest return value is -13% for Turkey, whereas the highest return of 12% is from Indonesia. Minimum returns range from -13% to -3%, while maximum returns vary from 4% to 12%.

Insert Table 2 here

Table 2 reports the descriptive statistics for all the independent variables. $\Delta InfectionsLocal_{i,t}$, $\Delta DeathsLocal_{i,t}$, $CHI_{i,t}$, $ESI_{i,t}$ and $\Delta InfectionsGlobal_{i,t}$ and $\Delta DeathsGlobal_{i,t}$ are continuous variables. $\Delta InfectionsLocal_{i,t}$ are additional Covid-19 infections within country *i* in day *t*, $\Delta DeathsLocal_{i,t}$ are the deaths that occurred within day *t* in country *i* due to Covid-19 virus. $\Delta InfectionsGlobal_{i,t}$ and $\Delta DeathsGlobal_{i,t}$ are the new infections and deaths, respectively, that are reported within a day in all sample countries less the new infections and deaths reported in country i within the same day, respectively. We exclude the infections and deaths of country i from $\Delta InfectionsGlobal_{i,t}$ and $\Delta DeathsGlobal_{i,t}$ because their effect is already being measured by $\Delta InfectionsLocal_{i,t}$, $\Delta DeathsLocal_{i,t}$, respectively. $CHI_{i,t}$, *and* $ESI_{i,t}$ are government policy response indices quantifying the strength of containment and health policy response, economic policy response within day *t* in country *i* , respectively. High values on the two government response indices indicate a more substantial response by the government of country i in day t, whereas lower values suggest a weak response. The sample period for Covid-19 data covers 6 months, from the beginning of January 2020 to the end of June 2020. There are a total of 4810 observations for CHI and ESI. *ΔInfectionsLocal*, *ΔDeathsLocal*, *ΔInfectionsGlobal* and *ΔDeathsGlobal* have a total of 4255 observations each, comprising panel data covering 26 weeks and 37 countries. Johns Hopkins data is available from January 22, 2020, onwards. Consequently, the observations regarding infections and deaths are fewer than the government response variables. Most countries had no confirmed Covid-19 cases prior to this date, with only a few exceptions. The data concerning region and development status is obtained from UNCTADstat (United Nations Trade and Development Statistical Portal), which is maintained by UNCTAD. The development status and region, as outlined by UNCTADstat, are presented in Table 1.

Table 2 shows that *ΔInfectionsLocal* has a mean of 15.77, with minimum and maximum values ranging from -211.84 to 303.89. The highest number of deaths per million of population reported in a day in any country is 44.13, while the mean stands at 1.17 deaths per million of population.

The Containment and Closure Index (CHI) ranges from 0 to 91.96, averaging 41.03. The Economic Support Index (ESI) ranges from 0 to 100, averaging at 36. The new global infection reported in a day reached a high of 99,681, whereas the maximum deaths reported in a day were 8,197 at maximum.

Insert Table 3 here

Table 3 reports the correlation matrix for all variables, including the control variables to test for multicollinearity. The collinearity matrix indicates a high multicollinearity of 0.78 between *CHI* and *ΔGlobalInfections*, both of which are main variables. The high correlation between *CHI* and *ΔGlobalInfections* may stem from governments increasing the intensity of closure and health measures due to the spread of Covid-19 infections globally. As a result, both variables are highly correlated. The closure and health-related measures likely increased following the rise in Covid-19 cases worldwide. The anticipated effect of both variables is positive, as closures, health measures, and global infections tend to instil fear among investors, leading to a higher rate of stock market contagion. We exclude CHI from our sample due to its high prevalence of multicollinearity. All the continuous variables are standardized for analysis using max-min scaling:

$$\text{X normalized} = \frac{\text{X} - \text{min}_a}{\text{max}_a - \text{min}_a} \tag{3}$$

Where X is a random value in series *a*, min_a is the minimum value of series *a*, and max_a is the maximum value of series *a*.

4. Methodology

We first test for evidence of contagion in international stock markets during the Covid-19 crisis. We use the Exponential GARCH (EGARCH) model by Nelson (1991), which is a variation of the GARCH model first introduced by Bollerslev (1986):

$$\text{Log } v^2_t = \omega + \alpha \left| \frac{\varepsilon_{t-1}}{v_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{v_{t-1}} + \beta \log v^2_{t-1} \tag{4}$$

where v^2_t is conditional variance, and Log v^2_t is the natural logarithm of v^2_t. ε_{t-1} is lagged disturbance and v_{t-1} is lagged standard deviation. γ is the asymmetric term that accounts for asymmetry in the model. Like GARCH-M α and β coefficients reflect the effect of lagged squared residual and lagged conditional variance, and ω is the unconditional variance. $log\ v^2_{t-1}$ is the natural logarithm of lagged conditional variance. EGARCH use a maximum log-likelihood function similar to other GARCH models. However, the EGARCH model is superior to standard GARCH models as it captures the asymmetry in the series. Asymmetry means that a negative shock at time t-1 in comparison to a positive shock has a greater impact on the variance at time t. EGARCH accommodates this asymmetry through the asymmetric term, γ.

EGARCH variance measures correlations over the entire sample period from January 2017 to June 2020, as well as the pre-crisis sub-period from January 2017 to December 2019. As noted earlier, we use January 2017 as start date for pre-crisis period as previous studies including that of Acharya et al., 2024; Ding et al., 2021; Izzeldin et al., 2021; Mamaysky, 2024, have found that the periods of exceptionally high volatility and substantial decline in stock returns were confined to the onset of the Covid-19 crisis. The correlations are assessed for all sample countries, with a focus on Italy, the USA, and China. Italy was chosen as it was the first G7 country where Covid-19 spread rapidly, resulting in a high mortality rate. Ding et al. (2021) provide evidence that many stock markets were strongly correlated with infection rates in Italy; consequently, we include Italy as one of our countries of origin. The USA is included due to its influence on international stock markets, as demonstrated in numerous previous studies (e.g., Bekaert et al., 2014; K. Forbes and Rigobon, 2002; King and Wadhwani, 1990). As the country with the largest stock market and significant economic impact, the USA must be considered a country of origin. Lastly, China is included for evident reasons: it was the first country where the Covid-19 virus spread, triggering a massive global crisis.

We measure lagged correlations for the pre-crisis sub-period, the full sample period, and an extended sample period covering January 2017 to December 2021. The extended sample period is primarily employed to test the robustness of our results relating to contagion. We utilise lagged correlations to identify spillovers from the originating countries to others as using contemporaneous correlations would merely indicate co-movement. It is important to note here that lagged correlations account for temporal precedence which is essential for inferring directional influence. In contrast, contemporaneous correlation indicates whether both markets move in unison, although it doesn't specify which market exerts influence over the other. Next, we perform tests to determine if the increase in correlations for the full sample period is significantly larger than that of the pre-crisis sub-period. If the difference is significant, it signals contagion. To test for the presence of contagion during the Covid-19 crisis, we employ the following test:

$$H0: Correl <= Correl_t$$

$$H1: Correl > Correl_t \tag{5}$$

Where $Correl_t$ is the lagged correlation of country i and the country of origin for the precrisis sub-period, and $Correl$ is the lagged correlation of country i and the country of origin for the full sample period. The correlation coefficients are transformed using the Fisher-z transformation as follows:

$$Z_i = ½ \log \left(\frac{1+Correl}{1-Correl}\right) \tag{6}$$

$$z_i = ½ \log \left(\frac{1+Correl_t}{1-\text{Correl}_t}\right) \tag{7}$$

where z_i and Z_i represent the fisher z-transformation for country i during the precrisis subperiod, represented by $Correl_t$ and the full sample period represented by $Correl$, respectively. Once the correlation coefficients are transformed, the test statistic Z is calculated as follows:

$$Z = \frac{(\text{Zi} - \text{zi})}{\sqrt{\left(\frac{1}{N-3}\right)+\left(\frac{1}{n-3}\right)}} \tag{8}$$

where N represents the number of observations for the full sample period, whereas n represents the number of observations for the pre-crisis subperiod.

Next, we utilise joint extreme returns to determine if contagion occurred in a country on a specific day. Our approach aligns with those of Forbes (2012), Boyer et al. (2006), Poon et al. (2004), Longin and Solnik (2001), and Bae et al. (2003). We define an extreme return as a value that resides at the tail of the return distribution. It is only deemed a result of contagion if multiple countries experience an extreme return on the same day, which we refer to as joint extreme returns. We employ the EGARCH variance model as a baseline case, defining extreme returns as volatility that exceeds the 95th percentile. We include only the volatility associated with negative returns in our model. We identify joint extreme return days when at least 30% of the sample countries experienced extreme volatility. We utilise the EGARCH volatility rather than actual returns since the latter is influenced by heteroskedasticity during periods of high volatility, as noted by Forbes and Rigobon (2001, 2002). For robustness, we apply different percentiles and sample percentages to define contagion. In the next phase, we utilise logistic regression to ascertain whether the variables identified in hypotheses 2, 3, and 4 significantly affect a country's contagion transmission. We compute the probability of contagion as the dependent variable (1 if contagion is present, 0 otherwise).

The results of multicollinearity tests (see Table 3) indicate high multicollinearity between two main variables, CHI and ΔGlobalInfections. Consequently, CHI was removed from the sample. Next, we assess the linearity assumption of the independent variables using the Box-Tidwell test developed by G. E. P. Box and Paul W. Tidwell in 1962. The test reveals that one of our main variables, ESI, does not exhibit a linear relationship with the independent variable, with a p-value below 5%. Attempts to transform ESI were made; however, ESI could not be transformed using the Box-Tidwell method due to the suggested lambda for transformation being exceedingly high. ESI is converted into an ordered categorical variable. Details of the transformed variable, CatESI, are provided in Appendix B. To estimate the effects of changes in Covid-19 infections and policy responses on the probability that country i experienced contagion on day t, we employ the logistic regression model (9).

We assume that the marginal probability of contagion follows a logistic distribution and is given by

$$P_t(Contagion_{i,t}=1) = \frac{1}{1+e^{-(\alpha + \beta_1 \text{ x } \Delta DeathsLocal_{i,t-1} + \beta_2 \text{x} \Delta DeathsGlobal_{i,t-1} + \beta_3 \text{ x } CatESI_{i,t} + Controls + v_{i,t})}} \quad (9)$$

where $Contagion_{i,t}$ is a dummy variable that is equal to 1 if contagion occurred in country *i* in day *t,* and 0 otherwise. $\Delta LocalInfection_{i,t-1}$ are additional covid-related infections in day *t* for country *i*. It is expected that coefficients β1 is positive and statistically significant. $\Delta GlobalInfection_{i,t-1}$ is the sum of additional Covid-19 infections globally in day *t* less the additional Covid-19 infections in country *i* in day *t*. CatESI,i,t refers to the categorical variable for the economic support index for country i at time t, which reflects two distinct policy measures implemented by governments to address the adverse economic effects of the virus: income support for the public due to lost wages and measures benefiting households in debt or with contractual obligations, such as banning evictions. CatESI,i,t ranges from 1 to 5, indicating low to high economic support. Control variables include trade openness, GDP, current account balance, globalisation, GDP per capita, and inflation to account for pre-crisis national traits. Details of the control variables are provided in Appendix C. vi,t denotes the error term. Finally, we estimate our regression model for various groups by clustering the sample countries according to their development status and geographical region to analyse similarities at the group level, which can be accounted for by regional and development-related differences. The sample countries are categorised into groups based on region and development status, as presented in Table 1. Data on geographical regions and development status are sourced from UNCTADstat (the United Nations Conference on Trade and Development statistical portal), which is maintained by UNCTAD.

5. Empirical Findings

5.1 Financial Contagion During Covid-19 crisis

The descriptive statistics for the EAGRCH variance, calculated using Equation 4, are presented in Appendix D. The first plot in Figure 1 illustrates the daily EGARCH volatility from the beginning of January 1997 to November 2024, while the second plot of Figure 1 shows the daily EGARCH volatility from January 2017 to November 2024. The figure clearly indicates that the occurrence of extreme volatility related to the Covid-19 crisis spanned from February 2020 to June 2020. Another cluster of high volatility is observable in the initial months of 2022. This second episode of heightened volatility is not linked to the health crisis. As our analysis focuses solely on the effects of the health crisis on stock market contagion, we limit our sample to the end of June 2020. This is why the sample timeframe is restricted to the first six months of the crisis period. The rationale for limiting the dataset until 30 June 2020 is drawn from other studies that demonstrate that episodes of significant declines in returns and periods of exceptionally high volatility are observed in the initial months of the crisis (see Acharya et al., 2024; Ding et al., 2021; Izzeldin et al., 2021; Mamaysky, 2024). Subsequently, the market exhibits recovery, and the volatility is considerably lower compared to the first few months (February-April 2020).

Insert Table 4 here

Table 4 reports the lagged correlations for all sampled countries with the three countries of origin: Italy, the USA, and China, across three periods: the pre-crisis sub-period (January 2017 to December 2019) and the full sample period (January 2017 to June 2020). Nearly all countries exhibit significantly higher correlations during the full sample period compared to the pre-crisis sub-period when the country of origin is Italy or the USA. However, the results are mixed for China as the country of origin.

Insert Table 5 here

Table 5 provides the test statistic Z-score to evaluate the hypothesis that the correlation for the full sample period is significantly higher than for the pre-crisis sub-period. The findings indicate that nearly all countries show a significantly higher correlation with the countries of origin, Italy and the USA, during the full sample period compared to the pre-crisis sub-period. Out of 37 countries, 35 display strong spillovers from Italy, with similar results concerning the USA. However, when China is considered as the country of origin, approximately 13 countries do not demonstrate a significant increase in correlation. Despite being the initial epicentre of the COVID-19 virus, China has not exhibited significant spillovers into other stock markets. These results correspond with the findings of Ding et al. (2021), who reported that the spread of COVID-19 in China did not significantly impact the stock markets. In contrast, the effect on the global stock market was far more pronounced when the infection spread in Italy. The second methodology utilised to assess contagion is grounded in extreme value theory. It evaluates contagion as extreme returns experienced by numerous sample countries within a single day. We establish the threshold level at the 95th percentile, indicating that all volatility values exceeding this level in the return distribution are deemed extreme. 'Contagion' is characterised as extreme volatility concurrently experienced in at least 30% of the sample countries. Furthermore, we analyse various threshold levels for extreme returns to ensure robustness, such as the 97th percentile, and we adjust the percentage of countries experiencing extreme returns simultaneously to define contagion as well.

Insert Figure 2 here

Figure 2 illustrates the number of countries experiencing contagion daily, presenting the results with various threshold levels. The first plot in Figure 2 indicates the number of countries that faced contagion when the threshold was set at the 99th percentile, while the second plot reflects the results with the threshold set at the 97th percentile. Lastly, the third plot outlines the results with a threshold set at the 95th percentile. We note that the results are sensitive to the threshold level; as the threshold increases, the instances of contagion decrease, and vice versa. While the first method evaluates correlations for both pre-crisis and full sample timeframes across each sample country, this approach centres on the number of days contagion occurred. This method is non-parametric. According to this approach, all countries experienced contagion on some days.

Insert Table 6 here

Table 6 reports the number of days each country faced contagion throughout the entire sample period. Sri Lanka recorded the lowest incidence of contagion during the crisis period, with only 12 days, whereas Germany experienced contagion for 52 days during the full sample period, the highest of any country.

5.2 Contagion Mechanisms during Covid-19 crisis

Table 7 reports the results of regression equation 9 in the first column. In the second column, we introduce an interaction term that measures the relationship between *ΔDeathsLocal,i,t-1* and *ΔDeathsGlobal,i,t-1*. The third column replaces the variables *ΔDeathsLocal,i,t-1* and *ΔDeathsGlobal,i,t-1* with *ΔInfectionsLocal,i,t-1* and *ΔInfectionsGlobal,i,t-1* to assess the size and significance of the infection rate on the probability of contagion, in comparison to the death rate. The variable $\Delta DeathsLocal,_{i,t-1}$ represents the change in the Covid-19-related mortality rate per million of the population in country *i* within a day. It has a positive, statistically significant at the 1% level and has an odds ratio of 17.4, indicating that a unit increase in $\Delta DeathsLocal_{i,t-1}$ raises the probability of contagion by 17.4 times.

Insert Table 7 here

The high and significant odds ratio suggests that the death rate in a country causes its stock market to move more in tandem with other markets. The variable $\Delta DeathsGlobal_{i,t-1}$ denotes the number of deaths reported in day *t-1* across all sample countries minus the deaths reported in country *i*. $\Delta DeathsGlobal_{i,t-1}$ is not significant. When the interaction term of $\Delta DeathsLocal_{i,t-1} * \Delta DeathsGlobal_{i,t-1}$ is included in the model, it is found to be significant at the 5% level, with an odds ratio of 0.004. This implies that the effect of $\Delta DeathsGlobal_{i,t-1}$ on the odds of contagion occurring in a day decreases by 99.6% with a unit increase in $\Delta DeathsLocal_{i,t-1}$ and vice versa. Consequently, while high global deaths elevate the probability of contagion within a country, once local deaths begin to rise, the influence of foreign deaths on the probability of contagion within a country's stock market diminishes. In the third column, the variables *ΔDeathsLocal,I,t-1* and *ΔDeathsGlobal,i,t-1* are replaced by *ΔInfectionsLocal,i,t-1* and *ΔInfectionsGlobal,i,t-1* to examine the effect of changes in local and global Covid-19 infections on the probability of contagion, and to assess whether the infection rate possesses better predictive power than the death rate. The odds ratio for *ΔInfectionsLocal,i,t-1* is 307.1 at a significance level of 1%, while *ΔInfectionsGlobali,t-1* is also significant at a 5% significance level, with an odds ratio of 8.81. The interaction term, *ΔInfectionsLocal,i,t-1* * *ΔInfectionsGlobali,t-1*, is also significant at a significance level of 1%, with an odds ratio of 0.001. The effect of *ΔInfectionsGlobal,i,t-1* on the probability of contagion occurring in a day diminishes with an increase of one unit of *ΔInfectionsLocal,i,t-1* by 99.9%. Similarly, when *ΔInfectionsGlobal,i,t-1* increases by one unit, the effect of ΔInfectionsLocali,t-1 on the odds of contagion declines by 99.9%.The results for ESI in all three columns of Table 7 are quite similar. As the scale of economic support increases, the odds ratio falls, which means that the odds of contagion reducing with an increase in the government's economic support decrease. The odds ratio is between 2.69 and 3.01 at a low level of ESI, and at a very high level of ESI, it is between 1.11 and 1.57.

Insert Table 8 here

Table 8 compares country clusters based on development status (see Table 1). The cluster of advanced countries includes 19 nations, excluding the G7 nations, while the second cluster consists of 11 developing countries and 26 countries in the cluster of advanced countries. When we compare the results for the three clusters, the findings for developing countries indicate that the economic support provided by respective governments does not have a significant impact on the probability of contagion. The odds ratio is significant at the 5% level for medium and very high levels of economic support, but overall, the impact is much smaller in comparison to that of advanced countries. In contrast, for the cluster of advanced economies (both including and excluding G7 nations), we observe that when support levels are low, the odds ratio is very high; however, as economic support increases, the odds ratio declines, suggesting that an increase in economic support reduces the likelihood of contagion occurring in a stock market. Another feature to note is that while advanced countries experience a significant and economically substantial impact on the odds of contagion from local infection rates, developing nations are greatly influenced by the global infection rate, which shows a remarkable odds ratio of 25,884. This likely suggests that developing nations look towards other countries in times of crisis, which also explains why the ESI does not have a noticeable effect within the cluster of developing countries. In the case of developing nations, the factors affecting the odds of contagion are more external than internal countries.

Insert Table 9 here

Table 9 presents the results at the regional level, with countries grouped by their respective regions. The odds ratio is high at low levels of economic support and decreases as the levels increase. For Asian nations, the odds ratio shows slight variation across different scales of the Economic Support Index (ESI). In contrast, European nations and advanced economies exhibit a greater sensitivity to economic policy responses. These findings support Hypothesis 2, which posits that a high local Covid-19 death rate increases the likelihood of contagion. Our results align with those of Levine et al. (2021), indicating that higher Covid-19 infection rates lead to increased anxiety among the population, resulting in greater bank deposits and withdrawals from riskier investments. Similarly, Ding et al. (2021) report that stock prices react negatively to rising Covid-19 cases. In our analysis, the mortality rate is more strongly correlated with the probability of contagion than the infection rate itself. This follows logically, as the fear instigated by high mortality rates is significantly greater than the fear associated with infection. The Covid-19 mortality rate was the primary cause of fear experienced by the general population.

5.3 Contagion within Clusters

Next, we conduct the regression on country clusters based on region and development status. The results for clusters categorised by development status are presented in Table 8, while those for regional clusters are shown in Table 9. For advanced countries and the G7, the variable *ΔDeathsLocal* is more significant and has a stronger association with the probability of contagion than that of other clusters. This variable is not particularly significant for developing and Asian countries. The latter two clusters also exhibit the lowest average incidences of contagion.

ΔInfectionG7 is a significant variable for all clusters based on region and development status, exhibiting a positive relationship with the probability of contagion. Consequently, changes in infections within the G7 countries serve as a crucial factor in determining the likelihood of contagion. The variable *ΔInfectionG7* notably impacts the probability of infection in the European country cluster and among the G7 economies. This could be attributed to the closer proximity of European countries to the G7 nations, along with their stronger economic connections; therefore, they respond more significantly to fluctuations in the infection rate within the G7 economies. The variable *CatESI* is significant across all clusters except for Europe. In all cases, economic support does not have a notable association with the probability of contagion among European countries. Furthermore, *CatESI* is negatively correlated with the probability of contagion across all clusters. For European countries, economic support appears to have no effect on the probability of contagion significantly.

6. Conclusion

The unprecedented nature and distinctive characteristics of the Covid-19 crisis render it fundamentally different from other economic and financial crises. This study examines the unique features of this pandemic and identifies the factors that influence financial contagion within international stock markets. We demonstrate that the forces limiting or spreading contagion during the pandemic differ from those observed in crises that are purely economic or financial. In an epidemic, the fear engendered by the spread of infection and a high mortality rate can serve as a source of contagion. Our findings indicate that elevated death rates from Covid-19 acted as a transmission mechanism for contagion by instilling fear among the public, particularly investors.

We discover that the high infection rate is insignificant when the death rate of Covid-19 is included in the analysis, which is a unique characteristic of a pandemic. Moreover, we find that the effectiveness of economic support policies in mitigating contagion increases when a substantial level of economic support is provided. At the same time, it remains insignificant at lower levels of support. We show that the death rate and government economic support significantly influence the probability of contagion. The containment and health index becomes insignificant when analysed alongside the infection rate of the G7 countries. Numerous previous studies have examined the containment and health index but have failed to consider the global infection rate, which ultimately makes the containment and health index appear significant. Lastly, we find that the G7 infection rate has the most substantial impact on the probability of contagion compared to the global infection rate. Similarly, we note that China does not generate strong spillovers, despite being the first country affected by the Covid-19 virus. The sample countries are highly correlated with the lagged variance of the USA and Italy. Thus, G7 countries wield a greater influence on the spread of financial contagion.

Overall, we demonstrate that economic policy support can help mitigate contagion. This finding is significant for both regulators and investors because, although such extreme events occur relatively infrequently, a shock to one country can swiftly spread to others through various channels. Due to globalisation, such epidemics may not be as rare as they once were. Consequently, this pandemic offers a vital opportunity for governments to learn from past mistakes and make more informed decisions should a similar event arise in the future.

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Table 1: Descriptive Statistics for Daily Country-level Stock Market Returns: Two-Day Rolling Average

Country	*Region*	*Status*	Mean	Standard Error	Sample Variance	Kurtosis	Skewness	Range	Minimum	Maximum	Obs
Australia	*Oceania*	*Advanced*	-1.35E-05	0.0003	8.20E-05	13.079	-0.808	0.136	-0.068	0.067	962
Austria	*Europe*	*Advanced*	-1.25E-04	0.0004	1.50E-04	10.316	-0.668	0.168	-0.089	0.079	962
Belgium	*Europe*	*Advanced*	-2.86E-04	0.0003	1.00E-04	13.153	-1.312	0.136	-0.082	0.054	962
Canada	*America*	*Advanced G7*	1.11E-05	0.0003	7.60E-05	30.88	-1.143	0.175	-0.086	0.088	962
China	*Asia*	*Developing*	4.79E-04	0.0003	7.80E-05	1.392	-0.311	0.075	-0.034	0.041	962
Czechia	*Europe*	*Advanced*	-6.44E-05	0.0003	7.90E-05	16.564	-1.627	0.129	-0.075	0.053	962
Denmark	*Europe*	*Advanced*	4.77E-04	0.0003	5.70E-05	6.822	-0.628	0.099	-0.056	0.043	962
Finland	*Europe*	*Advanced*	1.85E-04	0.0003	7.90E-05	10.92	-0.689	0.128	-0.069	0.06	962
France	*Europe*	*Advanced G7*	1.54E-04	0.0003	8.20E-05	14.652	-0.926	0.14	-0.075	0.065	962
Germany	*Europe*	*Advanced G7*	6.35E-05	0.0003	8.40E-05	14.669	-0.859	0.139	-0.076	0.063	962
Greece	*Europe*	*Advanced*	-3.30E-04	0.0005	2.10E-04	5.772	-0.792	0.152	-0.09	0.062	962
Hong Kong	*Asia*	*Advanced*	1.57E-04	0.0003	6.10E-05	4.301	-0.365	0.09	-0.045	0.044	962
Hungary	*Europe*	*Developing*	1.10E-04	0.0004	1.40E-04	13.214	-1.597	0.162	-0.111	0.051	962
India	*Asia*	*Developing*	1.47E-04	0.0003	8.30E-05	8.755	-0.614	0.113	-0.06	0.053	962
Indonesia	*Asia*	*Developing*	-1.04E-04	0.0004	1.50E-04	18.925	0.395	0.198	-0.074	0.123	962
Ireland	*Europe*	*Advanced*	8.46E-05	0.0003	9.60E-05	11.01	-0.811	0.138	-0.077	0.061	962
Israel	*Asia*	*Advanced*	4.27E-05	0.0003	8.50E-05	8.677	-1.029	0.114	-0.063	0.051	962
Italy	*Europe*	*Advanced G7*	5.62E-05	0.0003	9.90E-05	17.715	-1.933	0.147	-0.095	0.053	962
Japan	*Asia*	*Advanced G7*	1.44E-04	0.0002	5.00E-05	10.716	-0.32	0.11	-0.056	0.055	962
Korea	*Asia*	*Advanced*	2.01E-04	0.0003	1.00E-04	11.162	-0.272	0.165	-0.076	0.089	962
Mexico	*America*	*Developing*	-2.92E-04	0.0004	1.40E-04	6.042	-0.6	0.133	-0.072	0.061	962
Netherlands	*Europe*	*Advanced*	3.93E-04	0.0003	6.10E-05	11.602	-1.032	0.108	-0.061	0.047	962
New Zealand	*Oceania*	*Advanced*	4.01E-04	0.0003	7.10E-05	6.632	-0.519	0.11	-0.068	0.042	962
Norway	*Europe*	*Advanced*	-8.80E-05	0.0003	9.80E-05	11.231	-1.056	0.131	-0.08	0.051	962
Pakistan	*Asia*	*Developing*	-1.22E-03	0.0004	1.50E-04	4.52	-0.699	0.122	-0.076	0.046	962
Poland	*Europe*	*Developing*	-2.47E-05	0.0004	1.20E-04	14.05	-1.407	0.159	-0.113	0.046	962
Portugal	*Europe*	*Advanced*	2.16E-04	0.0003	8.70E-05	13.802	-0.892	0.132	-0.065	0.067	962
Russia	*Europe*	*Developing*	8.59E-05	0.0004	1.40E-04	8.946	-1.27	0.131	-0.073	0.057	962
Singapore	*Asia*	*Advanced*	-1.78E-05	0.0003	6.00E-05	12.839	0.303	0.112	-0.041	0.071	962
South Africa	*Africa*	*Developing*	-1.71E-04	0.0005	1.90E-04	4.593	-0.188	0.157	-0.076	0.081	962
Spain	*Europe*	*Advanced*	-1.24E-04	0.0003	8.70E-05	13.877	-1.222	0.14	-0.081	0.06	962
Sri Lanka	*Asia*	*Developing*	-4.42E-04	0.0003	9.70E-05	15.293	-0.574	0.152	-0.081	0.071	962
Sweden	*Europe*	*Advanced*	1.48E-04	0.0003	9.10E-05	10.64	-0.595	0.139	-0.075	0.064	962
Switzerland	*Europe*	*Advanced*	3.33E-04	0.0002	4.40E-05	16.573	-1.426	0.106	-0.059	0.047	962
Turkey	*Asia*	*Developing*	-3.27E-04	0.0005	2.20E-04	9.2	-1.067	0.187	-0.131	0.056	962
UK	*Europe*	*Advanced G7*	-1.45E-04	0.0003	7.40E-05	20.522	-0.773	0.153	-0.075	0.078	962
USA	*America*	*Advanced G7*	3.90E-04	0.0003	6.30E-05	13.736	-1.283	0.123	-0.072	0.051	962

This table reports the descriptive statistics for two-day rolling average returns for the sample time frame 1 01/01/2017 to 30/06/2020 for all sample countries.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Standard Error	Standard Deviation	Kurtosis	Skewness	Minimum	Maximum
CHI	4,810	41.03	0.39	27.30	-1.43	-0.31	0.00	91.96
ESI	4,810	36.00	0.53	37.00	-1.39	0.38	0.00	100.00
ΔInfectionsLocal	4,255	15.77	0.45	29.46	12.35	2.79	-211.84	303.89
ΔDeathsLocal	4,255	1.17	0.05	3.15	36.97	5.04	-12.63	44.13
ΔInfectionsGlobal	4,255	40285.14	458.22	29890.18	-1.43	-0.18	4.00	99681.00
ΔDeathsGlobal	4,255	2559.77	35.55	2318.88	-0.69	0.58	0.00	8179.00

This table reports the descriptive statistics, such as means, standard deviation, kurtosis, and skewness, of all independent variables used in regression equation 9 for the crisis period from 1/01/2020 to 30/06/2020. The details of all measures are given in appendix B and C.

Table 3: Test of Multicollinearity

Variables	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
CHI (a)	1												
ESI (b)	0.67	1											
Infections Local (c)	0.39	0.36	1										
Deaths Local (d)	0.27	0.30	0.60	1									
Infections Global (e)	0.78	0.73	0.30	0.24	1								
Deaths Global (f)	0.73	0.57	0.36	0.34	0.79	1							
Trade Opennes (g)	0.01	0.20	0.10	0.01	0.02	0.02	1						
GDP (h)	0.10	-0.07	0.10	0.05	-0.07	-0.05	-0.28	1					
Current Account Balance (i)	0.02	0.02	0.09	-0.04	0.01	0.01	0.35	-0.09	1				
Unemployment (j)	0.03	-0.05	0.04	0.05	0.00	0.00	-0.19	-0.14	-0.20	1			
Globalization (k)	-0.12	0.17	0.23	0.25	0.00	-0.01	0.21	-0.08	0.27	0.01	1		
GDP Per Capita (l)	-0.09	0.18	0.22	0.14	-0.01	-0.01	0.39	0.06	0.26	-0.26	0.69	1	
Inflation (m)	0.04	-0.13	-0.14	-0.14	-0.01	0.00	-0.26	-0.04	-0.25	0.01	-0.66	-0.62	1

This table presents the correlation matrix for all variables in our sample. Details of all measures can be found in Appendices B-C.

Table 4: Precrisis and Full Sample Correlations

	Precrisis Sub-period	Full Sample Period	Precrisis Sub-period	Full Sample Period	Precrisis Sub-period	Full Sample Period
Country	Italy		USA		China	
Australia	0.4	0.83	0.66	0.86	0.47	0.54
Austria	0.23	0.19	0.02	0.09	0.33	0.33
Belgium	0.33	0.69	0.51	0.67	0.37	0.41
Canada	0.57	0.87	0.79	0.88	0.5	0.55
China	0.36	0.52	0.58	0.61	0.94	0.94
Czechia	0.37	0.84	0.29	0.76	0.25	0.47
Denmark	0.53	0.77	0.42	0.7	0.41	0.53
Finland	0.52	0.86	0.56	0.82	0.5	0.56
France	0.73	0.92	0.69	0.87	0.58	0.58
Germany	0.68	0.91	0.69	0.87	0.65	0.62
Greece	0.47	0.75	0.19	0.64	0.24	0.42
Hong Kong	0.43	0.64	0.58	0.69	0.66	0.72
Hungary	0.47	0.81	0.15	0.66	0.24	0.44
India	0.43	0.75	0.43	0.76	0.49	0.57
Indonesia	0.44	0.76	0.3	0.72	0.51	0.58
Ireland	0.52	0.87	0.48	0.8	0.39	0.52
Israel	0.11	0.49	0.3	0.57	0.21	0.33
Italy	0.93	0.96	0.39	0.75	0.33	0.48
Japan	0.42	0.77	0.74	0.87	0.51	0.57
Mexico	0.3	0.69	0.34	0.69	0.36	0.49
Netherlands	0.64	0.88	0.75	0.89	0.67	0.64
New Zealand	0.23	0.69	0.39	0.71	0.38	0.48
Norway	0.59	0.88	0.6	0.83	0.44	0.51
Pakistan	0.05	0.47	0.1	0.47	0.09	0.31
Poland	0.37	0.68	0.33	0.64	0.35	0.42
Portugal	0.48	0.76	0.29	0.68	0.26	0.42
Russia	0.15	0.67	0.3	0.69	0.24	0.43
Singapore	0.45	0.81	0.58	0.81	0.72	0.68
South Africa	0.42	0.7	0.3	0.66	0.46	0.53
South Korea	0.45	0.77	0.66	0.84	0.67	0.63
Spain	0.72	0.92	0.36	0.78	0.36	0.49
Sri Lanka	-0.04	0.19	-0.02	0.17	-0.02	0.14
Sweden	0.59	0.86	0.77	0.88	0.59	0.58
Switzerland	0.52	0.84	0.75	0.89	0.55	0.59
Turkey	0.29	0.36	0.08	0.25	0.21	0.27
United Kingdom	0.58	0.89	0.68	0.87	0.63	0.58
United States	0.4	0.76	0.97	0.97	0.59	0.61

The table presents the lagged correlations between each sample country and Italy, the USA, and China. For each group of correlations, the first column displays the correlation for the pre-crisis sub-period from January 2017 to December 2019, while the next column shows the full sample period from January 2017 to June 2020.

Table 5: Test Results for Contagion

	Z-Score - Precrisis period vs Full Sample period		
Country	**Italy**	**USA**	**China**
Australia	15.94***	10.42***	1.98***
Austria	-0.91	1.41	-0.06
Belgium	10.24***	5.01***	0.94
Canada	13.98***	6.76***	1.39
China	4.07***	1.01	
Czechia	17.25***	14.16***	5.07***
Denmark	8.73***	8.73***	3.075***
Finland	14.42***	10.81***	1.913***
France	12.99***	9.82***	0.10
Germany	13.75***	9.98***	-1.10
Greece	9.63***	11.36***	4.21***
Hong Kong	5.93***	3.84***	2.23***
Hungary	12.79***	13.14***	4.71***
India	10.39***	11.12***	2.41***
Indonesia	11.07***	12.49***	2.19***
Ireland	15.12***	11.87***	3.21***
Israel	8.63***	6.75***	2.74***
Italy		11.59***	3.74***
Japan	11.88***	7.90***	1.64***
Mexico	11.01***	10.24***	3.27***
Netherlands	13.05***	8.90***	-1.21
New Zealand	12.63***	9.66***	2.61***
Norway	14.19***	10.06***	1.86***
Pakistan	9.31***	8.35***	4.78***
Poland	8.91***	8.57***	1.71***
Portugal	9.62***	10.63***	3.87***
Russia	13.25***	10.98***	4.47***
Singapore	13.26***	9.74***	-1.46
South Africa	8.45***	9.87***	1.96***
South Korea	11.04***	8.98***	-1.44
Spain	13.81***	13.46***	3.23***
Sri Lanka	4.59***	3.91***	3.35***
Sweden	12.67***	7.44***	-0.40
Switzerland	13.54***	8.75***	1.07
Turkey	1.45	3.62***	1.35
United Kingdom	15.20***	10.47***	-1.55
United States	11.64***		0.48

The table presents the results of contagion during the Covid-19 crisis. The first three columns show the z-score, which measures whether the correlations during the full sample period were significantly greater than those in the pre-crisis period. A statistically significant z-score is indicated by ∗∗∗, representing significance levels at 5%.

Table 6: Contagion Results using Extreme Value Theory

Country	Region	Status	Total Days with Contagion	
			Jan 2017 to Jun 2020	Jan 2017 to Nov 2024
Australia	Oceania	Advanced	40	51
Austria	Europe	Advanced	44	67
Belgium	Europe	Advanced	47	67
Canada	America	Advanced G7	42	56
China	Asia	Developing	16	27
Czech Republic	Europe	Advanced	35	54
Denmark	Europe	Advanced	21	39
Finland	Europe	Advanced	45	68
France	Europe	Advanced G7	50	77
Germany	Europe	Advanced G7	52	77
Greece	Europe	Advanced	34	46
Hong Kong	Asia	Advanced	34	57
Hungary	Europe	Developing	34	57
India	Asia	Developing	33	48
Indonesia	Asia	Developing	39	42
Ireland	Europe	Advanced	39	64
Israel	Asia	Advanced	33	46
Italy	Europe	Advanced G7	44	69
Japan	Asia	Advanced G7	32	40
Mexico	Asia	Advanced	43	54
Netherlands	America	Developing	36	58
New Zealand	Oceania	Advanced	29	42
Norway	Europe	Advanced	42	59
Pakistan	Europe	Advanced	19	23
Poland	Asia	Developing	35	63
Portugal	Europe	Developing	33	51
Russia	Europe	Advanced	30	43
Singapore	Europe	Developing	42	55
South Africa	Asia	Advanced	39	47
South Korea	Africa	Developing	37	45
Spain	Europe	Advanced	48	67
Sri Lanka	Asia	Developing	12	24
Sweden	Europe	Advanced	43	69
Switzerland	Europe	Advanced	36	60
Turkey	Asia	Developing	17	21
United Kingdom	Europe	Advanced G7	46	65
United States	America	Advanced G7	35	49

The table reports the number of days when a country's stock market experienced contagion, measured using EGARCH volatility associated with negative returns. Volatility that exceeds the threshold level of 95% is considered extreme; however, if at least 30% of the countries experience extreme volatility on the same day, it is termed contagion. The last two columns of the table display the number of days of contagion for each country from 1 January 2017 to 30 June 2020 and from 1 January 2017 to 7 November 2024.

Table 7: Determinants of contagion during Covid 19

Dependant Variable: Probability of contagion	(1)		(2)		(3)	
Variables	**Odds Ratio**	**Std. error**	**Odds Ratio**	**Std. error**	**Odds Ratio**	**Std. error**
Intercept	0.098	0.02	0.048	0.016	0.018	0.010
ΔDeathsLocalLagged	17.4***	10.76	388.60***	542.57		
ΔInfectionsLocallagged					307.10***	416.98
ΔInfectionsgloballagged					8.81**	9.47
ΔDeathsGloballagged	0.759	0.13	2.97**	1.65		
ΔDeathsLocalLagged * ΔDeathsGloballagged			0.004**	0.008		
ΔInfectionsLocallagged * ΔInfectionsgloballagged					.0010***	.0026
CatESI:						
Low	2.8***	0.83	2.69***	0.79	3.01***	0.90
Medium	1.93***	0.25	1.80***	0.23	2.26***	0.34
High	1.30**	0.14	1.21*	0.13	1.50***	0.21
Very High	1.18	0.15	1.11	0.14	1.57***	0.25
Controls	Yes		Yes		Yes	
Pseudo R^2	0.020		0.022		0.025	
No. of Countries	37		37		37	
Observations	4,292		4,292		4,292	

This table reports the results of a logistic regression analysing the probability of contagion during the Covid-19 crisis in relation to changes in local and global infection rates, mortality rates, and government economic responses. The dependent variable is the probability of contagion within an international stock market, represented as a binary variable (0 = No contagion, 1 = Contagion). The data for all variables is daily, spanning from 1 January 2020 to 30 June 2020. Various controls are employed at the country level to account for variations, namely trade openness, GDP per capita, inflation, globalisation score, and the current account balance of GDP. ΔDeathsLocal i,t-1 represents the change in the number of deaths within a country in a day as a percentage of that country's population, while ΔInfectionsLocal i,t-1 indicates the change in the infection rate in a country within a single day as a percentage of that country's population. ΔInfectionsGlobal i,t-1 refers to the change in the number of infections across all sample countries excluding country i, and ΔDeathsGlobal i,t-1 refers to the number of deaths reported in a day for all sample countries excluding country i. The interaction variables ΔDeathsLocal i,t-1 * ΔDeathsGlobal i,t-1 and ΔInfectionsLocal i,t-1 * ΔInfectionsGlobal i,t-1 measure the impact of the interactions between ΔDeathsLocal i,t-1 and ΔDeathsGlobal i,t-1, and ΔInfectionsLocal i,t-1 and ΔInfectionsGlobal i,t-1, on the probability of contagion, respectively. CatESI is the categorical variable representing the economic support provided by the government within a country, measured on a scale from very low to very high across five levels. Details of the main variables and the control variables are provided in appendices B to D. The table presents odds ratios and standard errors in parentheses, with ***, **, and * indicating statistical significance at the 1%, 5%, and 10% levels.

Table 8: Determinants of contagion during Covid 19 with Clusters (Advanced ex-G7, Developing and Advanced Economies)

Dependant Variable: Probability of contagion	**(Advanced ex G7)**		**(Developing)**		**(Advanced)**	
Variables	**Odds Ratio**	**Std. error**	**Odds Ratio**	**Std. error**	**Odds Ratio**	**Std. error**
Intercept	0.022	0.0198	0.0408	0.0659	0.037	0.024
ΔInfectionsLocali,t-1	406.98***	859.84	743.66*	2591.06	94.730***	133.96
ΔInfectionsglobal i,t-1	3.401	5.43	25884.89***	87320.26	2.296	2.70
ΔInfectionsLocali,t-1* ΔInfectionsglobal i,t-1	0.0014*	0.0051	0.0000006***	0.0000001	0.009*	0.024
CatESI:						
Low	35.71***	27.124	.474	0.313	36.40***	27.37
Medium	5.73***	1.318	.585**	0.159	4.48***	0.90
High	3.18***	0.743	.765	0.179	2.42***	0.476
Very High	3.12***	0.762	.461**	0.179	2.54***	0.533
Controls	Yes		Yes			
Pseudo R2	0.052		0.046		0.042	
No. of Countries	19		11		26	
Observations	2,204		1,276		3,016	

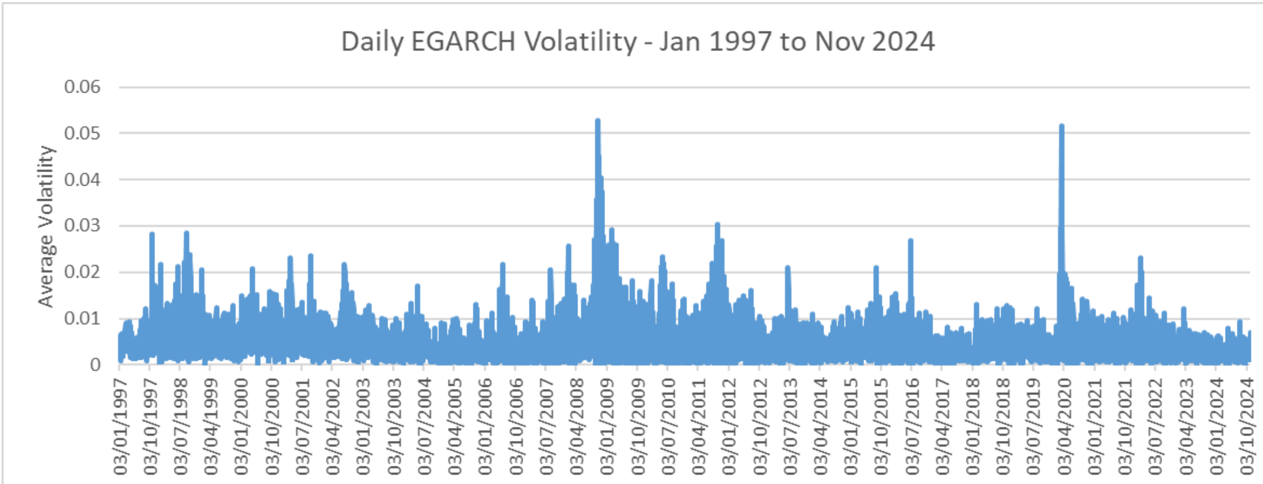
This table reports logistic regression results analysing the probability of contagion during the Covid-19 crisis in response to changes in local and global infection rates, mortality rates, and government economic support. The dependent variable is the probability of contagion within an international stock market, represented as a binary variable (0 = No contagion, 1 = Contagion). Various controls are employed at the country level to account for variations, namely trade openness, GDP per capita, inflation, globalization score, and the current account balance of GDP. ΔInfectionsLocal i,t-1 denotes the change in the infection rate within a country over a single day as a percentage of that country's population, while ΔInfectionsglobal i,t-1 refers to the change in the number of infections for all sample countries excluding country i. The term ΔInfectionsLocal i,t-1 * ΔInfectionsglobal i,t-1 represents the interaction variable measuring the impact of the interaction between ΔInfectionsLocal i,t-1 and ΔInfectionsglobal i,t-1 on the probability of contagion, respectively. CatESI is the categorical variable for government economic support within a country, measured on a scale ranging from very low to very high at five levels. Details of the main and control variables are provided in Appendices B to D. The odds ratio and standard errors are presented in parentheses, with ***, **, and * indicating statistical significance at the 1%, 5%, and 10% levels.

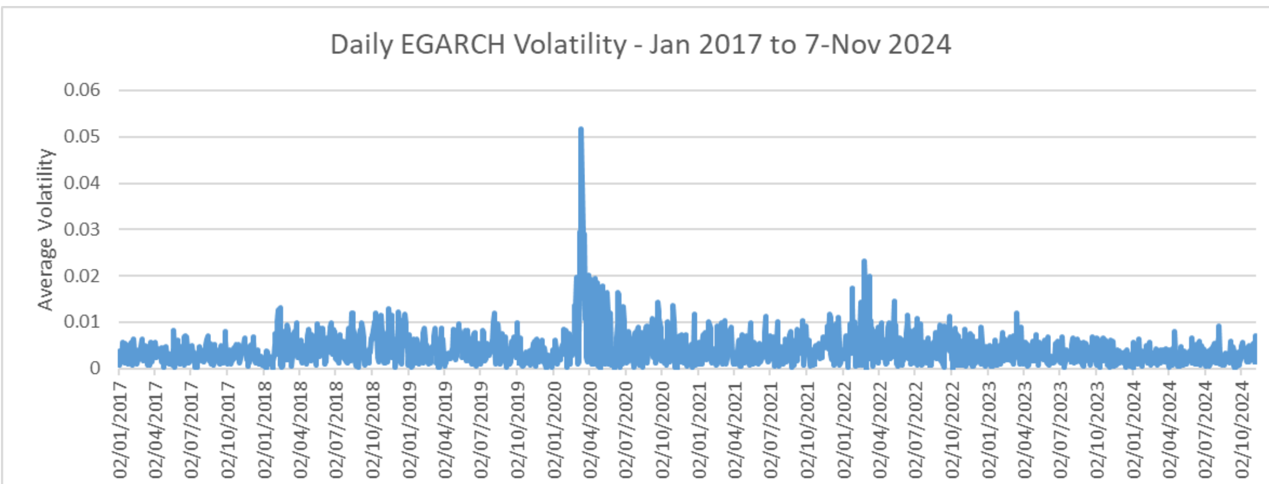
Table 9: Determinants of contagion during Covid-19 with Clusters (Europe and Asia)

Dependant Variable: Probability of contagion	**Europe**		**Asia**	
Variables	**Odds Ratio**	**Std. error**	**Odds Ratio**	**Std. error**
Intercept	0.0096	0.008	0.019	0.03
ΔInfectionsLocali,t-1	619.55***	1230.38	1090.64*	4150.97
ΔInfectionsglobal i,t-1	6.764	10.443	10.01	28.70
ΔInfectionsLocali,t-1* ΔInfectionsglobal i,t-1	0.001**	0.003	0.0001	0.0007
CatESI:				
Low	18.55***	10.39	0.66	0.51
Medium	3.19***	0.725	2.92***	0.89
High	2.197***	0.50	2.13***	0.54
Very High	2.035***	0.49	2.63***	0.88
Controls	Yes		Yes	
Pseudo R2	0.042		0.040	
No. of Countries	20		11	
Observations	2,321		1,276	

This table reports the results of a logistic regression analysing the probability of contagion during the Covid-19 crisis in response to changes in both local and global infection rates, as well as government economic support. The dependent variable is the probability of contagion within an international stock market, which is a binary variable (0 = No contagion, 1 = Contagion). Various controls are introduced at the country level to account for variations between countries, namely trade openness, GDP per capita, inflation, globalization score, and current account balance as a percentage of GDP. ΔInfectionsLocal i,t-1 indicates the change in the infection rate in a country within a single day, expressed as a percentage of that country's population, while ΔInfectionsGlobal i,t-1 refers to the change in the number of infections across all sample countries, excluding country i. ΔInfectionsLocal i,t-1 * ΔInfectionsGlobal i,t-1 is the interaction variable measuring the effect of the interaction between ΔInfectionsLocal i,t-1 and ΔInfectionsGlobal i,t-1 on the probability of contagion, respectively. CatESI is the categorical variable for economic support provided by the government within a country, measured on a scale from very low to very high across five levels. Details of the main and control variables are provided in appendices B to D. The odds ratio and standard errors are in parentheses, with ***, **, and * denoting statistical significance at the 1%, 5%, and 10% levels.

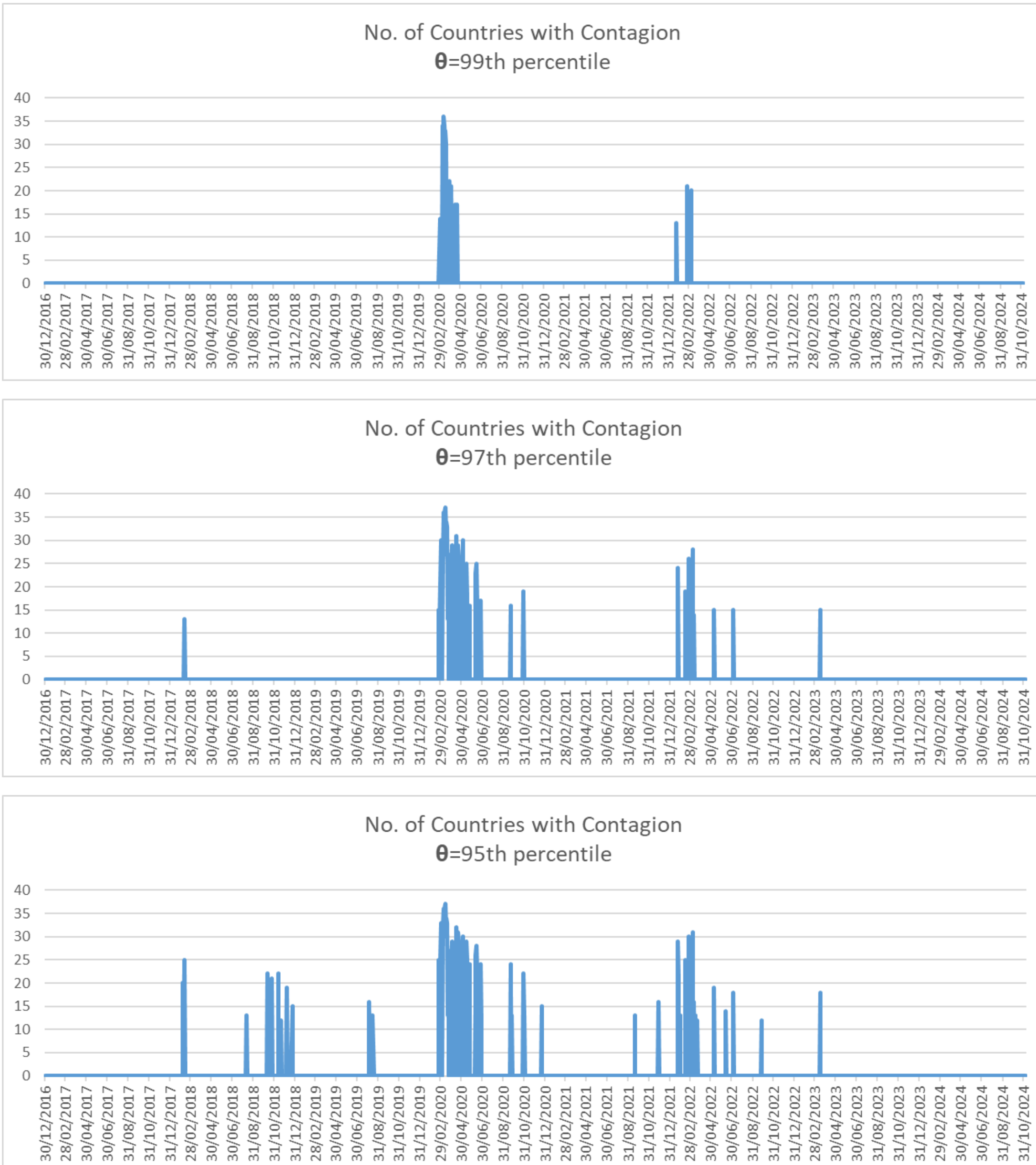
Figure 1: Volatility during Covid-19 Crisis





The above figure depicts the average volatility for the sample countries from January 1997 to 7 November 2024 and from January 2017 to 7 November 2024. The volatility is predicted using the EGARCH model. The value represented on the x-axis signifies the equal-weighted average of volatilities of all sample countries. The data is at a daily level, depicting only negative volatility, as the paper focuses solely on declines in market returns.

Figure 2: Contagion during Covid-19 crisis



The above figure illustrates the number of countries that experienced contagion on a given day within the sample timeframe. The graph presents incidences of contagion at various threshold levels. We employ threshold levels at the 99th percentile, 97th percentile, and 95th percentile. In each of the three graphs, a country is considered to experience contagion if 30% or more of the sample countries exhibit an extreme return on the same day. In other words, an extreme return is regarded as contagion only if at least 30% of the countries experience an extreme return on that day. The occurrence of contagion is sensitive to the threshold level. A lower threshold level means that more events are classified as extreme. Conversely, when the threshold level is increased, extreme returns become more limited.

Appendix A: List of Policies

Containment and Health Index	School closing Workplace closing Cancel public events Restrictions on gathering Close public transport Stay at home requirements Restrictions on internal movement Restrictions on international travel Public information campaign Testing Policy Facial coverings Protection of elderly people
Economic Support Index	Income support Debt/contract relief for households

The table presents the list of policies included in each government policy response category used in this paper. These indices are sourced from the Oxford Covid-19 Government Response Tracker by Hale et al. (2021).

Appendix B: Description of Independent Variables

Variable	Range (Unit)	Description	Source	Periodicity
ΔInfectionsLocal	(211.84) – 303.89	Daily data is obtained for total Covid-19 infections from John Hopkins Coronavirus Resource Centre. The difference is taken between the infections on dayt and dayt-1 to measure the change in Covid-19 infections for each day.	The daily Covid-19 infection data was obtained from Coronavirus Resource Centre, managed by Dong et al. (2020) at the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU).	Daily
ΔDeathsLocal	(12.63) – 44.13	Daily Covid-19 related deaths data is obtained from John Hopkins Coronavirus Resource Centre. The difference is taken between the total deaths on dayt and dayt-1 to measure the change in Covid-deaths for daily analysis.	The daily death rate was obtained from Coronavirus Resource Centre, managed by Dong et al. (2020) at the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU).	Daily
ΔInfectionsGlobal	4 - 99,681	Daily Covid-19 infection rate for sample countries is used to create the variable ΔInfectionsGlobal. The variable is a sum of new infections in all sample countries at time t, less the new infections in country i at time t.	The daily Covid-19 infection data was obtained from Coronavirus Resource Centre, managed by Dong et al. (2020) at the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU).	Daily
ΔDeathsGlobal	0 - 8,179	Daily Covid-19 infection rate for sample countries is used to create the variable ΔDeathsGlobal. The variable is a sum of new deaths in all sample countries at time t, less the new deaths in country i at time t.	The daily death rate was obtained from Coronavirus Resource Centre, managed by Dong et al. (2020) at the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU).	Daily
Containment and Health Index (CHI)	0 - 91.96	This index represents the average stringency of policy measures related to Containment and Health during Covid-19 across countries (see appendix A for the list of policies included in this index).	The Containment and Health Index was obtained from The Oxford Covid-19 Government Response Tracker (OxCGRT), managed by (Hale et al., 2021) at Blavatnik School of Government, University of Oxford.	Daily
Economic Support Index (ESI)	0 - 100	This index, created by (Hale et al., 2021) at Blavatnik School of Government, University of Oxford, is a measure of economic support provided by governments across countries.	The Economic Support Index was obtained from The Oxford Covid-19 Government Response Tracker (OxCGRT), managed by (Hale et al., 2021) at Blavatnik School of Government, University of Oxford.	Daily
CatESI	ESI	Categorical	There are 5 categories namely, 'very low', 'low', 'medium', 'high' and 'very high'. 1 represents very low index score and 5 represents very high index score.	Daily

The table reports a detailed description of the independent variables.

Appendix C: Description of Control variables

Variable	Range (Unit)	Description	Source	Periodicity
Trade Openness	26.97 - 369.18	Trade openness index measures the sum of exports and imports of goods and services as a percentage of gross domestic product.	Trade as a percentage of GDP Index is obtained from the World Bank.	Annual
Financial Openness	0.16 - 1	Financial openness index measures the level of capital account openness of a country based on the data provided by IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).	The Chinn-Ito Financial Openness Index (2020 Update) by Chinn & Ito (2006)	Annual
Globalization Score	53.59 - 90.91	The KOF Globalisation Index measures the social, economic and political aspects of globalisation. The index is a blend of 43 variables that cover different dimensions of globalization.	The KOF Globalization Index by Gygli et al. (2019)	Annual
GDP per Capita (Current US$)	1322.31 - 85973.09	GDP per capita is calculated by dividing the Gross domestic product of a country by its mid-year population.	World Bank	Annual
Current Account Balance	(11.26) - 14.26	Current account balance represents the total of net primary income, net secondary income and net exports of goods and services.	World Bank	Annual
Unemployment Rate	2.38 - 27.47	Unemployment rate is a percentage value representing the share of the labour force that is available for and actively seeking employment.	(International Labour Organization, 2023)	Annual
GDP (Current US$ Million)	853491.1-210604736.1	Gross Domestic Product (GDP) refers to the sum of gross value added by all resident producers of a country in the economy, plus any product taxes and minus any subsidies that are not included in the value of the product.	World Bank	Annual
Inflation	(1.25) - 12.28	Inflations represents the average annual change in consumer price index.	The inflation rate is obtained from the World Bank and Centre for Economic Policy Research (CEPR)	Annual

The table above reports the details for each of the control variables used in the analysis.

Appendix D: Descriptive Statistics for EGARCH variance

	Mean	Median	St. Dev	Kurtosis	Skewness	Range	Minimum	Maximum	Obs.
Australia	0.008	0.006	0.004	18.487	3.775	0.037	0.003	0.041	912
Austria	0.009	0.008	0.004	3.607	1.607	0.025	0.004	0.029	912
Belgium	0.008	0.007	0.006	121.501	7.920	0.110	0.003	0.114	912
Canada	0.007	0.005	0.005	21.794	4.161	0.044	0.002	0.046	912
China	0.009	0.009	0.003	2.234	1.275	0.021	0.004	0.025	912
Czechia	0.008	0.007	0.005	28.859	4.645	0.042	0.003	0.046	912
Denmark	0.008	0.007	0.003	19.215	3.407	0.029	0.004	0.033	912
Finland	0.009	0.007	0.004	16.754	3.410	0.038	0.004	0.041	912
France	0.008	0.006	0.005	19.043	3.684	0.044	0.003	0.047	912
Germany	0.008	0.006	0.005	18.984	3.645	0.042	0.004	0.046	912
Greece	0.014	0.013	0.006	15.007	3.070	0.056	0.005	0.061	912
Hong Kong	0.008	0.007	0.003	3.447	1.489	0.021	0.003	0.024	912
Hungary	0.011	0.010	0.005	28.474	4.282	0.058	0.006	0.063	912
India	0.008	0.007	0.005	16.130	3.390	0.039	0.003	0.042	912
Indonesia	0.011	0.009	0.007	18.658	3.635	0.065	0.004	0.069	912
Ireland	0.009	0.007	0.005	21.343	3.895	0.044	0.004	0.048	912
Israel	0.008	0.007	0.004	20.091	3.533	0.037	0.004	0.041	912
Italy	0.009	0.007	0.005	29.662	4.330	0.052	0.004	0.056	912
Japan	0.007	0.006	0.003	15.190	3.236	0.028	0.003	0.032	912
Mexico	0.011	0.009	0.005	11.304	2.810	0.040	0.005	0.045	912
Netherlands	0.007	0.006	0.004	20.239	3.677	0.038	0.003	0.041	912
New Zealand	0.008	0.007	0.003	9.529	2.471	0.026	0.004	0.029	912
Norway	0.009	0.008	0.005	22.082	3.961	0.043	0.004	0.047	912
Pakistan	0.012	0.011	0.005	12.242	2.587	0.045	0.004	0.049	912
Poland	0.010	0.009	0.005	38.514	4.232	0.067	0.005	0.072	912
Portugal	0.008	0.007	0.004	24.555	4.066	0.039	0.004	0.043	912
Russia	0.012	0.010	0.007	17.876	3.685	0.057	0.005	0.062	912
Singapore	0.007	0.006	0.004	16.040	3.323	0.030	0.003	0.033	912
South Africa	0.012	0.011	0.006	15.928	3.143	0.052	0.006	0.058	912
South Korea	0.010	0.009	0.004	18.171	3.647	0.037	0.005	0.042	912
Spain	0.009	0.007	0.004	23.904	4.030	0.044	0.004	0.048	912
Sri Lanka	0.009	0.007	0.013	256.750	14.853	0.254	0.004	0.258	912
Sweden	0.009	0.007	0.005	11.666	2.868	0.038	0.004	0.041	912
Switzerland	0.006	0.005	0.003	21.322	3.809	0.031	0.003	0.034	912
Turkey	0.015	0.014	0.006	32.234	3.975	0.077	0.007	0.084	912
United Kingdom	0.007	0.006	0.005	20.314	3.868	0.043	0.003	0.046	912
United States	0.006	0.005	0.005	9.120	2.614	0.035	0.002	0.037	912

This table shows the descriptive statistics for the country stock market variance estimated using the EGARCH process given in Equation 4 for the time frame ranging from January 2017 to June 2020.