Fund Characteristics Immunity to COVID-19 pandemic: Evidence from Thailand

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This research investigates the relationship between COVID-19 growth rates and the performance of Thai equity funds during the pandemic. Focusing on weeks with substantial increases in COVID-19 cases, we hypothesize that negative returns primarily originate from these weeks. We acknowledge the pandemic's impact as a black swan event, instilling fear and uncertainty, and its demonstrated negative effect on fund returns. Moreover, our research aims to identify the fund characteristics that have provided resilience and immunity to the negative effects of the crisis. Using a panel data regression with a fixed effect model, we analyze various fund characteristics and their impact on performance. The dataset covers the initial and peak periods of the pandemic in Thailand from March 2020 to October 2021, and performance is evaluated using three metrics: excess risk-free return, Sharpe ratio, and Jensen's alpha.

The findings reveal a negative relationship between COVID-19 growth rates and domestic equity fund performance. Specifically, extreme growth cases have a significant detrimental effect on fund performance. However, certain fund characteristics, such as equity large-cap funds and fund age, demonstrate resilience and positive performance during the pandemic. The research contributes to our understanding of how fund characteristics and COVID-19 growth rates interact to influence performance. It provides valuable insights for investors and fund managers in fund selection and management strategies during challenging market conditions.

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1. INTRODUCTION

Mutual funds have been gaining popularity as investment vehicles in Thailand. Due to their features such as variety of funds to choose to suit investors' risk appetize, not require self-management as there are fund manager manage the fund for you and with the economy of scale leading to portfolio diversification to optimize the portfolio performance etc. Therefore, investors are getting more and more interest in mutual fund investment, as a result, total net assets (TNA) of Thailand mutual funds have come close to 5.4 trillion baht in 2021 which make the average annual growth rate of total net assets of Thailand mutual funds from 2002 to 2021 reaches to approximately 14%.

Due to the rapid infection nature of COVID-19 pandemic, public health strategies have been introduced to slow down the rate of infection causing a disruption that can be felt on a global scale. These strategies and measures included social distancing, limiting of public gathering, and closure of certain businesses. Many countries impose border closures and lockdowns which lead to disrupted supply chains across the world (Moosavi et al., 2022), which was worsened by the reduction in productivity due to premature deaths and workplace absenteeism (Pak et al., 2020). Additionally, the rise in unemployment contributed to the fluctuation of demand for consumer goods. COVID-19 had a major impact on the global economy.

The severe impacts that can be observed included negative returns, higher risk and volatility on the global economy, financial and commodity markets. There are several studies revealed that the impacts of COVID-19 on the trading markets i.e., equity market, cryptocurrency markets etc. around the world were different from the

past infectious disease outbreaks (Iqbal et al., 2021). In addition, this is also insisted by Reinhart, 2020 that the COVID-19 crisis is different from other past crises regarding its severity, scale, and scope of the coronavirus pandemic. Moreover, it was found that there is correlation between the stocks markets and the daily COVID-19 confirmed cases and deaths (Ashraf, 2020; Rehman et al., 2021). Therefore, empirical results concluded in the past cannot entirely be applied in the ongoing COVID-19 pandemic.

Previous studies have extensively examined the impact of fund characteristics on fund performance, revealing diverse influences on performance. Notably, expense ratios, portfolio turnover, and load fees were found to exhibit a significant negative correlation with fund performance, while no relationship was observed between fund size and performance(Carhart, 1997). Additionally, it was discovered that increasing fund management fees led to a deterioration in fund performance(GIL-BAZO & RUIZ-VERDÚ, 2009). On the other hand, fund age was found to have a positive effect on performance (Agnesens, 2013; Ben Belgacem, 2011). Furthermore, well-rated funds by Morning Star demonstrated a greater ability to protect investors' wealth during adverse market conditions. Lastly, small-cap funds were found to experience larger declines during extreme downturns compared to their gains during extreme upturns (Valadkhani, 2022).

In addition, there is recent evidence, from Chinese public funds, showing certain characteristics may be more resistant to the adverse effects of COVID-19. Active funds and balanced funds outperformed passive funds and value funds respectively. Surprisingly, high management fees had a positive impact on fund

performance, which is contrary to earlier research. Additionally, the study found no association between fund age or size and fund performance. (Ling et al., 2022)

Building upon these findings, our research aims to investigate the relationship between COVID-19 growth rates and fund performance in Thailand. We will specifically focus on weeks characterized by a substantial increase in the number of COVID-19 cases, with the hypothesis that the negative returns would primarily originate from these weeks with extreme growth rate. Since it is crucial to acknowledge the impact of the COVID-19 pandemic, which has been identified as a black swan event that instilled fear and uncertainty in people's minds (Lyócsa et al., 2020; Mamaysky, 2020). Recent studies have demonstrated a significant negative effect of the pandemic on stock returns (Javed and Mark, 2023).

Furthermore, we aim to understand which characteristics of Thai mutual funds may have provided a level of immunity to the negative impact of the COVID-19 pandemic by applying panel data regression model. Our scope of the study adopted fund characteristics based on previous studies' findings includes the fund-level characteristics of two investment types (Active, and Passive), two investment styles (Equity Large-Cap and Equity Small/Mid-Cap) and three fund-level characteristics (management fee ratio, fund age, and Morning Star rating).

We posit that specific fund characteristics grant resilience to fund performance amid the COVID-19 pandemic. Our hypothesis suggests that active funds will outperform passive funds due to their flexibility in adjusting asset allocations in response to evolving market risks, whereas passive funds are required to stick to a specific tracking goal and may not be able to respond to market conditions as

efficiently. With evidence from the previous study, large-cap funds are expected to perform better than small/mid-cap funds. The management fee ratio (MFR) is a direct indicator of fund management competence, with a higher MFR often reflecting a higher level of management ability, such as in the case of actively managed funds. Consequently, the COVID-19 pandemic may make funds with a high management fee ratio more appealing to investors. As younger funds incur higher expenses and lack of experience, fund age should have a positive impact on performance. Additionally, according to Morning Star ratings, funds with a high rating should perform better during the COVID-19 crisis as high ratings indicate well-performing funds.

As the nature of the pandemic progresses there is more data available to test during the initial to peak periods of the pandemic, therefore this study will cover the period between March 1st, 2020 and October 31st, 2021. This is due to the first death case in Thailand reported on March 1st, 2020. The end date is selected to be the day before Thailand reopened the country for the vaccinated tourists, as it might be misleading in reported cases. Previous research has indicated that market reactions are stronger to increases in COVID-19 confirmed cases compared to increases in confirmed deaths. Therefore, in our study, the number of confirmed cases is taken into account as the factor that affects financial markets and fund performance.

Our study fills an important research gap by being the first to investigate the relationship between COVID-19 growth rates and fund performance in Thailand, specifically focusing on weeks characterized by a substantial increase in the number of COVID-19 cases. Additionally, our research contributes to the existing literature

by examining the impact of fund-level characteristics on the performance of Thai equity funds during the COVID-19 pandemic.

In our analysis, we consider various fund characteristics, including the widely recognized Morning Star rating. To evaluate fund performance, we utilize three metrics: excess risk-free return, which measures the difference between the investment's return and the risk-free rate; the Sharpe ratio, which assesses the average return above the risk-free rate per unit of volatility; and Jensen's alpha, which provides a risk-adjusted evaluation of the fund's returns. Furthermore, to assess the specific impact of the pandemic on fund performance, we utilize the growth rate of cumulative confirmed cases as proxy for COVID-19. The empirical results shall be used to deduce key characteristics of Thai domestic equity funds that have conferred immunity to the adverse effects of the crisis. This will be beneficial to investors who are interested in Thai equity funds, as they can use it as guidance to select the appropriate funds to invest during periods of a sudden global disruption like COVID-19. In addition, it can also provide suggestions to fund managers on how to build fund characteristics to deal with similar crises.

2. LITERATURE REVIEW

Mutual funds have gained popularity over the years. Many studies have been dedicated to determining how factors affect the fund’s performance. For example, MALKIEL, 1995 noted that the returns on equity mutual funds underperformed the benchmark after expenses and the performance was strong in the 1970s but grew weaker in the 1980s, which was inconsistent. Carhart, 1997 found a significant

negative correlation between expense ratios, portfolio turnover, load fees and fund performance in his study period of 1962 to 1993. The study on fund characteristics in relation to risk-adjusted performance by Otten and Bams (2002) suggested that European mutual funds, specifically small cap funds have shown to have a higher return in relation to their counterparts. There are studies suggested that young fund may be at a disadvantage as they might suffer from higher cost and lack of experience during the start-up period. (Agnesens, 2013; Ben Belgacem, 2011) Additionally, Fulkerson & Riley, 2019 established that fund performance is positively impacted by an increase in portfolio concentration. Moreover, Otero et al., 2019 suggested that the best ratings have a superior VaR (value at risk) behavior, indicating that investments in well-rated funds can better protect investors' wealth under adverse market conditions. Besides, Valadkhani, 2022 found that small-cap fund tended to perform worse in extreme market downturns.

However, as emphasized by Reinhart's study (2020) these literatures before the COVID-19 may not provide a complete picture of the current pandemic, as it differs from the past crises regarding its severity, scale, and scope of impact.

As the COVID-19 is still ongoing in many countries, its impacts to the global economy and financial markets, including mutual funds, are still prevalent. Therefore, many scholars have dedicated their research to focus on the impacts of COVID-19 pandemic on the economic and financial market as follows:

Ashraf, 2020 examined the relationship between stock markets and daily COVID-19 confirmed cases and deaths was examined. The findings revealed a negative correlation between these factors and their impact on the stock market.

However, the study observed that the market's response was more pronounced in relation to the increase in the number of confirmed cases, compared to the increase in confirmed deaths.

The study by Rehman et al., 2021 on the co-movement of the G7 stock returns and the daily COVID-10 data during December 31st, 2019 to November 13th, 2020 found a compelling linkage between both confirmed cases and confirmed deaths, and the G7 equity markets. It is noted that the correlation degree differed between countries, such as the effects on the Canadian and Japanese markets.

Li et al., 2021 studied the effects of COVID-19 on the G20 stock markets, which includes measuring the responsiveness of the cross-market linkages as a function of confirmed cases, confirmed deaths, and recovered cases on the volatility spillovers of G20 stock markets. The study found that the stock markets were most responsive to COVID-19 confirmed cases compared to confirmed deaths and recovered cases, pointing to investors pricing in negative impacts of COVID-19 since early COVID-19 indication which is the number of reported cases.

Ding et al., 2021 studied the corporate characteristics of over 6,700 firms across 61 economies were analyzed between January and May 2020 to assess the stock price reactions to COVID-19. The study examined various characteristics and the findings indicated that firms with certain characteristics performed better during the pandemic. These characteristics included strong financial conditions prior to 2020, active corporate social responsibility initiatives, and being family controlled.

Additional characteristics were also highlighted in a study by Zaremba et al., 2021 that examined the financial, economic, demographic, technological

development, healthcare, governance, cultural and law-related factors of 67 equity markets during January to April 2020. The study suggested that the stock markets with above average performance during the pandemic shared conservative investment policies, low valuations relative to future earnings, as well as low unemployment rates.

So far, our study aligns closely with the findings of Ling et al., 2022 , who conducted a comprehensive analysis of the relationship between public equity fund characteristics and their performance during the COVID-19 pandemic, focusing specifically on Chinese public funds. Their study, which included data from over 1,300 equity funds, revealed that open-ended funds and exchange-traded funds (ETFs) outperformed other fund types due to their superior liquidity. Active and growth funds that were well-managed also demonstrated strong performance. Notably, private company funds and funds with higher management fees exhibited resilience in their performance. Furthermore, the study highlighted the successful performance of funds managed by joint ventures with foreign partners, suggesting that the foreign parties' expertise in selecting high-performing funds and managers played a significant role.

3. DATA

3.1 Data Sample

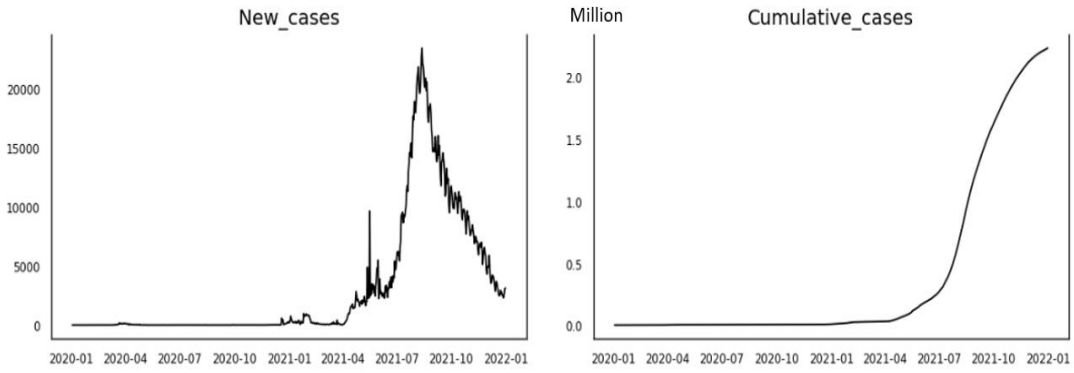
As this study uses fund-related data, the main source of data is Morningstar Direct. All samples of Thai domestic equity funds collected in which we focus on fund’s total return and each fund characteristics including fund investment types, fund

investment styles and fund-level characteristics. All data was collected from March 1st, 2020 till October 31st, 2021.

In addition to fund data, 3-month Treasury bill rate is used as a proxy for the risk-free rate in the calculation of excess returns which the 3-month Treasury bill rate retrieved from the Bloomberg Terminal.

To measure the proxy levels of COVID-19 pandemic, we use the growth rate of the cumulative number of confirmed cases in Thailand in which the number of cumulative confirmed cases obtained from World Health Organization see Figure 1.

Figure 1: Number of COVID-19 confirmed cases and cumulative confirmed cases announced.
Data source: World Health Organization



3.2 Variables

3.2.1 Dependent variables

To examine the impact of Thai equity fund characteristics on performance during the COVID-19 pandemic and identify the key attributes that provide immunity to the crisis, we evaluate the fund's excess return, Sharpe ratio, and Jensen's alpha. We define a fund's ability to maintain stable performance throughout the pandemic as its immunity to the outbreak. Through this analysis, we aim to understand the

relationship between Thai domestic equity fund characteristics and their performance during the challenging period of the COVID-19 crisis.

Excess return, a commonly used financial metric for evaluating investment performance, is employed in our study. We utilize the risk-free rate as the benchmark, which involves subtracting the average risk-free rate return from the investment's return. This calculation is represented by the following equation:

$$\text{Excess return (weekly): } ER_{i,t} = R_{i,t} - R_{f,t} \quad (1)$$

where $ER_{i,t}$ is the excess return of fund i during week t. $R_{i,t}$ represents the weekly return rate of fund i during week t and $R_{f,t}$ is the risk-free rate represented by the scaled 3-month Treasury bill rate during week t.

Sharpe ratio provides a way to compare the returns of investments with different risk levels, by normalizing the returns to account for risk. A higher Sharpe ratio indicates that the return of an investment is higher compared to its risk which is calculated by the following equation:

$$SR_{i,t} = \frac{R_{i,t} - R_f}{\sigma_{R_{i,t}}} \quad (2)$$

where $SR_{i,t}$ represents the weekly Sharpe ratio of fund i at week t, $R_{i,t}$ is the return rate of fund i at week t, and $\sigma_{Ri,t}$ is the standard deviation of fund i at the same week calculated by finding standard deviation of the daily return over week t . R_f is the weekly risk-free rate.

Jensen's alpha, a risk-adjusted performance measure, quantifies the disparity between an investment's actual return and its expected return based on a market benchmark. It is commonly referred to as excess return or alpha in the Capital Asset

Pricing Model (CAPM). A higher Jensen's alpha signifies superior fund performance. To calculate Jensen's alpha for fund i at week t, a regression analysis is conducted using the following equation:

$$(R_{i,t} - R_{f,t}) = JA_{i,t} + \beta_{i,t}(R_{m,t} - R_{f,t}) \quad (3)$$

where $JA_{i,t}$ is Jensen's alpha of fund i at week t. $R_{i,t}$ is the daily return of fund i at week t. $R_{f,t}$ is the daily risk-free rate at week t. $R_{m,t}$ is daily return of market index m at week t which in our study, SET TRI index is used as the proxy of market index. One important aspect of our study is the use of weekly Jensen's alpha instead of monthly data. This decision was made to effectively capture the changes in fund performance on a weekly basis. Utilizing monthly data might result in the averaging out of returns over the entire month, potentially obscuring the subtle variations in performance. However, it is worth noting that using weekly data for Jensen's alpha estimation does limit the number of sample points available for regression analysis. Despite this drawback, the adoption of weekly Jensen's alpha allows for a more granular examination of fund performance dynamics during the COVID-19 pandemic.

3.2.2 Measurement of COVID-19

The spread of the pandemic can be measured using various variables, such as the number of cases, death cases and cured cases. According to Ashraf, 2020 , studies have consistently shown a correlation between the return of financial markets and the daily confirmed cases of COVID-19. Among the various factors influencing financial markets, the change in the number of new infections or confirmed cases has emerged as a crucial determinant (Ashraf, 2020; Zaremba et al., 2021).

In this study, the change in the number of confirmed COVID-19 cases is used as the primary indicator of the spread of the disease. This choice is supported by the findings of Ding et al., 2021 , who suggested that the growth rate of COVID-19 cases serves as a proxy for the pandemic. In light of these findings, it is crucial to monitor and consider the growth rate of COVID-19 cases in this study as a means of evaluating the impact of the pandemic on fund performance.

Therefore, the growth rate of the cumulative number of confirmed cases in Thailand is used to match with the fund performance data to measure changes in fund exposure to the COVID-19 pandemic. And the growth rate of the cumulative number of confirmed cases is calculated by applying the following equation Eq. (4).

$$COVID_t = \ln (CCC_t) - \ln (CCC_{t-1}) \quad (4)$$

Where $COVID_t$ measures the growth rate of cumulative confirmed cases in Thailand from time t-1 to t. CCC_t denotes the cumulative confirmed cases number in Thailand of time t.

3.2.3 Fund-Level characteristics

Based on major findings of mutual fund literature, we consider seven fund characteristics' variables including dummy variables consisting of two investment types; Active and Passive fund, two investment styles; Equity Large-Cap and Equity Small/Mid-Cap fund, and one fund-level characteristics; Morning Star rating. The remaining two variables are time-series variables of fund-level characteristics including management fee ratio, and fund age.

The variables used in the equation include ACT_i taking a value of one if the fund is active fund and zero otherwise. $LARGE_i$ taking a value of one if the fund is Thailand Fund Equity Large-Cap and zero otherwise. $MFR_{i,t-1}$ is management fee ratio of fund i at time t-1. $AGE_{i,t-1}$ is age of fund i at time t-1.

For Morning Star ratings, we categorize funds into two groups: underperforming (1-star and 2-star) and well-performing (4-star and 5-star). The 3-star rated funds are used as the benchmark performance. $STAR1_{i,t-1}$ taking a value of one if the fund is 1-star and 2-star rating fund at time t-1 and zero otherwise. $STAR5_{i,t-1}$ taking a value of one if the fund is 4-star and 5-star rating fund at time t-1 and zero otherwise.

Table 1 Correlation Matrix of fund level characteristics: The table illustrates the correlation of each fund level characteristics.

	ACT	*STAR1*	*STAR5*	*LARGE*	*MFR*	*AGE*
ACT	1.000					
STAR1	0.050	1.000				
STAR5	0.120	-0.464	1.000			
LARGE	-0.132	-0.020	0.016	1.000		
MFR	0.531	0.151	-0.068	-0.195	1.000	
AGE	0.127	0.002	0.005	0.298	0.155	1.000

The correlation analysis conducted on the fund characteristics used in the regression equation indicates that there is no significant issue of multicollinearity. Each of the fund characteristics shows low to moderate correlations with one another, suggesting that they capture distinct aspects of the funds' characteristics. Therefore, we can proceed with confidence in the regression analysis without the concern of multicollinearity affecting the results.

3.3 Data Descriptive

For this analysis, data from a total of 346 Thai domestic equity funds was collected from March 2020 to October 2021. The data was retrieved from Morningstar Direct's database, which served as the primary data source for this study. Note that for the weekly fund performance data that is three sigma away from mean, it is classified as outliers and is removed out from the dataset. The relevant data required for our models are presented in Tables 1-3, along with their respective descriptive statistics. It is important to note that all the data used in this analysis was collected and calculated on a weekly basis, providing a comprehensive overview of the fund's performance and characteristics during the specified period.

Table 2 Summary of Weekly Fund Performance: The table illustrates statistics of weekly Thai Equity fund performance during COVID-19 period. The t-values of mean are provided in parentheses beside the estimates, indicating the level of significance. The asterisks (*) denote significance levels, with *, **, and *** representing significance at the 10%, 5%, and 1% levels, respectively.

Variable	Observations	Mean	S.D.	Min	Max
Dependent Variables					
Excess Return %	29,636	0.414 (0.18)	2.29	-8.700	9.302
Sharpe Ratio	29,774	0.369 (0.13)	2.819	-9.039	9.911
Jensen's Alpha %	30,031	0.003 (0.01)	0.248	-1.361	1.381

From table 1, the table illustrates statistics of weekly Thai Equity fund performance during COVID-19 period. The first dependent variable, Excess Return, is characterized by 29,636 observations. The mean excess return stands at 0.414%, indicating an average positive return for the fund on a weekly basis or equivalent to 21.528% per annum. The range of excess returns varies from a minimum of -8.700%

to a maximum of 9.302%, showcasing the fund's performance spanning both positive and negative returns.

The second dependent variable, Sharpe Ratio, consists of 29,774 observations. The mean Sharpe Ratio is calculated at 0.369, which indicates the risk-adjusted return of the fund. The standard deviation of 2.819 suggests a wide dispersion of Sharpe Ratio values, reflecting varying levels of risk and return across different weeks. The minimum and maximum values of -9.039 and 9.911, respectively, further underscore the variability in risk-adjusted returns.

The third dependent variable, Jensen's Alpha, encompasses 30,031 observations. The mean of weekly Jensen's Alpha is computed as 0.003% or equals to 0.156% per annum, suggesting a small positive excess return beyond what could be explained by the fund's systematic risk (beta). The standard deviation of 0.248% indicates the dispersion of Jensen's Alpha values, representing the fund's deviation from its expected returns. The range of Jensen's Alpha extends from -1.361% to 1.381%, showcasing the fund's performance relative to its expected returns.

The results presented in Table 1 indicate that there was no significant difference observed in the mean values of the three fund performance measures. This suggests that the funds did not generate any significant excess return compared to the risk-free rate, nor did they exhibit a noteworthy risk-adjusted return measured by the Sharpe ratio during the study period. Besides, there was no significant evidence of generating excess returns compared to the market. These findings align with previous research on individual fund performance, which has shown the difficulty in identifying mutual funds with statistically significant positive net-alphas. Instead,

there tends to be a larger number of funds that can be classified as "unskilled" with negative alphas (Fama & French, 2010).

Table 3 Measurement of Weekly COVID-19 Growth: The table summarizes data descriptive of the variable that measure the weekly growth rate of cumulative confirmed cases in Thailand.

Variable	Observations	Mean	S.D.	Min	Max
Measurement of COVID-19					
$COVID_t$	30,102	0.123	0.219	0.004	1.457
D5	30,102	0.057	0.233	0.000	1.000

Table 2 presents a summary of the descriptive data for the variable measuring the weekly growth rate of cumulative confirmed COVID-19 cases in Thailand. During the specified period, it is observed that the rate of COVID-19 cases in Thailand exhibited weekly growth. The minimum recorded growth rate was 0.4%, indicating periods of relatively slower increase in confirmed cases. However, on average, the number of confirmed cases displayed a substantial weekly increase of approximately 12.3%. This average growth rate signifies a significant escalation in the number of confirmed cases over time. Moreover, notable variations in the growth rate were observed across different weeks, with some periods displaying significantly higher rates of increase. In fact, the growth rate reached a maximum of 145.7% during the worst-case scenario, indicating a rapid surge in the number of confirmed cases within a given week.

Additionally, the inclusion of a dummy variable, D5, provides further insights into the growth rate distribution. This dummy variable takes a value of 1 if the growth rate falls within the top 5 percentile, indicating weeks with exceptionally high growth rates. The mean value of 0.057 and the standard deviation of 0.233 highlight the

prevalence and variability of these high-growth-rate weeks. The significant increase in the number of confirmed cases causes panic to the investors and could result in great shocks to the financial markets.

Table 4: Summary of Fund Characteristics: The table illustrates data descriptive of the fund characteristics for Thai domestic equity fund.

Variable	Observations	Mean	S.D.	Min	Max
Dependent Variables					
ACT	30,102	0.899	0.302	0.000	1.000
STAR1	30,102	0.266	0.442	0.000	1.000
STAR5	30,102	0.373	0.484	0.000	1.000
LARGE	30,102	0.743	0.437	0.000	1.000
MFR	30,102	1.462	0.597	0.000	2.670
AGE	30,102	10.546	7.805	0.197	29.268

Table 3 provides a summary of the fund characteristics for a Thai domestic equity fund. These characteristics offer insights into various aspects of the fund's profile. The first dummy variable, ACT, has a mean value of 0.899, indicating that approximately 89.9% of the funds in the sample are active funds, while the remaining 11.1% are passive funds. The other three dummy variables including STAR1, STAR5 and LARGE have the means of 0.266, 0.373, and 0.743 respectively. These results indicate the proportions of funds with 1 and 2-morning star rating, funds with 4 and 5-morning star rating funds, and equity large-cap funds in the total samples which are approximately 26.6%, 37.3%, and 74.3% respectively.

As for continuous variables of fund-level characteristics, we consider MFR and AGE. Table 3 reported that MFR has a mean of 1.462 suggested that, on average,

the fund has a moderate to high expense ratio. At the minimum, there was no charge on management fee. However, it could be charged up to to 2.670 at the highest. Finally, the sixth variable, AGE has a mean of 10.546 years. This indicates the average age of the funds in the sample's dataset. The standard deviation of 7.805 suggests a wide dispersion in the age of funds. The values range from 0.197 years (indicating a relatively new fund) to 29.268 years (indicating an established fund).

4 METHODOLOGY

In the following section, we outline our research methodology for examining the impact of fund characteristic variables on immunity to the coronavirus pandemic. To assess the impact of seven fund characteristics on fund performance during the COVID-19 pandemic, we employ the following regression equation in each section of our study.

Following the studies of Ding et al., 2021; Ling et al., 2022 , we applied the panel data regression analysis with fixed effects in which is a type of regression analysis that is used to control for the effects of variables that are constant over time. These variables are typically omitted from the regression equation and are referred to as "fixed effects" which are estimated by including dummy variables for each category of the omitted variable in the regression equation. In our study, we considered two fixed effects including fund individual (δ_i), and time fixed effect (δ_t) to condition out time-invariant differences across fund individuals, and common factors influencing returns in each period.

4.1 Impact of COVID-19 on fund performance (as benchmark)

To evaluate the relationship between fund performance and exposure to the COVID-19 pandemic, we consider the benchmark of funds' performance and their susceptibility to the crisis. The analysis encompasses three performance indicators: excess return, Sharpe ratio, and Jensen's alpha. Additionally, we use a proxy measure for the level of COVID-19 impact, specifically the growth rate of confirmed cases (COVIDt). The relationship between these variables is assessed as shown in the Eq. (5)-(7).

4.1.1 Excess Return

In the initial section, we utilize excess return as a performance indicator, as indicated by equation (5).

$$ER_{i,t} = \alpha\, COVID_t + \delta_i + \varepsilon_{i,t} \quad (5)$$

Where $ER_{i,t}$ is the excess return of fund i during week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. To account for the potential impact of unobserved missing variables on the outcomes, we include fund individual fixed effect (δ_i). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

In section 4.1, our objective is to estimate the alpha value, which serves as an indicator of the impact of COVID-19 on fund performance. A positive alpha suggests that COVID-19 has a positive influence on fund performance, while negative alpha indicates a negative impact. Based on our hypothesis, we anticipate a negative estimate for the alpha, supporting the notion that COVID-19 growth cases have an adverse effect on fund performance. This aligns with previous research indicating that

an increase in the number of COVID-19 cases negatively affects financial markets (Ding et al., 2021).

4.1.2 Sharpe ratio

To ensure the robustness of the analysis, the evaluation of performance indicators includes the Sharpe ratio, which measures risk-adjusted returns. This additional measure provides further insights into the fund's performance and its ability to generate returns in relation to the level of risk taken.

$$SR_{i,t} = \alpha\, COVID_t + \delta_i + \varepsilon_{i,t} \quad (6)$$

Where $SR_{i,t}$ is the Sharpe ratio of fund i at week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. To account for the potential impact of unobserved missing variables on the outcomes, we include fund individual fixed effect (δ_i). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

4.1.3 Jensen's alpha

In order to further strengthen the analysis, the evaluation of risk-adjusted performance includes the use of Jensen's alpha. This measure compares the actual returns of an investment with the expected returns based on a market benchmark, providing valuable insights into the fund's ability to outperform or underperform relative to the benchmark. By incorporating Jensen's alpha alongside the Sharpe ratio, a more comprehensive assessment of the fund's risk-adjusted performance is achieved.

$$JA_{i,t} = \alpha\, COVID_t + \delta_i + \varepsilon_{i,t} \quad (7)$$

Where $JA_{i,t}$ is the Jensen's alpha of fund i at week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. To account for the potential impact of unobserved missing variables on the outcomes, we include fund individual fixed effect (δ_i). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

4.2 Impact of Extreme COVID-19 Growth Rates on Fund Performance

During the COVID-19 study period, Thai equity funds exhibited an overall positive average weekly return, as indicated by the positive mean values of all fund performance indicators. This implies that, on average, the funds experienced positive returns throughout the study period. In order to further investigate the relationship between COVID-19 growth rates and fund performance, it is essential to focus on weeks characterized by a significant increase in the growth of COVID-19 cases, specifically those in the top five percentile. To identify this group of weeks, a dummy variable named D5 has been created and an interaction term between D5 and the COVID-19 growth rate has been incorporated into the analysis.

Through this approach, we seek to gain a deeper understanding of the influence of extreme COVID-19 growth rates on fund performance. By focusing on the weeks with the most pronounced increases in case numbers, we can assess the potential negative impact of these periods on the overall performance of Thai equity funds.

4.2.1 Excess Return

In the first section, we utilize excess return as a performance indicator, as indicated by equation (8).

$$ER_{i,t} = \alpha_1 COVID_t + \alpha_2 * D5_t * COVID_t + \delta_i + \varepsilon_{i,t} \quad (8)$$

Where $ER_{i,t}$ is the excess return of fund i during week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. $D5_t$ is a dummy variable to capture the extreme COVID-19 growth rates which takes a value of one if the growth rate of cumulative confirmed cases ($COVID_t$) is in the top 5% percentile and zero otherwise. To account for the potential impact of unobserved missing variables on the outcomes, we include fund individual fixed effect (δ_i). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

In Section 4.2, our objective is to examine the influence of weeks characterized by extreme COVID-19 growth rates on fund performance. To capture this impact, we introduce the D5 dummy variable into our regression analysis. The underlying hypothesis is that the negative returns observed in fund performance can be attributed to the weeks with the highest growth rates in COVID-19 cases. This hypothesis is supported by recent studies highlighting the significant negative effect of the pandemic on stock returns (Javed and Mark, 2023). If our hypothesis holds true, we expect the regression analysis to yield a significantly negative alpha2 value, further validating the link between extreme COVID-19 growth rates and fund performance.

4.2.2 Sharpe ratio

To ensure the robustness of the analysis, the evaluation of performance indicators also includes the Sharpe ratio.

$$SR_{i,t} = \alpha_1 COVID_t + \alpha_2 * D5_t * COVID_t + \delta_i + \varepsilon_{i,t} \quad (9)$$

Where $SR_{i,t}$ is the Sharpe ratio of fund i at week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. $D5_t$ is a dummy variable to capture the extreme COVID-19 growth rates which takes a value of one if the growth rate of cumulative confirmed cases ($COVID_t$) is in the top 5% percentile and zero otherwise. To account for the potential impact of unobserved missing variables on the outcomes, we include fund individual fixed effect (δ_i). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

4.2.3 Jensen's alpha

Jensen's alpha, in addition to the Sharpe ratio, is used to assess the fund's risk-adjusted performance by comparing its actual returns to the expected returns based on a market benchmark.

$$JA_{i,t} = \alpha_1 COVID_t + \alpha_2 * D5_t * COVID_t + \delta_i + \varepsilon_{i,t} \quad (10)$$

Where $JA_{i,t}$ is the Jensen's alpha of fund i at week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. $D5_t$ is a dummy variable to capture the extreme COVID-19 growth rates which takes a value of one if the growth rate of cumulative confirmed cases ($COVID_t$) is in the top 5% percentile and zero otherwise. To account for the potential impact of unobserved missing variables on the outcomes, we include fund individual fixed effect (δ_i). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

4.3 Impact of fund-level characteristics shaping fund price reaction to COVID-19.

Our objective of the study is to examine how each fund characteristics interact with COVID-19 variable influence fund performance reaction to the COVID-19

pandemic. In this section, a panel data regression is used, similar to the previous section. The difference is that the $COVID_t$ variables are added as an interaction term with each fund characteristic that we would like to test based on our hypothesis that is drawn from previous studies.

Our hypothesis posits the existence of specific characteristics that exhibit immunity to the COVID-19 pandemic. To evaluate this, we utilize three fund performance indicators: excess return, Sharpe ratio, and Jensen's alpha. Additionally, we incorporate the growth rate of confirmed cases ($COVID_t$) as a proxy measure for the level of COVID-19 impact. Moreover, we conduct separate tests focusing on fund investment types (active and passive funds) and fund investment styles (equity large-cap and equity small/mid-cap funds) to examine the influence of active versus passive management on fund performance, independent of the company size in which they invest. See Eq. (11)-(16).

4.3.1 Excess Return

In the first regression of this section, our objective is to assess the impact of active and passive funds, along with other fund characteristics, on fund performance measured by excess return. We employ equation (11) for this analysis.

$$ER_{i,t} = \beta_1 * ACT_i * COVID_t + \beta_2 * STAR1_{i,t-1} * COVID_t + \beta_3 * STAR5_{i,t-1} * COVID_t + \beta_4 * MFR_{i,t-1} * COVID_t + \beta_5 * AGE_{i,t-1} * COVID_t + \delta_i + \delta_t + \varepsilon_{i,t} \quad (11)$$

In addition, we aim to evaluate the impact between equity large-cap and small-cap funds together with other fund characteristics by utilizing eq. (12).

$$ER_{i,t} = \beta_1 * ACT_i * COVID_t + \beta_2 * LARGE_i * COVID_t + \beta_3 * STAR1_{i,t-1} * COVID_t + \beta_4 * STAR5_{i,t-1} * COVID_t + \beta_5 * MFR_{i,t-1} * COVID_t + \beta_6 * AGE_{i,t-1} * COVID_t + \delta_i + \delta_t + \varepsilon_{i,t} \quad (12)$$

Where $ER_{i,t}$ is the excess return of fund i during week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. ACT_i takes a value of one if the fund is active fund and zero otherwise. $LARGE_i$ takes a value of one if the fund is Thailand Fund Equity Large-Cap and zero otherwise. $STAR1_{i,t-1}$ taking a value of one if the fund is 1-star and 2-star rating fund at time t-1 and zero otherwise. $STAR5_{i,t-1}$ taking a value of one if the fund is 4-star and 5-star rating fund at time t-1 and zero otherwise. $MFR_{i,t-1}$ is management fee ratio of fund i at time t-1. $AGE_{i,t-1}$ is age of fund i at time t-1. To account for the potential impact of unobserved missing variables on the outcomes, we include two fixed effects, including fund individual (δ_i), and time fixed effect (δ_t). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

In Section 4.3, our focus is on estimating the beta values for each fund characteristic variable. Positive beta values suggest that specific fund characteristics have a positive impact on fund performance or possess immunity to the adverse effects of COVID-19. This finding is supported by recent research on Chinese funds, which has shown that certain characteristics exhibit greater resistance to the negative effects of COVID-19 (Ling et al., 2022). By analyzing the beta values, we can gain insights into the influence of these fund characteristics on fund performance during the pandemic.

4.3.2 Sharpe Ratio

In order to ensure the robustness of the analysis, the evaluation of performance indicators includes the Sharpe ratio. Furthermore, the impact of active and passive funds, along with other fund characteristics, is assessed using equation (13).

$$SR_{i,t} = \beta_1 * ACT_i * COVID_t + \beta_2 * STAR1_{i,t-1} * COVID_t + \beta_3 * STAR5_{i,t-1} * COVID_t + \beta_4 * MFR_{i,t-1} * COVID_t + \beta_5 * AGE_{i,t-1} * COVID_t + \delta_i + \delta_t + \varepsilon_{i,t} \quad (13)$$

Besides, to evaluate the impact between equity large-cap and small-cap funds together with other fund characteristics, the following eq. (14) is used.

$$SR_{i,t} = \beta_1 * ACT_i * COVID_t + \beta_2 * LARGE_i * COVID_t + \beta_3 * STAR1_{i,t-1} * COVID_t + \beta_4 * STAR5_{i,t-1} * COVID_t + \beta_5 * MFR_{i,t-1} * COVID_t + \beta_6 * AGE_{i,t-1} * COVID_t + \delta_i + \delta_t + \varepsilon_{i,t} \quad (14)$$

Where $SR_{i,t}$ is the Sharpe ratio of fund i at week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. ACT_i takes a value of one if the fund is active fund and zero otherwise. $LARGE_i$ takes a value of one if the fund is Thailand Fund Equity Large-Cap and zero otherwise. $STAR1_{i,t}$ taking a value of one if the fund is 1-star and 2-star rating fund at time t-1 and zero otherwise. $STAR5_{i,t}$ taking a value of one if the fund is 4-star and 5-star rating fund at time t-1 and zero otherwise. $MFR_{i,t-1}$ is management fee ratio of fund i at time t-1. $AGE_{i,t-1}$ is age of fund i at time t-1. To account for the potential impact of unobserved missing variables on the outcomes we include two fixed effects, including fund individual (δ_i),

and time fixed effect (δ_t). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

4.3.3 Jensen's alpha

Jensen's alpha, in addition to the Sharpe ratio, is used to assess the fund's risk-adjusted performance by comparing its actual returns to the expected returns based on a market benchmark.

To evaluate the impact between active and passive funds together with other fund characteristics, the following eq. (15) is used.

$$\begin{aligned} JA_{i,t} = {} & \beta_1 * ACT_i * COVID_t + \beta_2 * STAR1_{i,t-1} * COVID_t + \\ & \beta_3 * STAR5_{i,t-1} * COVID_t + \beta_4 * MFR_{i,t-1} * COVID_t + \\ & \beta_5 * AGE_{i,t-1} * COVID_t + \delta_i + \delta_t + \varepsilon_{i,t} \end{aligned} \quad (15)$$

In addition, to evaluate the impact between equity large-cap and small-cap funds together with other fund characteristics, the following eq. (16) is used.

$$\begin{aligned} JA_{i,t} = {} & \beta_1 * ACT_i * COVID_t + \beta_2 * LARGE_i * COVID_t + \beta_3 * STAR1_{i,t-1} * \\ & COVID_t + \beta_4 * STAR5_{i,t-1} * COVID_t + \beta_5 * MFR_{i,t-1} * COVID_t + \\ & \beta_6 * AGE_{i,t-1} * COVID_t + \delta_i + \delta_t + \varepsilon_{i,t} \end{aligned} \quad (16)$$

Where $JA_{i,t}$ is Jensen's alpha of fund i at week t. $COVID_t$ measures the weekly growth rate of confirmed cases in Thailand over week t. ACT_i takes a value of one if the fund is active fund and zero otherwise. $LARGE_i$ takes a value of one if the fund is Thailand Fund Equity Large-Cap and zero otherwise. $STAR1_{i,t}$ taking a value of one if the fund is 1-star and 2-star rating fund at time t-1 and zero otherwise.

$STAR5_{i,t}$ taking a value of one if the fund is 4-star and 5-star rating fund at time t-1 and zero otherwise. $MFR_{i,t-1}$ is management fee ratio of fund i at time t-1. $AGE_{i,t-1}$ is age of fund i at time t-1. To account for the potential impact of unobserved missing variables on the outcomes, we include two fixed effects, including fund individual (δ_i), and time fixed effect (δ_t). $\varepsilon_{i,t}$ is the error term representing any unobserved factors that affect the dependent variable.

5 EMPIRICAL RESULTS

In order to investigate the impact of the growth rate of COVID-19 cases in Thailand and Thai fund characteristics on fund performance, the analysis is segmented into three stages. Initially, the analysis conducts to evaluate the relation between the growth rate of COVID-19 cumulative confirmed case in Thailand on Thai domestic equity fund performance. Subsequently, the analysis aims to capture the differences of the fund performance impact between those periods with the normal growth versus the extreme growth rate in cases. Finally, we assess the differences in the impact of each fund-level characteristic on fund performance during COVID-19. The empirical results of those mentioned topics will be discussed in this section.

5.1 Growth of COVID-19 Cases VS Thai Fund Performance

In the first section of our analysis, we examine the impact of the growth rate of COVID-19 cases in Thailand on the performance of Thai domestic equity funds. To investigate this relationship, we utilize a fixed effect model, eq. (5)-(7), and the estimated alpha values are presented in Table 4.

Table 5: Impact of COVID-19 Growth Rate on Fund Performance. The dependent variables of interest included in the table are Excess Return, Sharpe Ratio, and Jensen Alpha. The respective estimates alpha values are reported in columns (5), (6), and (7) which are obtained from a fixed effect model, represented by equations (5): $ER_{i,t} = \alpha\ COVID_t + \delta_i + \varepsilon_{i,t}$ (6): $SR_{i,t} = \alpha\ COVID_t + \delta_i + \varepsilon_{i,t}$,and (7): $JA_{i,t} = \alpha\ COVID_t + \delta_i + \varepsilon_{i,t}$, respectively. The t-values are provided in parentheses below the estimates, indicating the level of significance. The asterisks (*) denote significance levels, with *, **, and *** representing significance at the 10%, 5%, and 1% levels, respectively.

Variables	**Excess Return**	**Sharpe Ratio**	**Jensen Alpha**
	(5)	(6)	(7)
COVID	-0.0079***	-0.4299***	-0.0006***
	(-12.93)	(-5.78)	(-8.92)
Individual fixed effect	Yes	Yes	Yes
Number of observations	29,636	29,774	30,031

The alpha estimates reveal a significant negative relationship between the growth rate of COVID-19 cases (COVID) and the performance indicators of the equity funds. The estimated values for Excess Return, Sharpe Ratio, and Jensen Alpha all display statistically significant negative coefficients. Specifically, the Excess Return coefficient is -0.0079 at 1% significant level, indicating that a one-unit increase in the growth rate of COVID-19 cases leads to a decrease of 0.79% in the weekly excess return of the funds. Similarly, the Sharpe Ratio coefficient is -0.4299 at 1% significant level, implying that the growth rate of COVID-19 cases has a negative impact on the risk-adjusted performance of the funds. Furthermore, the Jensen Alpha coefficient is -0.0006 at 1% significant level, indicating a decrease of -0.06% in the weekly abnormal returns or approx. 3% per annum generated by the funds due to one unit higher in COVID-19 case growth.

These findings are consistent with expectations, as prior research has shown that an increase in the number of COVID-19 cases has a negative impact on

financial markets (Ding et al., 2021). Besides, the recent analysis demonstrates that this negative impact extends to the fund market as well (Ling et al., 2022).

In conclusion, the results highlight a significant negative relationship between the growth rate of COVID-19 cases in Thailand and the performance of Thai domestic equity funds. These findings underscore the importance of considering the impact of the pandemic on investment outcomes and suggest that higher COVID-19 case growth adversely affects the returns and risk-adjusted performance of the funds.

5.2 Extreme Growth of COVID-19 Cases VS Thai Fund Performance

In the subsequent section of our analysis, we aim to examine and quantify the disparities in the impact of extreme and normal growth rates of COVID-19 cases on Thai fund performance. To accomplish this, we employ a fixed effect model, specifically equations (8)-(10), to estimate the alpha values. The estimated coefficients and their significance levels are reported in Table 5.

The variable COVID, representing the growth rate of COVID-19 cases, shows statistically significant coefficients at 1% level: 0.0121 for weekly Excess Return, 1.8207 for Sharpe Ratio, and 0.0013 for weekly Jensen Alpha. These coefficients indicate a positive relationship between the growth rate of COVID-19 cases and fund performance.

However, with the present of D5 to the interaction term, D5*COVID, captures the impact of extreme growth in COVID-19 cases on fund performance. The coefficients for this interaction term are statistically significant at 1% level and negative: -0.0219 for Excess Return, -2.4438 for Sharpe Ratio, and -0.0020 for Jensen Alpha, implying that for those extreme cases, in response to COVID-19 shock with

the mean value of 0.123, it would decrease fund performance by 0.27% (=0.123*-2.19%), 0.3 (=0.123*-2.4438), and 0.025% (=0.123*-0.2%) for weekly excess return, Sharpe ratio, and Jensen Alpha respectively. These coefficients suggest that extreme growth in COVID-19 cases has a detrimental effect on fund performance.

Table 6: Impact of COVID-19 Normal and Extreme Growth Rate on Fund Performance. The dependent variables of interest included in the table are Excess Return, Sharpe Ratio, and Jensen Alpha. The respective estimates alpha1 and alpha2 values are reported in columns (8), (9), and (10) which are obtained from a fixed effect model, represented by equations (8): $ER_{i,t} = \alpha_1 COVID_t + \alpha_2 * ED5_t * COVID_t + \delta_i + \varepsilon_{i,t}$ (9): $SR_{i,t} = \alpha_1 COVID_t + \alpha_2 * ED5_t * COVID_t + \delta_i + \varepsilon_{i,t}$,and (10): $JA_{i,t} = \alpha_1 COVID_t + \alpha_2 * ED5_t * COVID_t + \delta_i + \varepsilon_{i,t}$ respectively. The t-values are provided in parentheses below the estimates, indicating the level of significance. The asterisks (*) denote significance levels, with *, **, and *** representing significance at the 10%, 5%, and 1% levels, respectively.

Variables	**Excess Return**	**Sharpe Ratio**	**Jensen Alpha**
	(8)	(9)	(10)
COVID	0.0121***	1.8207***	0.0013***
	(7.72)	(9.45)	(7.62)
D5*COVID	-0.0219***	-2.4438***	-0.0020***
	(-13.89)	(-12.65)	(-12.02)
Individual fixed effect	Yes	Yes	Yes
Number of observations	29,636	29,774	30,031

In contrast to the previous section, where the analysis focused on overall COVID-19 growth rates, the coefficients for COVID in this section change from negative to positive. This indicates that fund performance is better during periods of normal COVID-19 growth, as the dataset includes market recovery periods. Nonetheless, the negative coefficients for the interaction term D5*COVID indicate that the negative impact on fund performance is mainly driven by extreme growth cases. The COVID-19 pandemic, identified as a black swan event, instilled fear in people's minds (Lyócsa et al., 2020; Mamaysky, 2020). This heightened level of fear and uncertainty had a significant negative effect on stock returns, as evidenced by

recent studies (Javed and Mark, 2023). These findings emphasize the substantial and noteworthy influence of both normal and extreme COVID-19 growth rates on the performance of Thai domestic equity funds. It underscores the importance of considering the impact of the pandemic on investment outcomes and highlights the vulnerability of funds to extreme market conditions associated with the COVID-19 crisis.

5.3 Thai Fund-Level Characteristics on Fund Performance

In the final section of our analysis, we delve into the examination of the distinct impacts of various fund-level characteristics on the performance of Thai domestic equity funds during the COVID-19 pandemic. To accomplish this, we estimate the beta values associated with each fund-level characteristic, and the results are presented in Tables 6-8.

The results from the fixed effect model (equations 11 and 12), presented in Table 6, provide insights into the impact of fund-level characteristics on the excess return (ER) of Thai domestic equity funds during the COVID-19 pandemic.

Recall from the first stage of the analysis, the regression coefficient of COVID found in column (5) is -0.0079 and is significant at 1%level which suggests that the average weekly exposure to the COVID-19 shock (mean value of COVID = 0.123) is associated with falling of 0.1% (=0.123*-0.0079) or 5.1% annually in excess return.

Although COVID-19 has a negative shock on Thai fund market, the regression result in Table 6 indicates that some fund characteristics have conferred immunity to the adverse effects of the crisis.

Table 7: Beta Estimates for Fund-Level Characteristics and Their Impact on Fund Performance. The dependent variable of interest is Excess Return (ER). The respective estimates beta values are reported in columns (11), and (12) which are obtained from a fixed effect model, represented by equations (11): $ER_{i,t}= \beta_1*ACT_i*COVID_t+\beta_2*STAR1_{i,t-1}*COVID_t+\beta_3*STAR5_{i,t-1}*COVID_t + \beta_4*MFR_{i,t-1}*COVID_t+\beta_5*AGE_{i,t-1}*COVID_t+ \delta_i+ \delta_t+ \varepsilon_{i,t}$ and (12): $ER_{i,t} = \beta_1*ACT_i*COVID_t+ \beta_2*LARGE_i*COVID_t + \beta_3*STAR1_{i,t-1}*COVID_t+ \beta_4*STAR5_{i,t-1}*COVID_t+ \beta_5*MFR_{i,t-1}*COVID_t +\beta_6*AGE_{i,t-1}*COVID_t + \delta_i+ \delta_t+ \varepsilon_{i,t}$. The t-values are provided in parentheses below the estimates, indicating the level of significance. The asterisks (*) denote significance levels, with *, **, and *** representing significance at the 10%, 5%, and 1% levels, respectively.

Variables	**Excess Return**		
	(5)	(11)	(12)
COVID	-0.0079***		
	(-12.93)		
ACT*COVID		-0.0036***	-0.0025***
		(-3.75)	(-2.62)
LARGE*COVID			0.0120***
			(20.22)
STAR1*COVID		-0.0011*	-0.0014**
		(-1.83)	(-2.30)
STAR5*COVID		-0.0002	-0.0004
		(-0.41)	(-0.77)
MFR*COVID		-0.0039***	-0.0020***
		(-8.01)	(-4.04)
AGE*COVID		0.0003***	0.0001
		(8.78)	(1.40)
Individual fixed effect	Yes	Yes	Yes
Time fixed effect	No	Yes	Yes
Number of observations	29,636	29,636	29,636

On the one hand, from column (11) and (12), the regression coefficients of AGE*COVID and LARGE*COVID are significantly positive at 1% level, the coefficient values are 0.0003 and 0.0120 respectively indicating that Thai equity large-cap funds perform better, and older funds tend to exhibit slightly better performance. On average, large-cap funds can reduce the negative impact by approximately 0.15% per week (=0.123*0.0120) or equivalent to 7.7% per annum based on the mean value of COVID during the study period.

On the other hand, the coefficient estimates suggest that, compared to passive funds, active funds would cause negative effect by 0.04% per week (=0.123*-0.0036) or 2.30% per annum on excess return in response to the COVID-19 shock. Furthermore, the higher the management fee ratio results in lower fund performance as a result of significantly negative regression coefficients of MFR*COVID.

Comparing these findings to the results from the fixed effect model (equations 13 and 14) in Table 7, which focuses on the impact of fund-level characteristics on the Sharpe Ratio (SR), the estimated coefficients yield similar implications to those obtained from the regression on excess return.

In line with the previous findings, large-cap funds continue to perform better during the pandemic, as indicated by the significantly positive coefficient at 1% for LARGE*COVID. This implies that large-cap funds have a higher likelihood of generating positive risk-adjusted returns, reflected in their higher Sharpe Ratios.

Additionally, the 1% significant and positive estimated coefficient of AGE*COVID found in column (13) implies that older funds tend to exhibit higher Sharpe Ratios, indicating the benefits of stability and experience during the crisis.

However, from both column (13) and (14), the coefficient estimate for ACT*COVID is negative and significant at the 5% level, similarly, the coefficient for MFR*COVID is negative and significant at the 1% level, suggesting that active management and higher management fee ratios lead to lower Sharpe Ratios.

Table 8: Beta Estimates for Fund-Level Characteristics and Their Impact on Fund Performance. The dependent variable of interest is Sharpe Ratio (SR). The respective estimates beta values are reported in columns (13), and (14) which are obtained from a fixed effect model, represented by equations (13): $SR_{i,t}= \beta_1*ACT_i*COVID_t+\beta_2*STAR1_{i,t-1}*COVID_t+\beta_3*STAR5_{i,t-1}*COVID_t + \beta_4*MFR_{i,t-1}*COVID_t+\beta_5*AGE_{i,t-1}*COVID_t+ \delta_i+ \delta_t+ \varepsilon_{i,t}$ and (14): $SR_{i,t}=\beta_1*ACT_i*COVID_t+ \beta_2*LARGE_i*COVID_t+ \beta_3*STAR1_{i,t-1}*COVID_t+\beta_4*STAR5_{i,t-1}*COVID_t+ \beta_5*MFR_{i,t-1}*COVID_t +\beta_6*AGE_{i,t-1}*COVID_t + \delta_i+ \delta_t+ \varepsilon_{i,t}$. The t-values are provided in parentheses below the estimates, indicating the level of significance. The asterisks (*) denote significance levels, with *, **, and *** representing significance at the 10%, 5%, and 1% levels, respectively.

Variables	**Sharpe Ratio**		
	(6)	(13)	(14)
COVID	-0.4299***		
	(-5.78)		
ACT*COVID		-0.2614**	-0.202
		(-2.13)	(-1.64)
LARGE*COVID			0.6510***
			(8.52)
STAR1*COVID		0.0318	0.0160
		(0.40)	(0.20)
STAR5*COVID		-0.0537	-0.0645
		(-0.73)	(-0.88)
MFR*COVID		-0.1917***	-0.0884
		(-3.08)	(-1.40)
AGE*COVID		0.0154***	0.0030
		(3.83)	(0.69)
Individual fixed effect	Yes	Yes	Yes
Time fixed effect	No	Yes	Yes
Number of observations	29,774	29,774	29,774

The analysis extends to examine the impact of fund-level characteristics on the Jensen Alpha (JA) of Thai domestic equity funds during the COVID-19 pandemic, as presented in Table 8. The findings from the fixed effect model (equations 15 and 16) complement the previous results, shedding light on the relationship between fund characteristics and performance.

Table 9: Beta Estimates for Fund-Level Characteristics and Their Impact on Fund Performance. The dependent variable of interest is Jensen Alpha (JA). The respective estimates beta values are reported in columns (15), and (16) which are obtained from a fixed effect model, represented by equations (15): $JA_{i,t}= \beta_1*ACT_i*COVID_t+\beta_2*STAR1_{i,t-1}*COVID_t+\beta_3*STAR5_{i,t-1}*COVID_t + \beta_4*MFR_{i,t-1}*COVID_t+\beta_5*AGE_{i,t-1}*COVID_t+ \delta_i+ \delta_t+ \varepsilon_{i,t}$ and (16): $JA_{i,t} = \beta_1*ACT_i*COVID_t+ \beta_2*LARGE_i*COVID_t+ \beta_3*STAR1_{i,t-1}*COVID_t+\beta_4*STAR5_{i,t-1}*COVID_t+ \beta_5*MFR_{i,t-1}*COVID_t +\beta_6*AGE_{i,t-1}*COVID_t + \delta_i+ \delta_t+ \varepsilon_{i,t}$. The t-values are provided in parentheses below the estimates, indicating the level of significance. The asterisks (*) denote significance levels, with *, **, and *** representing significance at the 10%, 5%, and 1% levels, respectively.

Variables	**Jensen Alpha**		
	(7)	(15)	(16)
COVID	-0.0006***		
	(-8.92)		
ACT*COVID		-0.0010***	-0.0007***
		(-4.51)	(-3.28)
LARGE*COVID			0.0030***
			(22.04)
STAR1*COVID		-0.0002	-0.0002*
		(-1.16)	(-1.72)
STAR5*COVID		-0.0002	-0.0003**
		(-1.64)	(-2.05)
MFR*COVID		-0.0010***	-0.0005***
		(-8.71)	(-4.42)
AGE*COVID		0.0001***	0.0000
		(9.41)	(1.41)
Individual fixed effect	Yes	Yes	Yes
Time fixed effect	No	Yes	Yes
Number of observations	30,031	30,031	30,031

Consistent with the previous findings, the coefficient estimates in Table 8 provide further evidence that certain fund characteristics have demonstrated resilience to the adverse effects of the COVID-19 crisis. Specifically, the results indicate that equity large-cap funds have continued to outperform during the pandemic, as evidenced by the significantly positive coefficient for the variable LARGE*COVID. This suggests that large-cap funds have a higher probability of generating positive risk-adjusted returns of 0.04% per week (=0.123*0.0030) or 1.9% per annum at 1%

level, as measured by the Jensen Alpha. It is important to note that the positive performance of equity large-cap funds during the pandemic is not limited to the Jensen Alpha. Our previous analysis also revealed that these funds exhibited better performance in terms of excess return and the Sharpe ratio, further underscoring their ability to navigate challenging market conditions.

This finding aligns with previous studies that have highlighted the relative strength of large-cap funds during periods of market volatility. Moreover, it supports the notion that larger companies tend to be more stable and better positioned to economic downturns, leading to more consistent performance. Additionally, small-cap funds have been shown to be more susceptible to extreme market downturns compared to their performance during significant upswings (Valadkhani, 2022).

In contrast to the recent study on Chinese funds by Ling et al., 2022, which found no association between fund age or size and fund performance, our results demonstrate that fund age, as captured by the coefficient estimates for AGE*COVID, are positively related to fund performance during the pandemic. This finding provides additional support to the existing literature, which suggests that fund age has a positive effect on performance (Agnesens, 2013; Ben Belgacem, 2011). It indicates that older funds tend to exhibit slightly better performance and possess a certain level of resilience to the negative impact of COVID-19 on fund returns.

Contrary to previous findings that suggest active management and higher management fee ratio funds perform better during the pandemic (Ling et al., 2022), this study reveals an opposite perspective. This analysis finding is supported by Carhart (1997) who observed that there was a significant negative correlation between

expense ratios, portfolio turnover, load fees, and fund performance. Furthermore, it is evident that fund performance deteriorates with increasing fund management fees, as highlighted by GIL-BAZO and RUIZ-VERDÚ (2009).

The findings of the analysis indicate that the fund characteristics related to Morning Star Ratings, specifically STAR1 and STAR5, when interacted with the COVID-19 variable (STAR1*COVID and STAR5*COVID), do not demonstrate statistically significant effects on the three performance indicators (Excess Return, Sharpe Ratio, and Jensen Alpha) during the pandemic. This finding contradicts previous research, which suggested that well-rated funds according to Morning Star can provide better protection for investors' wealth during challenging market conditions (Valadkhani, 2022). However, it is essential to recognize that the lack of significance in these coefficients does not necessarily imply that these fund characteristics have no influence on fund performance overall. Rather, it indicates that their impact on performance is not statistically significant specifically during the COVID-19 period. Further investigation may be needed to explore the relationship between Morning Star Ratings and fund performance in different market conditions beyond the scope of the pandemic.

6 CONCLUSION

Our research focuses on the impact of fund-level characteristics on the performance of Thai equity funds during the COVID-19 pandemic. We aim to identify the characteristics that have provided resilience and immunity to the negative effects of the crisis. Our analysis encompasses multiple objectives in examining the

impact of the COVID-19 pandemic and each major fund characteristics on Thai domestic equity fund performance. We consider various fund characteristics, including investment types (active and passive), investment styles (large-cap and small/mid-cap), and three specific fund-level characteristics (management fee ratio, fund age, and Morning Star rating).

Previous studies have shown that certain characteristics, such as active management, large-cap focus, higher management fees, fund age, and higher ratings, can influence fund performance. We hypothesize that these characteristics may also play a role in mitigating the impact of the COVID-19 pandemic on fund performance.

To test our hypothesis, we employ a panel data regression with fixed effect model and evaluate fund performance using three metrics: excess risk-free return, Sharpe ratio, and Jensen's alpha. We analyze data from March 1st, 2020, to October 31st, 2021, encompassing the initial to peak periods of the pandemic in Thailand.

The study highlights a negative relationship between the overall growth rate of COVID-19 cases in Thailand and the performance of domestic equity funds. Specifically, extreme growth cases have a significant detrimental effect on fund performance.

However, within the assessment of fund characteristics on performance, it became evident that certain attributes have conferred immunity to the adverse effects of the crisis. Notably, equity large-cap funds exhibited remarkable resilience during the pandemic, outperforming other fund types with positive risk-adjusted returns. Their exceptional performance in excess return, Sharpe ratio, and Jensen Alpha aligns

harmoniously with prior studies emphasizing the robustness of large-cap funds in volatile markets. Furthermore, the analysis confirmed a positive relationship between fund age and performance during the pandemic, supporting previous research on the beneficial impact of fund age.

The analysis suggests that active management and higher management fee ratios didn’t give a higher return as expected. Nonetheless, the analysis did not find statistically significant effects for the fund characteristics related to Morning Star Ratings.

In summary, despite negative returns, the analysis revealed the positive impact of equity large-cap funds and fund age on performance during the COVID-19 pandemic. These findings contribute to our understanding of how fund characteristics relate to resilience and performance during challenging market conditions.

Despite the valuable insights gained from the analysis, there are opportunities for further improvement in our study. Specifically, the use of weekly Jensen's alpha to capture return changes was chosen to avoid the potential averaging effect of monthly returns. However, it may not be the most accurate approach in assessing performance. Exploring alternative performance indicators could enhance the precision and reliability of our analysis. Future studies could build upon these findings and employ more robust methodologies to deepen our understanding of fund performance during challenging market conditions.

REFERENCES

Agnesens, J. (2013). A statistically robust decomposition of mutual fund performance. *Journal of Banking & Finance*, *37*(10), 3867-3877. https://doi.org/https://doi.org/10.1016/j.jbankfin.2013.07.020

Ashraf, B. N. (2020). Stock markets' reaction to COVID-19: Cases or fatalities? *Res Int Bus Finance*, *54*, 101249. https://doi.org/10.1016/j.ribaf.2020.101249

Ben Belgacem, S., Hellara, S. (2011). Predicting Tunisian mutual fund performance using dynamic panel data model. *The Journal of Risk Finance*, *12*. https://doi.org/https://doi.org/10.1108/15265941111136950

Carhart, M. M. (1997). On Persistence in Mutual Fund Performance. *The Journal of Finance*, *52*(1), 57-82. https://doi.org/https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Ding, W., Levine, R., Lin, C., & Xie, W. (2021). Corporate immunity to the COVID-19 pandemic. *Journal of Financial Economics*, *141*(2), 802-830. https://doi.org/https://doi.org/10.1016/j.jfineco.2021.03.005

Fulkerson, J. A., & Riley, T. B. (2019). Portfolio concentration and mutual fund performance. *Journal of Empirical Finance*, *51*, 1-16. https://doi.org/https://doi.org/10.1016/j.jempfin.2019.01.006

GIL-BAZO, J., & RUIZ-VERDÚ, P. (2009). The Relation between Price and Performance in the Mutual Fund Industry. *The Journal of Finance*, *64*(5), 2153-2183. https://doi.org/https://doi.org/10.1111/j.1540-6261.2009.01497.x

Iqbal, N., Fareed, Z., Wan, G., & Shahzad, F. (2021). Asymmetric nexus between COVID-19 outbreak in the world and cryptocurrency market. *International Review of Financial Analysis*, *73*, 101613. https://doi.org/https://doi.org/10.1016/j.irfa.2020.101613

Li, Y., Zhuang, X., Wang, J., & Dong, Z. (2021). Analysis of the impact of COVID-19 pandemic on G20 stock markets. *The North American Journal of Economics and Finance*, *58*, 101530. https://doi.org/https://doi.org/10.1016/j.najef.2021.101530

Ling, A., Huang, X., & Ling, B. (2022). Fund immunity to the COVID-19 pandemic: Evidence from Chinese equity funds. *The North American Journal of Economics and Finance*, *63*, 101822. https://doi.org/https://doi.org/10.1016/j.najef.2022.101822

MALKIEL, B. G. (1995). Returns from Investing in Equity Mutual Funds 1971 to 1991. *The Journal of Finance*, *50*(2), 549-572. https://doi.org/https://doi.org/10.1111/j.1540-6261.1995.tb04795.x

Moosavi, J., Fathollahi-Fard, A. M., & Dulebenets, M. A. (2022). Supply chain disruption during the COVID-19 pandemic: Recognizing potential disruption management strategies. *International Journal of Disaster Risk Reduction*, *75*, 102983. https://doi.org/https://doi.org/10.1016/j.ijdrr.2022.102983

Pak, A., Adegboye, O. A., Adekunle, A. I., Rahman, K. M., McBryde, E. S., & Eisen, D. P. (2020). Economic Consequences of the COVID-19 Outbreak: the Need for Epidemic Preparedness [Perspective]. *Frontiers in Public Health*, *8*. https://doi.org/10.3389/fpubh.2020.00241

Rehman, M. U., Kang, S. H., Ahmad, N., & Vo, X. V. (2021). The impact of COVID-19 on the G7 stock markets: A time-frequency analysis. *The North American Journal of Economics and Finance*, *58*, 101526. https://doi.org/https://doi.org/10.1016/j.najef.2021.101526

Reinhart, C. M. (2020). *This Time Truly Is Different*. https://www.project-syndicate.org/commentary/covid19-crisis-has-no-economic-precedent-by-carmen-reinhart-2020-03?barrier=accesspaylog

Valadkhani, A. (2022). Do large-cap exchange-traded funds perform better than their small-cap counterparts in extreme market conditions?☆. *Global Finance Journal*, *53*, 100743. https://doi.org/https://doi.org/10.1016/j.gfj.2022.100743

Zaremba, A., Kizys, R., Tzouvanas, P., Aharon, D. Y., & Demir, E. (2021). The quest for multidimensional financial immunity to the COVID-19 pandemic: Evidence from international stock markets. *Journal of International Financial Markets, Institutions and Money*, *71*, 101284. https://doi.org/https://doi.org/10.1016/j.intfin.2021.101284

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