Cardiff Economics Working Papers



Working Paper No. E2025/16

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July 2025

ISSN 1749-6010

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The Impact of China's Zero-COVID Policy on Stock Returns

Wenwen Luo * Wojtek Paczos †

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Abstract

This study examines the impact of China's "Zero-COVID" policies on stock returns in the healthcare sector from January 2020 to December 2022. Using panel regression analysis, we find that increases in the Stringency Index increased healthcare stock returns. In contrast, vaccination rates are associated with a decline in returns when averaged across the full sample. However, a time-disaggregated analysis reveals heterogeneity: in the period of the initial vaccine rollout, vaccination had a statistically significant positive effect, while in the later period, the relationship turned negative. The interaction analysis indicates that the effect of stringency on returns was stronger and the effect of vaccinations was weaker when the number of new cases of COVID-19 was high. These findings indicate that investor responses were nonlinear and evolved over time, reflecting changing expectations around pandemic control.

Keywords: Stock Returns, Zero-COVID Policy, Healthcare Sector

JEL Codes: G12, E65, C23, I18

1 Introduction

The SARS-CoV-2 virus, officially named 2019-nCoV, was first detected in Wuhan, China, at the end of 2019, quickly escalating into a global public health crisis. In response, China implemented its strict zero COVID policy, which sought to completely stop virus transmission

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through comprehensive public health measures (Zhang, 2023). These measures included border closures, city-wide lockdowns, mass testing, and strict quarantine protocols, aimed at achieving "zero new cases" nationwide (Su, McDonnell, Wen, Kozak, Abbas, Šegalo, Li, Ahmad and Cheshmehzangi, 2022). Initially, the policy effectively curtailed the spread of the virus, allowing China to maintain lower infection rates compared to many other countries (Bai, Cai, Zhou, Lei and Zhou, 2022). However, the emergence of the Omicron variant in early 2022 posed significant challenges to the sustainability of the "Zero COVID" strategy. The two-month lockdown in Shanghai severely disrupted economic activities, highlighting tensions between public health objectives and economic stability (Dyer, 2022). The increasing economic pressure and widespread public discontent ultimately led to the end of the policy in December 2022 (Cai, Xu, Lin and Song, 2022). This shift marks a crucial transition in China's public health strategy.

Although significant research has been conducted on government interventions and their effects on global financial markets, there is a notable gap in understanding the prolonged impact of China's "Zero COVID" policy on its domestic industries, particularly the healthcare sector. Previous studies, such as Lu and Paczos (2024), examined the response of the UK stock market to vaccination, demonstrating a positive effect on healthcare returns. However, given China's more restrictive and sustained policies, more research is needed to understand how these measures affected the market performance of the healthcare sector. Although Ba, Wu, Jiang and Zhang (2023) investigated the broader economic and social implications of the policy "Zero COVID", its specific impact on healthcare stock returns has received limited attention.

This study aims to address this gap by examining the effects of China's "Zero COVID" policy on healthcare sector stock returns from January 2020 to December 2022. The primary research question is: *How did China's stringent public health measures influence stock returns in the healthcare sector?* The healthcare sector played a critical role during the epidemic but faced substantial market volatility under the influence of extensive government interventions and macroeconomic conditions. Understanding the financial impact of pandemic policies is essential for both policymakers and investors.

The data for this analysis were drawn from Investing.com and covered the stock returns of 474 publicly listed healthcare companies across the Beijing, Shanghai, and Shenzhen stock exchanges from January 2020 to December 2022. To measure the impact of key policy

measures, indices from the Oxford COVID-19 Government Response Tracker (OxCGRT) were used, including the Stringency Index, Government Response Index, Containment and Health Index, Economic Support Index, as well as vaccination data from Our World in Data, which serve as proxies for tools implemented under China's Zero-COVID policy. A fixed-effects regression model was employed to control for firm-specific factors. We provide three sets of results.

The first set of results are the average results from the full sample period. The Stringency Index positively correlated with stock returns, indicating that strict public health measures contributed to market stability. The logarithm of new vaccinations had a negative impact on stock returns on average. And the Economic Support Index positively influenced stock returns, highlighting the importance of fiscal measures in maintaining market confidence.

The second set of results breaks down the analysis and shows how these relationships evolved over the course of the pandemic. During the early period, when the vaccinations were not yet available, economic support exerted positive pressure on stock returns. In the mid-period, which coincided with the vaccine rollout, vaccinations were positively associated with healthcare stock returns, suggesting investor optimism around immunisation efforts. At the same time, the economic support effect turned negative. However, the effect of vaccines reversed in the later period, becoming negative, likely reflecting diminishing marginal optimism and rising policy fatigue.

The third set of results comes from the interaction analysis and shows that the impact of public health measures was conditional on the severity of the pandemic. Specifically, the positive effect of the Stringency Index on stock returns was stronger when the number of new COVID-19 cases was high, indicating that investors responded more favorably to strict interventions during acute outbreaks. Conversely, the effect of vaccination was weaker when case numbers were elevated, suggesting that in times of heightened risk, vaccination progress did not provide stabilising signals to markets.

2 Literature Review

Globally, the impact of governmental pandemic responses on financial markets has been heterogeneous. Ashraf (2020) analysed short-term effects of social distancing policies on financial markets in 77 countries during early COVID-19 stages, showing an initial market

returns decrease of 3.21% due to heightened uncertainty and panic, followed by a 2.56% recovery as policies were implemented. Additionally, economic support measures yielded an extra 2.5% returns increase, stabilising markets. Unlike Ashraf's global perspective, the current study focuses on China, specifically examining interactions between lockdown measures, vaccinations, and economic support within the healthcare sector. This nonlinear impact is echoed by Capelle-Blancard and Desroziers (2020), who show in a 74-country analysis that stringent lockdowns actually mitigated the decline in stock prices by "flattening the curve" of contagion.

Lu and Paczos (2024) study the impact of COVID-19 vaccinations on the UK stock market using a fixed-effects model and interaction analysis. Their findings indicate a significant positive effect of vaccinations on stock returns across all industries, particularly in the healthcare sector. However, this positive influence diminished as stricter lockdown measures were implemented. Their study employs the Stringency Index from the Oxford COVID-19 Government Response Tracker (OxCGRT) and vaccination data from Our World in Data (OWID). Although this research adopts similar methodologies and data series, contrasting results emerge: vaccinations negatively affected stock market returns in China, while stringent lockdown measures positively influenced returns. This highlights the role local context plays and shows that the effects of closure policies and vaccinations may be non-linear and time-dependent.

Industries showed varied responses to pandemic policies. He, Sun, Zhang and Li (2021) used an event study to evaluate Chinese A-share market sectors, revealing that healthcare stocks had a cumulative abnormal return (CAR) increase of 5.3%, contrasting a 7% decline in transportation and mining. Similar trends are observed herein, as the healthcare sector responds positively to strict lockdown measures. Mittal and Sharma (2021) examined India's healthcare and pharmaceutical sectors through an event study, finding an early-stage CAR increase of 14.19% due to vaccination policies and preventive measures. However, rising economic uncertainty introduced subsequent market volatility. Likewise, Mazur, Dang and Vega (2021) analysed the S&P 1500 in the US, observing healthcare returns increasing over 20%, while sectors like energy and transportation declined significantly. China's unique "Zero-COVID" regime involved more frequent and intense interventions, so its market dynamics can differ from countries with looser policies. For example, Al-Awadhi, Alsaifi, Al-Awadhi and Alhammadi (2020) document that daily growth in COVID cases and deaths

had a significantly negative effect on Chinese stock returns in early 2020 reflecting strict lockdown shocks. In another example involving COVID-19 vaccinations, Ho, Gao, Gu and Yang (2022) examining Chinese markets found that news of COVID-19 vaccine approvals had heterogeneous impacts across sectors, with consumer and tech sectors rising on reopening hopes, but some healthcare sub-sectors lagging as investors anticipated lower demand for emergency medical services post-vaccination.

This divergence highlights that vaccination, while crucial for ending the health crisis, can produce winners and losers in equities. Firms directly involved in vaccines or poised to benefit from reopening (travel, retail) gained, whereas those that thrived under pandemic conditions (e.g. providers of tests, personal protective gear) saw their outlook soften as vaccination progressed.

On the quantified theory front, recent epi-macro models have increasingly incorporated vaccination campaigns as a key policy instrument, with particular attention to their nonlinear effects. For example, Garriga, Manuelli and Sanghi (2022) develop a DSGE-SIR framework in which an optimal vaccination policy features rapid deployment as soon as vaccines become available. Their analysis demonstrates that "the dollar value of a vaccine decreases rapidly as time passes," showing that the marginal benefit diminishes swiftly after the initial rollout. This is because, early in a pandemic, vaccination not only prevents new infections but also enables a faster relaxation of costly non-pharmaceutical interventions. As time progresses and coverage expands, however, the remaining unvaccinated population becomes smaller and often less exposed. Fritz, Gries and Redlin (2023) provide empirical and simulation-based support for these theoretical results. Analysing cross-country data and model scenarios, they find strong evidence of nonlinear and saturating effects of vaccination: initial increases in vaccine coverage substantially reduce transmission rates and COVID-19 cases, but the incremental impact of each additional dose falls as the share of immunised individuals rises. Similarly, Datta and Saratchand (2021) develop a nonlinear macroeconomic model incorporating epidemic dynamics and show how intervention timing and intensity can lead to qualitatively different outcomes, including oscillatory and unstable epidemic trajectories. Together, these studies offer macroeconomic context and a possible interpretation for our findings: the initially positive response of healthcare sector stock prices to vaccination news may fade or even reverse over time as the marginal value of additional vaccination declines.

3 Methodology and Data

3.1 Methodology

The methodology of this study is based on the framework established by Lu and Paczos (2024), who analysed the impact of COVID-19 vaccinations on stock market performance. The primary aim of this study is to quantify the impact of stringent COVID-19 measures on stock returns in China's healthcare sector, focusing on key indices (e.g., Stringency, Health Containment, and Vaccination Rates). These variables form the foundation for assessing how public health measures influenced market performance during different stages of the pandemic.

The study applies different versions of the following basic regression model:

$$\begin{aligned} R_{it} =& \alpha_0 + \alpha_1 Policy_{t-1} + \alpha_2 NewCases_{t-1} + \alpha_3 PB_{it-1} \\ &+ \alpha_4 Policy_{t-1} \times NewCases_{t-1} \\ &+ \mu_i + \epsilon_{it} \end{aligned} \tag{1}$$

where R_{it} represents the log returns of stock i on day t. The $Policy_{t-1}$ variables capture the "Zero COVID" policies in China, including the Stringency Index, Health Containment Index, Economic Support Index, the overall Government Response Index, and the logarithm of the 7-day rolling average of new daily COVID-19 vaccinations. These indices were population-weighted to account for provincial differences across China. Vaccination data were included as a logarithm of the national averages. The pandemic control variable is the number of new COVID-19 cases (7-day rolling average), and the firm-level control variable is the price-to-book ratio, reflecting firm valuation. In some specifications, we also analyse the interactions between the policy variables and the stages of the pandemic measured by new cases. All variables were lagged by one day to account for the delayed effects of policy measures on stock prices. Firm-specific fixed effects μ_i address unobserved heterogeneity, and ϵ_{it} denotes the error term.

Statistical tests validate the use of a fixed-effect model. The F-test confirmed significant firm-specific effects, while the Hausman test showed consistent and unbiased estimates compared to the random-effect model.

3.2 Data and Sources

This study utilises data from a variety of reliable sources to analyse the stock returns of the healthcare sector in China. The primary financial data set, sourced from Investing.com, includes 474 companies within the healthcare sector that are listed on the Beijing, Shanghai, and Shenzhen stock exchanges. Investing.com classifies these companies into four main sub-industries: Biotechnology & Medical Research, Healthcare Equipment & Supplies, Healthcare Providers & Services, and Pharmaceuticals. This classification allows for a detailed analysis of how different segments within the healthcare sector respond to external factors, especially during China's "Zero COVID" policy period. The dependent variable is calculated using logarithmic returns.

To evaluate the impact of China's "Zero COVID" policy, we rely on data from the Oxford COVID-19 Government Response Tracker (OxCGRT). The OxCGRT database (Hale, Angrist, Goldszmidt, Kira, Petherick, Phillips, Webster, Cameron-Blake, Hallas, Majumdar and Tatlow, 2021) offers a comprehensive set of indicators that quantify various aspects of government responses to the pandemic across China's 31 provinces. For this study, we focus on four key indices. The Economic Support Index measures the level of financial assistance provided by the government, such as income support and debt relief. The Containment and Health Index reflects the comprehensiveness of public health measures, including testing policies and contact tracing efforts. The Government Response Index offers an overall score of government actions by synthesising multiple policy responses. Lastly, the Stringency Index measures the strictness of lockdown policies, such as restrictions on movement and public activities. Each index ranges from 0 to 100, with higher scores indicating stronger government intervention.

These indices are aggregated using population weights based on data from the Seventh National Population Census to reflect the national impact of policies across China's 31 provinces, ensuring that larger provinces are appropriately represented. The weighted average for each index is calculated as follows:

$$WeightedIndex_t = \frac{\sum_{p=1}^{31} Index_{p,t} \times Population_p}{\sum_{p=1}^{31} Population_p} \tag{2}$$

In addition to these indices, this study incorporates vaccination data from Our World in Data (OWID). Specifically, the "New Vaccinations Smoothed" index tracks the seven-

day rolling average of new daily vaccinations. This data is pivotal in understanding how vaccination campaigns, as part of the broader public health policy, contributed to market responses. The inclusion of this data allows for a more nuanced analysis of how vaccination efforts interacted with other government policies to influence stock returns in the healthcare sector.

The Vaccination data from OWID are provided at the national level and span from December 2020 to December 2022. To ensure accuracy, no interpolation or data smoothing was applied prior to the introduction of vaccines. Instead, a logarithmic transformation was applied to reduce the impact of extreme values and stabilise variance.

Moreover, the "New Cases Smoothed" index from OWID is used to reflect the seven-day rolling average of daily reported COVID-19 cases. This index smooths short-term fluctuations, providing a clearer view of the pandemic's progression. A higher value of this index typically signals a surge in infection rates, while a lower value suggests successful containment measures.

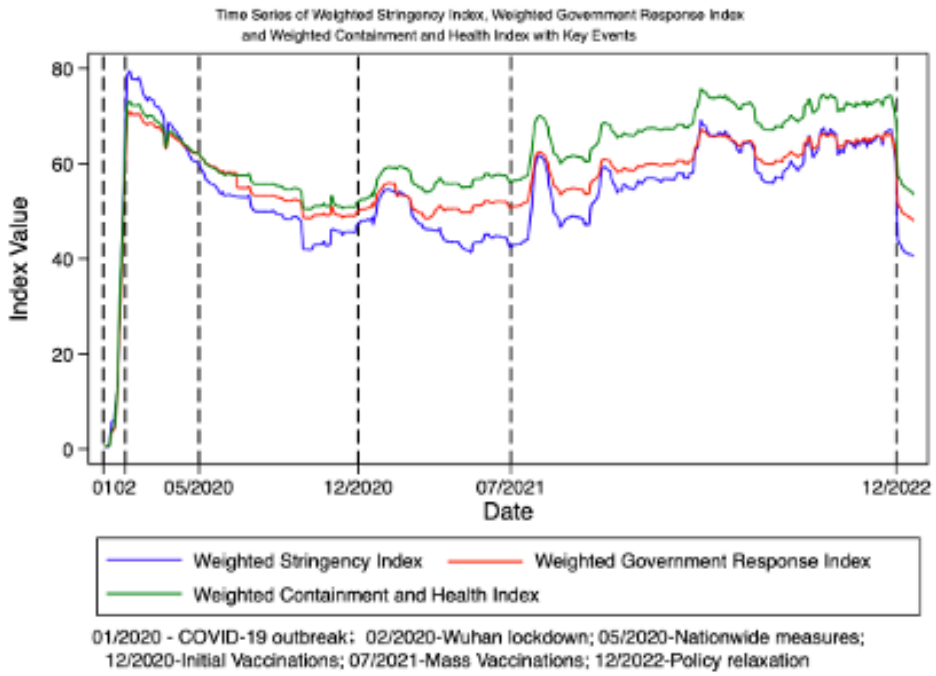
The price-to-book (PB) ratio data, sourced from Yahoo Finance, serves as a control variable to account for valuation differences within the healthcare sector. The PB ratio compares a company's market value to its book value, providing insights into whether a stock is overvalued or undervalued (Asness, Frazzini, Israel and Moskowitz, 2018). A PB ratio greater than 1 suggests optimism about a company's growth prospects, while a ratio below 1 implies undervaluation. Using this as a control variable allows the study to isolate the effects of government policies on stock returns from the inherent differences in firm valuations.

3.3 Data Description and Statistical Analysis

Figure 1 presents the time series of the Stringency Index, Government Response Index, and Containment and Health Index. The vertical red lines indicate the timing of six major pandemic-related events: the COVID-19 outbreak in January 2020, the Wuhan lockdown in February 2020, the nationwide measures in May 2020, the initial vaccinations in December 2020, the mass vaccination campaign in July 2021, and the policy relaxation in December 2022.

In January 2020, a surge in policy indices reflected the rapid implementation of stringent public health measures. The strict Wuhan lockdown in February 2020 marked the peak level

Figure 1: Stringency Index, Government Response Index, and Containment Health Index with Key Events

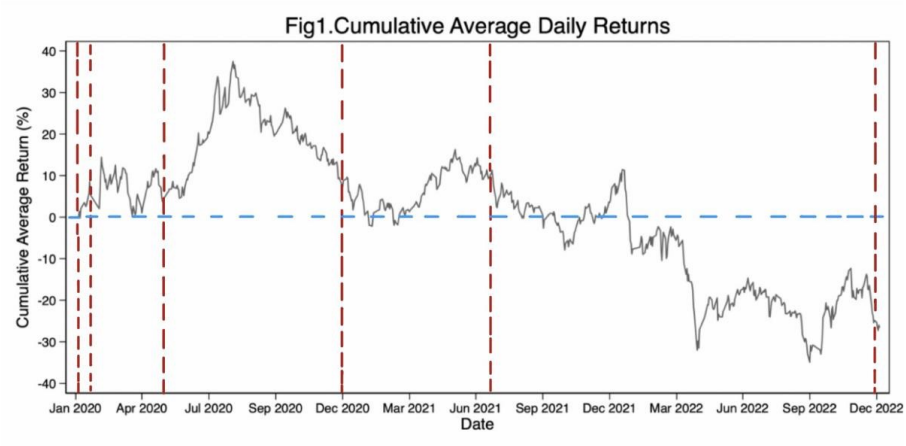


of all three policy measures. After this policy indices remained elevated, but with a steady downward trend, until the vaccine rollout in December 2020, when, as the rollout of the vaccination programmes coincided with the new Covid-19 variants, and the public health measures became stricter again. December 2022 marks a visible moment of policy relaxation.

Figure 2 illustrates the cumulative average daily returns of China's healthcare sector from January 2020 to December 2022. The blue horizontal line represents the zero-return benchmark, and horizontal lines mark the six major pandemic events.

The healthcare sector's initial reaction to the COVID-19 outbreak in January 2020 showed resilience despite global economic challenges (Ashraf, 2020). Following the Wuhan lockdown in February, returns briefly dipped below zero but rebounded by mid-2020, entering positive territory. The nationwide lockdown in May marked a turning point, with cumulative returns surging to a peak later that year. However, from July 2020, returns steadily declined, nearing the zero line by the year's end as initial optimism about the sector's growth potential faded amid broader market uncertainties. The vaccine rollout in December briefly stabilised returns, but performance remained close to zero. The mass vac-

Figure 2: Cumulative average daily returns of China's healthcare sector from January 2020 to December 2022



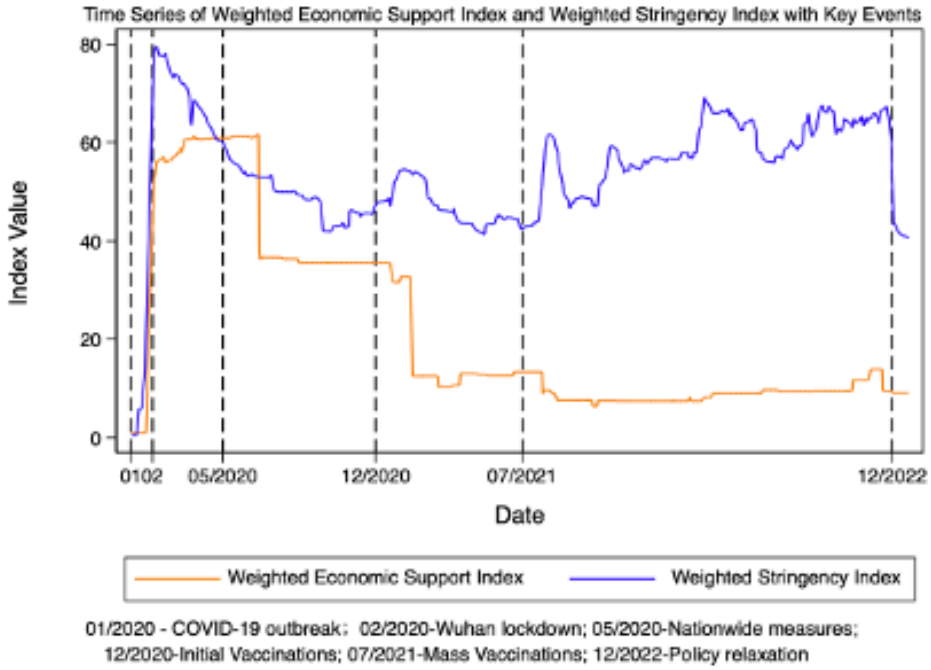
cination campaign in July 2021 brought slight improvements in cumulative returns, but the gains were limited as the market quickly stabilised. By December 2022, the relaxation of strict pandemic control measures led to volatility, pushing cumulative returns into negative territory.

Figure 3 illustrates the time series of the Stringency Index and the Economic Support Index, highlighting the government's efforts to balance pandemic control with economic relief. The Economic Support Index peaked after the Wuhan lockdown, reflecting large-scale fiscal policies aimed at mitigating the economic impact of strict containment measures He et al. (2021).

Figure 4 illustrates the relationship between vaccination efforts and public health measures, represented by the Logarithm of Vaccinations Smoothed and the Containment and Health Index. As vaccination efforts intensified, the Containment and Health Index gradually declined, signalling a transition from strict public health measures to vaccination as the primary pandemic control strategy.

The sharp increase in vaccination rates after the December 2020 vaccine rollout aligned with a rise in healthcare sector returns (Figure 1). However, by December 2022, following the relaxation of public health policies, the sector experienced heightened volatility and declining returns. This indicates that initial benefits from increased vaccination coverage were overshadowed by investor concerns over the sustainability of pandemic control without

Figure 3: Time Series of Economic Support Index and Stringency Index with Key Events



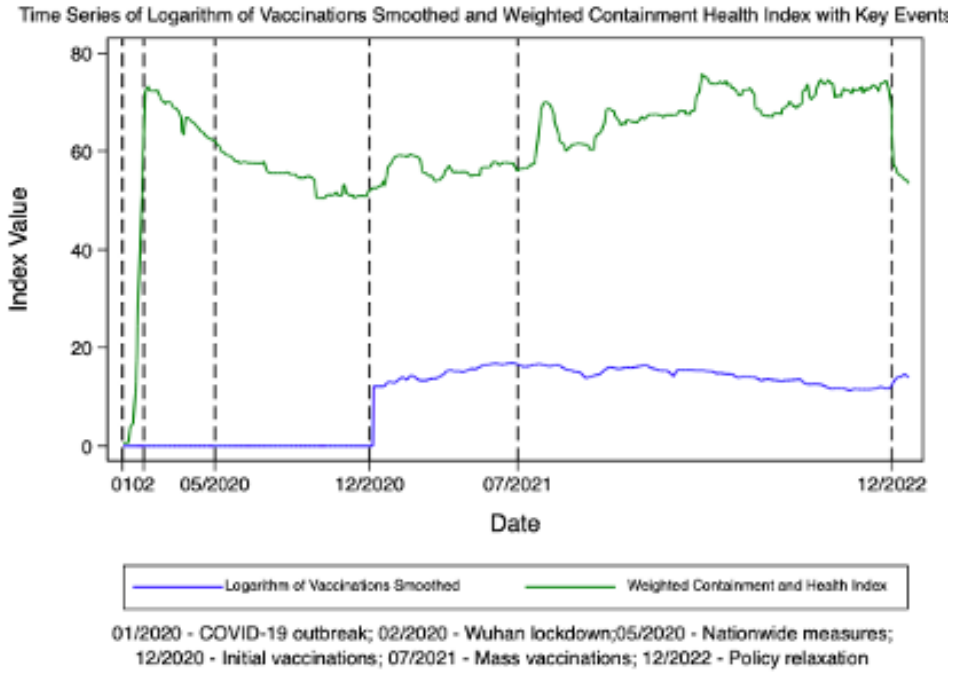
stringent interventions, contributing to market uncertainty (Ashraf, 2020, Ba et al., 2023).

Table 1 provides summary statistics for the key variables analysed in this study, illustrating the government's pandemic response and its impact on the healthcare sector. The Stringency Index (mean: 54.58) and Government Response Index (mean: 57.23) highlight the generally high level of stringency and sustained policy measures during the pandemic. Similarly, the Containment and Health Index (mean: 62.56) reflects the government's focus on public health management, while the Economic Support Index (mean: 19.89) indicates that financial support, initially substantial, tapered off as conditions improved.

The Price-to-Book Ratio (PB) exhibits notable volatility, with a high standard deviation of 6.45. The minimum value of the PB ratio is negative (-132.31), which reflects the financial challenges faced by specific firms during the pandemic, primarily due to accumulated losses exceeding total assets. For these companies, high R&D expenses, operational losses, and asset impairments contributed to negative book equity, highlighting the diverse financial pressures within the healthcare sector under pandemic-related disruptions.

Table A1 in the Appendix lists the detailed definitions and sources of each of the variables

Figure 4: Time Series of Logarithm of Vaccinations Smoothed and Containment Health Index with Key Events



used in this study. Table A2 in the Appendix presents the correlation matrix.

4 Empirical Analysis

4.1 Model Selection

To evaluate the impact of China's "Zero-COVID" policy on the healthcare sector, we conducted model selection tests to determine the most appropriate regression framework. We first compared a pooled Ordinary Least Squares (OLS) model with a random effects panel model using the Breusch–Pagan Lagrange Multiplier (LM) test, which failed to reject the null hypothesis ($p = 1.0000$), suggesting that panel structure is unnecessary. However, the Hausman test comparing fixed and random effects produced a $\chi^2(5) = 150.56$ ($p = 0.0000$), strongly rejecting the random effects assumption and favouring the fixed effects specification. Furthermore, an F-test confirmed the joint significance of the fixed effects ($F = 1.15$, $p = 0.0246$), supporting their inclusion. We therefore adopt the fixed effects model with

Table 1: Summary statistics

Variables	Mean	Std. Dev.	Min	Max
R	0.00	0.03	-0.11	0.11
Stringency Index	54.58	10.86	0.46	79.50
Government Response Index	57.23	9.14	0.64	71.07
Containment and Health Index	62.56	10.44	0.59	75.79
Economic Support Index	19.89	17.42	1.02	61.71
Price-to-Book Ratio (PB)	3.57	6.45	-132.31	55.46
Logarithm of Vaccination smoothed (LVAC)	10.49	6.53	0.00	16.93

standard errors clustered at the firm level, which effectively controls for unobserved heterogeneity and yields robust coefficient estimates. The full results of the model selection tests are reported in Appendix Table A3, and coefficient comparisons across model specifications are presented in Appendix Table A4.

4.2 Benchmark Results

The benchmark regression estimates the effects of government policy measures and epidemiological developments on daily stock returns in China's healthcare sector. The explanatory variables include the Stringency Index, the Government Response Index, the Containment and Health Index, the Economic Support Index, the logarithm of smoothed vaccinations, and the number of new confirmed COVID-19 cases. The price-to-book ratio is included as a firm-level control variable.

The estimation proceeds in two stages. First, each of the policy indices is included individually, together with the control variable, in order to isolate the marginal effect of each policy component. Second, a stepwise regression is conducted, beginning with the number of new confirmed COVID-19 cases as the baseline variable. Each policy index is then added one at a time to evaluate the robustness and incremental explanatory power of policy interventions when accounting for contemporaneous infection dynamics.

The results of the first exercise are reported in Table 2. When included individually, the Weighted Stringency Index has a positive and statistically significant effect on daily healthcare stock returns. The estimated coefficient is 0.0000187, with a standard error of 0.0000665, indicating statistical significance at the one percent level. Although the coefficient appears small, the economic impact can accumulate over sustained periods of policy stringency. The positive sign implies that more restrictive government policies were associ-

Table 2: Separate Regressions with Individual Variables

	(1)	(2)	(3)	(4)	(5)	(6)
Price-to-Book Ratio	0.0000284***	0.0000277***	0.0000276***	0.0000270***	0.0000269***	0.0000271***
	(0.0000370)	(0.0000369)	(0.0000370)	(0.0000369)	(0.0000369)	(0.0000369)
Weighted Stringency Index	0.0000187***					
	(0.0000665)					
Government Response Index		0.00000779				
		(0.0000784)				
Containment and Health Index			0.00000198			
			(0.0000691)			
Economic Support Index				0.0000123***		
				(0.0000411)		
Logarithm of Vaccinations					-0.0000404***	
					(0.0000109)	
New COVID-19 Cases						-0.000000000505***
						(0.00000000013)
Constant	-0.00337***	-0.00278***	-0.00245***	-0.00255***	-0.00188***	-0.00227***
	(0.0000399)	(0.0000481)	(0.0000467)	(0.0000167)	(0.0000191)	(0.0000149)
R^2	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Observations	174,651	174,651	174,651	174,651	174,651	174,651

Note: Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

ated with higher returns in the healthcare sector, potentially reflecting investor expectations of increased demand for health-related goods and services under strict public health conditions.

The Government Response Index, the Containment and Health Index, and the Economic Support Index are also estimated separately. Among these, only the Economic Support Index exhibits a statistically significant effect. The coefficient is 0.0000123 with a standard error of 0.0000411, significant at the one percent level. This suggests that fiscal and financial support policies had a positive impact on healthcare stock performance, likely through mechanisms of macroeconomic stabilisation or direct financial support to firms operating in the sector.

The logarithm of smoothed vaccinations has a statistically significant negative coefficient of -0.0000404, with a standard error of 0.0000109. This indicates that increases in vaccination rates were associated with declines in healthcare stock returns. This result is economically meaningful and suggests that the perceived long-term profitability of the sector

Table 3: Benchmark Results - Stepwise Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Price-to-Book Ratio	0.0002748***	0.0002714***	0.0002664***	0.0002695***	0.0002863***	0.0002914***
	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)
New Cases		-0.000000000505***	-0.000000000475***	-0.000000000456***	-0.000000000378***	-0.000000000365**
		(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Vaccinations			-0.0000378***	-0.0000425***	0.0000329	0.0000000212
			(0.00001)	(0.00001)	(0.00002)	(0.00002)
Containment and Health				0.00000872	-0.0001428***	-0.0001536***
				(0.00001)	(0.00003)	(0.00003)
Stringency Index					0.0001402***	0.0001561***
					(0.00003)	(0.00003)
Economic Support						-0.0000173*
						(0.00001)
Constant	-0.00232***	-0.00227***	-0.00186***	-0.00237***	-0.00140**	-0.00092
	(0.00015)	(0.00015)	(0.00019)	(0.00047)	(0.00051)	(0.00056)
R^2	0.00032	0.00041	0.00047	0.00048	0.00063	0.00066
Observations	174,651	174,651	174,651	174,651	174,651	174,651

Note: Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

declined as the population became increasingly immunised. One possible interpretation is that successful vaccination campaigns reduced the anticipated need for continued healthcare intervention, thereby moderating investors' expectations of future sector revenues.

The number of new confirmed COVID-19 cases also has a negative and statistically significant effect on daily returns. The estimated coefficient is -0.000000000505 with a standard error of 0.000000000130. While the effect of one additional case is extremely small, the aggregate effect becomes economically significant during periods of high transmission. The negative sign is consistent with a market response that incorporates concerns over economic disruption, regulatory uncertainty, or systemic strain arising from rising infection rates.

The results of the second exercise, with a stepwise specification, are reported in Table 3, and broadly confirm the findings. When the number of new confirmed COVID-19 cases is included as the baseline variable, the addition of policy indices sequentially reveals consistent signs and magnitudes for the estimated coefficients. In particular, the inclusion of the Economic Support Index and the logarithm of vaccinations leads to statistically significant estimates with consistent interpretations.

The price-to-book ratio is statistically significant and positive across all specifications, with estimated coefficients in the range of 0.000269 to 0.000284. This confirms the impor-

Table 4: Regression Results by Pandemic Stage

	Early Period	Mid Period	Late Period
Price-to-Book Ratio	0.00201***	0.000510***	0.000714***
	(0.000217)	(0.000719)	(0.000749)
New Cases	−5.28e-07**	−1.55e-04***	−3.85e-11
	(2.58e-07)	(1.21e-04)	(1.73e-10)
Vaccinations	0	−0.000333	−0.000642***
	(.)	(0.000360)	(0.000783)
Containment and Health	−0.00127***	0.000900***	0.000867***
	(0.000224)	(0.000104)	(0.000329)
Stringency Index	0.000923***	−0.000520***	−0.000592**
	(0.000155)	(0.000657)	(0.000239)
Economic Support Index	0.000330***	−0.000554**	0.0000689
	(0.000782)	(0.000261)	(0.0000649)
Constant	−0.00300***	−0.0251***	−0.0204**
	(0.000979)	(0.00378)	(0.00933)
R^2	0.00518	0.00771	0.00248
N	22,723	53,725	98,203

Note: Early Period: January 2020 – June 2020; Mid Period: July 2020 – June 2021; Late Period: July 2021 – December 2022. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

tance of firm-level valuation in explaining stock return dynamics within the sector. The estimated constant term is negative and statistically significant in all models.

Some of the results obtained in this section are not aligned with initial theoretical expectations. The positive impact of more stringent public health restrictions and the negative association between vaccination coverage and stock performance suggest that investor responses were contingent on evolving economic and epidemiological conditions. To explore this possibility further, the next section conducts a disaggregated analysis by sub-periods, allowing for heterogeneity in the effects of government policies and infection trends over time.

4.3 Time-disaggregated Analysis

To assess the potential time-heterogeneous effects of pandemic policy responses on the healthcare sector, we divide the sample into three distinct subperiods: (i) the initial pandemic and pre-vaccination phase (January 2020 to November 2020), (ii) the vaccination rollout and Delta variant phase (December 2020 to November 2021), and (iii) the Omicron wave and relaxation of restrictions (December 2021 to December 2022). This segmentation corresponds to key structural shifts in public health strategies, epidemiological conditions, and investor expectations.

The regression results for this time-disaggregated analysis are reported in Table 4. The estimation model remains consistent with the benchmark specification, with stock returns regressed on the Stringency Index, Government Response Index, Containment and Health Index, Economic Support Index, the logarithm of smoothed vaccinations, and the number of new confirmed COVID-19 cases. The price-to-book ratio is again included as a control.

The results reveal substantial variation in the effects of policy measures across periods. In the first subperiod, the Stringency Index is positively associated with stock returns, with the coefficient statistically significant at the one percent level. This is consistent with the benchmark result and reflects strong investor confidence in health sector performance during the initial response phase, when strict containment policies were seen as essential for managing uncertainty and stimulating demand for healthcare services.

In contrast, during the second subperiod, the coefficient on the Stringency Index becomes statistically insignificant, suggesting that the effectiveness of stringent measures in supporting market valuations diminished once the vaccination campaign was underway. During the third subperiod, the coefficient turns negative, reflecting waning market support for prolonged Zero-COVID measures, as restrictive policies were increasingly seen as economically costly and less effective in preventing the spread of highly transmissible variants.

The logarithm of smoothed vaccinations is associated with a negative and significant effect on returns only during the second subperiod. This aligns with the interpretation that, as vaccines became widely available, expectations of reduced pandemic-related expenditures in the healthcare sector began to dominate market valuations. In the first and third subperiods, the coefficient is statistically insignificant.

The number of new confirmed COVID-19 cases has a consistently negative and significant effect on returns in all three subperiods, with the magnitude of the coefficient largest during

the third period. This pattern suggests increasing sensitivity of the market to case surges, possibly reflecting broader concerns over policy instability, public resistance, or economic disruption.

To ensure robustness and clarify the role of each policy component, we also report auxiliary regressions in Appendix Tables A5-A8. These tables present results for each subperiod with a restricted model that includes the number of new confirmed cases and the price-to-book ratio as controls, alongside one policy variable at a time. The Stringency Index has a statistically significant and negative effect in the early and mid periods, but turns positive (and statistically significant) in the late period, when the vaccination campaigns are at their peak. A similar pattern is observed for the Economic Support Index: it is significantly negative in the early and mid periods, then becomes positive and statistically significant in the late period. For the Containment and Health Index, the coefficient is negative and significant in the early period, becomes positive and significant in the mid and late periods, indicating that containment and health policies had initially adverse, but later positive effects as the pandemic evolved. Finally, for the vaccination variable, the effect is insignificant in the early period - as vaccines were not yet available - starts out as positive and highly significant in the mid period, but reverses to negative and significant in the late period. This reversal suggests that the marginal effect of the vaccination campaign diminished and even became negative as the campaign matured, mirroring theoretical insights that the value of additional vaccination falls rapidly over time.

Taken together, these results suggest that the influence of pandemic policies on healthcare stock returns is nonlinear and time-dependent. Investors responded differently to public health and economic interventions depending on the prevailing epidemiological context and the perceived effectiveness of specific measures. This underscores the importance of accounting for dynamic policy-market interactions in empirical assessments of crisis response.

4.4 Interaction Analysis

This section investigates whether the impact of major COVID-19 policy interventions on healthcare sector stock returns depends on the current severity of the pandemic, as measured by the number of new COVID-19 cases. We estimate the baseline regression model with the addition of interaction terms between each policy variable and new cases, to directly test for conditional effects.

Table 5: Regression Results with Interaction Terms

	(1)	(2)	(3)	(4)
Price-to-Book Ratio	0.0002914***	0.0002964***	0.0003091***	0.0002924***
	(0.0000372)	(0.0000372)	(0.0000373)	(0.0000372)
New Cases	-0.000000000365***	0.0000000726***	-0.0000000677***	-0.000000242***
	(0.0000000)	(0.0000000)	(0.0000000)	(0.0000002)
Vaccinations	0.0000000212	0.0000178	0.0000615**	0.0000327
	(0.0000242)	(0.0000243)	(0.0000256)	(0.0000243)
Containment and Health	-0.0001536***	-0.0001597***	-0.0001764***	-0.0001021***
	(0.0000307)	(0.0000307)	(0.0000308)	(0.0000310)
Stringency	0.0001561***	0.0001544***	0.0001429***	0.0000731**
	(0.0000282)	(0.0000281)	(0.0000282)	(0.0000290)
Economic Support	-0.000173**	-0.000105	0.000130	-0.000000254
	(0.0000810)	(0.0000815)	(0.0000909)	(0.0000082)
Vaccinations × New Cases		-0.0000000051***		
		(0.0000000)		
Stringency × New Cases			0.00000000165***	
			(0.0000000)	
Economic Support × New Cases				0.0000000267***
				(0.0000000)
Constant	-0.000919*	-0.000862	-0.000452	-0.000591
	(0.0000556)	(0.0000556)	(0.0005592)	(0.0000556)
R^2	0.001	0.001	0.001	0.001
Observations	174,651	174,651	174,651	174,651

Notes: Significance levels denoted by *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors in parentheses.

The results are presented in Table 5. In column (1), for convenience, we repeat the results of the full benchmark model from Table 3, column (6). In the next columns, we add interaction terms between New Cases and three policy variables: Vaccinations, Stringency Index, and Economic Support Index. The results indicate that the effect of vaccination campaigns on stock returns is not constant, but varies with the intensity of the pandemic.

When the interaction between log vaccinations and new cases is included (column 2), the coefficient on the interaction is negative and statistically significant. This suggests that the average negative effect of increased vaccination rates on stock returns becomes more pronounced as the number of new COVID-19 cases rises. In other words, vaccination progress is associated with lower returns when infection rates are high.

Similarly, the interaction between the Stringency Index and new cases is positive and statistically significant highlighting how the effects of Zero-COVID policy tools were conditioned by the pandemic's severity. This indicates that strict lockdown and containment policies are more favourably received by the market when infection rates are high. During periods of elevated pandemic severity, increased stringency is interpreted as an effective government response, providing reassurance and supporting stock returns.

The interaction between the Economic Support Index and new cases is also positive and significant. This finding implies that fiscal support measures are particularly effective at stabilising returns when the healthcare system faces acute pressures. Economic interventions appear to mitigate the adverse market effects associated with pandemic surges, reinforcing investor confidence during times of heightened uncertainty.

Taken together, these results highlight the importance of the non-linear effects in shaping the financial market response to COVID-19 mitigation policies. Vaccination efforts, lockdowns, and economic support do not exert uniform effects; rather, their effectiveness depends on the stage and severity of the pandemic.

5 Discussion and Conclusions

This study analyses the effect of China's Zero-COVID policy on healthcare sector stock returns between January 2020 and December 2022. Using regression analysis across the full sample and disaggregated periods, as well as interaction terms, the results identify relationships between public health measures and financial market responses.

The Stringency Index, which captures the severity of containment policies, had a small but statistically significant positive effect on healthcare stock returns in the overall sample. Vaccination rates, in contrast, were associated with a significant decline in returns when averaged over the full period.

Time-disaggregated analysis reveals important variation. In the early period, vaccines were not yet available, but in the mid-period, when they were introduced, vaccination rates had a significant and positive effect on returns. This suggests that investors initially viewed the vaccine rollout as a positive development for the healthcare sector. In the late period, vaccination rates had a significant negative effect, likely reflecting expectations that increased immunity would reduce demand for healthcare services and reduce sector

profitability.

Economic support policies had a positive effect in the early period, a strong negative effect in the mid-period, and no significant effect later. This suggests that in the early phase of the pandemic, investors viewed government support as necessary and stabilising responses to uncertainty. However, by the mid-period, sustained fiscal interventions may have raised concerns about the long-term costs, leading to a decline in market confidence.

Interaction analysis shows that the effectiveness of policy measures also depended on case numbers. When infections were high, containment and economic support policies had stronger positive effects on returns. Conversely, vaccination rates had a significantly lower effect on stock returns when case numbers were rising, possibly due to uncertainty about the prospects of reopening the economy under high transmission.

The results of this study bear an important new lesson for investors: public health policies should not be treated as uniformly beneficial or harmful. The same measures, such as vaccinations, lockdowns, or economic support, can have opposite effects on stock returns depending on timing and case levels. A detailed understanding of policy dynamics and real-time pandemic conditions can improve investment decisions, particularly in health-related sectors during crises.

This study does not assess the broader effectiveness or appropriateness of China's Zero-COVID policy, but it does show how financial markets, particularly in the healthcare sector, responded to specific policy measures under different conditions. The results suggest that investor reactions to containment and support policies were not uniform, but varied with the stage of the pandemic and the level of infections. While public health decisions are made with multiple objectives in mind, understanding how markets respond to these measures may also help policymakers anticipate and manage economic signalling effects during future crises.

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Appendix

Table A1: Variable Definitions

Variable	Definition
Dependent variable	
R	The logarithm of daily stock return for company i on day t.
Explanatory variables	
Stringency Index	National-level index from OxCGRT, population-weighted average of provincial lockdown stringency scores on day $t-1$.
Government Response Index	Population-weighted average of provincial OxCGRT indices on day $t-1$, summarising overall government interventions.
Containment and Health Index	Population-weighted average of provincial OxCGRT indices on day $t-1$ reflecting health-related containment measures.
Economic Support Index	Population-weighted average of provincial OxCGRT indices on day $t-1$, reflecting economic support such as income aid.
Logarithm of Vaccinations (LVAC)	Log of new vaccinations administered on day $t-1$, 7-day rolling average.
Company-level control variable	
PB	Price-to-book ratio for company i at day $t-1$.
Health-level control variable	
New Cases	Number of new COVID-19 cases reported.
Industry-level control variables	
Biotechnology & Medical Research	Dummy variable = 1 if company i belongs to this sector, 0 otherwise.
Healthcare Equipment & Supplies	Dummy variable = 1 if company i belongs to this sector, 0 otherwise.
Healthcare Providers & Services	Dummy variable = 1 if company i belongs to this sector, 0 otherwise.
Pharmaceuticals	Dummy variable = 1 if company i belongs to this sector, 0 otherwise.

Table A2: Correlation Matrix

	R	Stringency	Gov. Response	C&H	Econ. Support	PB	VAC
R	1.00						
Stringency	-0.01**	1.00					
	(0.03)						
Gov.Response	-0.01***	0.96***	1.00				
	(0.00)	(0.00)					
C&H	-0.01***	0.92***	0.97***	1.00			
	(0.00)	(0.00)	(0.00)				
Econ Support	0.02***	0.18***	0.12***	-0.12***	1.00		
	(0.00)	(0.00)	(0.00)	(0.00)			
PB	0.01***	-0.02***	-0.01***	-0.01***	-0.00	1.00	
	(0.01)	(0.00)	(0.00)	(0.00)	(0.15)		
VAC	-0.02***	0.05***	0.17***	0.36***	-0.83***	0.00***	1.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note: R is the logarithm of stock returns; Stringency is the Stringency Index; Gov.Response is the Government Response Index; C&H is the Containment and Health Index; Econ Support is the Economic Support Index; VAC is the Logarithm of Vaccination smoothed; PB is Price-to-Book Ratio.
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table A3: Model Selection Tests

Test	Statistic	p-value	Conclusion
Breusch–Pagan LM Test	0.00	1.0000	No RE effect → OLS valid
Hausman Test	$\chi^2(5) = 150.56$	0.0000	RE rejected → Use FE
F-test for Fixed Effects	F = 1.15	0.0246	Fixed Effects jointly significant

Note: The LM test compares OLS and Random Effects, and fails to reject the null (p = 1.0000). The Hausman test strongly rejects the Random Effects model in favour of Fixed Effects (p = 0.0000). The F-test further confirms that Fixed Effects are jointly significant (p = 0.0246).

Table A4: Coefficient Estimates Under Different Models

	Pooled OLS	Random Effects	Fixed Effects	FE + Clustered SE
Price-to-Book Ratio	0.000347***	0.000347***	0.000291***	0.000291*
	(0.000108)	(0.000108)	(0.000372)	(0.000166)
New Cases	-4.60e-10***	-4.60e-10***	-3.65e-10***	-3.65e-10***
	(1.31e-10)	(1.31e-10)	(1.32e-10)	(1.35e-10)
Vaccinations	4.27e-06	4.27e-06	2.12e-08	2.12e-08
	(0.000241)	(0.000241)	(0.000242)	(0.000192)
Containment & Health	-0.000154***	-0.000154***	-0.000154***	-0.000154***
	(0.000305)	(0.000305)	(0.000307)	(0.000292)
Stringency Index	0.000144***	0.000144***	0.000156***	0.000156***
	(0.000280)	(0.000280)	(0.000282)	(0.000289)
Economic Support	-0.000006	-0.000006	-0.000173**	-0.000173**
	(0.000798)	(0.000798)	(0.000810)	(0.000825)
Constant	0.000445	0.000445	-0.000919*	-0.000919
	(0.000538)	(0.000538)	(0.000556)	(0.000722)

Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Regression Results by Pandemic Stage – Stringency Index

	Early Period	Mid Period	Late Period
Weighted Stringency Index	-0.0000553***	-0.000156***	0.0000773***
	(0.00000993)	(0.0000303)	(0.0000121)
Price-to-Book Ratio	0.0000689*	0.0000274	0.0000189
	(0.0000312)	(0.0000140)	(0.0000148)
New Cases	-6.54e-08	-0.00000375***	-7.97e-10***
	(0.000000188)	(0.000000927)	(1.24e-10)
Constant	0.00476***	0.00732***	-0.00551***
	(0.000583)	(0.00144)	(0.000715)
R^2	0.00149	0.000657	0.00102
Observations	29,424	68,773	124,877

Note: Early Period: January 2020 – June 2020; Mid Period: July 2020 – June 2021; Late Period: July 2021 – December 2022. Standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A6: Regression Results by Pandemic Stage – Containment and Health Index

	Early Period	Mid Period	Late Period
Price-to-Book Ratio	0.0000697*	0.0000278*	0.0000191
	(0.0000312)	(0.0000140)	(0.0000148)
Containment and Health Index	-0.0000501***	0.000444***	0.000114***
	(0.0000101)	(0.0000474)	(0.0000166)
New Cases	-0.000000201	-0.00000703***	-7.43e-10***
	(0.000000182)	(0.000000996)	(1.25e-10)
Constant	0.00452***	-0.0242***	-0.00879***
	(0.000597)	(0.00258)	(0.00114)
R^2	0.00128	0.00154	0.00107
Observations	29,424	68,773	124,877

Note: Early Period: January 2020 – June 2020; Mid Period: July 2020 – June 2021; Late Period: July 2021 – December 2022. Standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A7: Regression Results by Pandemic Stage – Economic Support Index

	Early Period	Mid Period	Late Period
Price-to-Book Ratio	0.0000703*	0.0000301*	0.0000164
	(0.0000312)	(0.0000140)	(0.0000148)
Economic Support Index	-0.0000368***	-0.000117***	0.000175***
	(0.00000994)	(0.00000983)	(0.0000458)
New Cases	-0.000000425*	-0.000000612***	-1.07e-09***
	(0.000000173)	(0.000000949)	(1.16e-10)
Constant	0.00367***	0.00318***	-0.00259***
	(0.0000558)	(0.0000310)	(0.0000432)
R^2	0.000905	0.00233	0.000807
Observations	29,424	68,773	124,877

Note: Early Period: January 2020 – June 2020; Mid Period: July 2020 – June 2021; Late Period: July 2021 – December 2022. Standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A8: Regression Results by Pandemic Stage – Vaccinations

	Early Period	Mid Period	Late Period
Price-to-Book Ratio	0.0000686*	0.0000296*	0.0000212
	(0.0000312)	(0.0000140)	(0.0000148)
Vaccinations	0	0.0000976***	-0.000453***
	(.)	(0.0000158)	(0.0000513)
New COVID-19 Cases	-0.000000487**	-0.00000573***	-0.00000000109***
	(0.000000173)	(0.000000988)	(1.16e-10)
Constant	0.00179***	-0.000647***	0.00546***
	(0.0000235)	(0.0000179)	(0.0000738)
R^2	0.000439	0.000830	0.00131
Observations	29,424	68,773	124,877

Note: Early Period: January 2020 – June 2020; Mid Period: July 2020 – June 2021; Late Period: July 2021 – December 2022. Standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.