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COVID-19: Fear of pandemic and short-term IPO performance

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\textbf{ARTICLE INFO}

\textbf{JEL classification:}
G01  
G11  
G14

\textbf{Keywords:}
Initial returns  
Fear of COVID-19  
Event study

\textbf{ABSTRACT}

This study analyzes the relationship between COVID-19 related fear and short-term IPO performance. Though the average market-adjusted initial return of IPOs in the year 2020 is higher than that of the last four decades, it decreases if fear of pandemic increases. The evidence is robust when we use matching firm-adjusted initial returns. Next, we analyze the persistence of performance after the IPO date. The results show that the performance of IPO firms is more sensitive to the fear of the pandemic than the performance of similar existing firms.

1. Introduction

The recent outbreak of Coronavirus (COVID-19) has infected almost 27.57 million people and caused 475,000 deaths in the US, at the time of writing. The increasing number of new cases and deaths related to COVID-19 has created a palpable fear and uncertainty among market participants, e.g., investors and analysts. A growing stream of literature analyzes the impact of the fear of infection and death related to the COVID-19 pandemic on global stock market performance, for example, fear and global stock market performances (Lyocsa et al., 2020; Salisu and Akanni, 2020), fear and commodity price returns (Salisu et al., 2020), death, panic, and the US equity market performance (Baig et al., 2020), the reactions of stock prices in the airline and tourism industry during the COVID-19 period (Carter et al., 2020), and the importance of social trust on firm performance during the pandemic (Mazumder, 2020), among many others. However, very few studies have analyzed the impact of fear of the pandemic on IPO underpricing and post-initial performance.\textsuperscript{1} Though the IPO underpricing puzzle has drawn considerable attention to both investors and researchers for decades (Bajo and Raimondo, 2017; Ibbotson, 1975, among others), the extent to how much investors’ fear of the pandemic affects underpricing begs further investigation.

The pandemic has resulted in a substantial economic meltdown throughout the world. In the United States, stock market volatility increased sharply in late February, and the stock market plunged almost 33\% in one month from an all-time high level.\textsuperscript{2} However, although the market retreated in late March 2020, the market volatility remained well above the normal level. Given the uncertainty, it

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\textsuperscript{1} IPO underpricing and initial returns are used interchangeably.

\textsuperscript{2} The S&P 500 index fell by 33\% from mid-February to late March. On February 19, 2020, the S&P closing value was 3,386.15, while the index plunged to 2,237.40 on March 23, 2020.
is surprising that the average initial return of IPO firms in 2020 is 9.30% higher than those of other years. Thus, it is appropriate to analyze the initial returns amid fear of the pandemic. In this study, we explore two relevant questions: first, whether IPO initial returns are sensitive to the overall fear and uncertainty due to the pandemic; second, whether the post-IPO date performance is more or less sensitive to fear of the pandemic.

Existing studies find that media coverage about IPO and the tone of reporting may also shape investors’ beliefs (Bajo and Raimondo, 2017). In this study, we argue that the fear associated with the COVID-19 pandemic creates remarkable uncertainty in the investment decision-making process. In one study, Bali et al. (2017) find that low uncertainty is associated with 6% higher annualized returns, as compared to the stocks of high uncertainty. Hence, we propose our first hypothesis, that underpricing is negatively associated with overall fear related to the pandemic. Next, we argue that fear affects IPO firms’ stock performance more than that of existing firms. Uncertainty about IPO firms’ future growth opportunities is higher, and increases heterogeneity in investors’ beliefs that results in a higher crash risk (Hong and Stein, 2003). Moreover, information asymmetry is more pronounced for new firms because old firms have more available information (Dasgupta et al., 2010). Thus, we offer a subsequent hypothesis that fear more adversely affects IPO firms’ stock returns than those of existing firms.

To test the hypotheses, we use 81 IPO firms in the year of 2020. Following Salisu and Akanni (2020) and Salisu et al. (2020), we measure the fear index as an equally weighted index of both the daily cases and the daily deaths in the US (see Appendix A.2 for more details). In baseline regression, the results show that the average initial return (average market-adjusted initial return) decreases by 18.6% (17.70%) if the fear of pandemic prevails high in the market. The association is more robust when we use matching-firm-adjusted returns adopting the propensity score matching (PSM) approach. The matching firm-adjusted initial return (Initial Delta Return) decreases by 23.9% (22.9%) if the fear index dummy increases from 0 to 1. The results are both statistically and economically significant. Upon testing the second hypothesis, we find that IPO firms are more affected by fear of the pandemic. We find that if the fear of pandemic increases by one standard deviation, IPO firms’ daily returns (Adj. daily returns) decrease by 0.34% (0.18%).

To our best knowledge, this study is the first to analyze first-day IPO performance during the COVID-19 crisis period. This study contributes to the prevailing literature as follows: first, the study contributes to current IPO underpricing literature from a new perspective that fear of the pandemic has explanatory power to explain IPO underpricing. Second, we compare post-IPO performance with that of existing firms. Thus, market reactions due to the pandemic fear for both IPO and existing firms will be an exciting addition to the current literature.

The remainder of the paper is organized as follows. Section 2 briefly reviews the existing literature and develops hypotheses. Section 3 describes the sample and data. Section 4 presents the empirical results. Section 5 concludes.

2. Literature review and hypothesis development

Empirical evidence of high first-day returns for IPO firms is well known as IPO underpricing. Ibbotson (1975) is the first who documents the high first-day returns. Numerous studies following this study document significant initial day return for IPO stocks and provide differential explanations for underpricing, such as information asymmetry between investors (Rock, 1986), the reputation of underwriters (Beatty and Ritter, 1986; Megginson and Weiss, 1991), signaling by qualitative firms (Grinblatt and Hwang, 1989; Welch, 1989), and so on. Several other firm-level attributes can explain IPO underpricing, such as ex-ante uncertainty of issuing firms (Beatty and Ritter, 1986; Betty & Zajac, 1994), uncertainty about future growth opportunity and firm age (Ritter, 1984; Loughran and Ritter, 2004), higher P/E ratio (Chen et al., 2004; Engelen, 2003), the proportion of insider shareholding (Habib and Ljungqvist, 2001). These explanations are based on the competitive theories, e.g., information asymmetry, signaling, market timing, agency theory, etc.

Existing studies predominantly explain the firm-specific factors that can explain the variation; however, they mostly ignore outside factors or exogenous shock that may affect IPO’s initial day return. To mitigate the gap, Engelen and Van Essen (2010) document that country-level factors, such as Rule of Law, Anti self-dealing index, and corruption, can also explain almost 10% variation in the IPO underpricing. A growing stream of research advocates investor sentiment as a critical factor for IPO initial day return (Chen et al., 2020b; Derrien, 2005; Wang and Wu, 2015). Issuing firms time the market and more firms go public when investors’ sentiment is high (Lee, Shleifer, and Thaler, 1995) to coincide with periods of excess market valuation (Baker and Wurgler, 2002). Zhao, Xiong, and Shen (2018) find that investor attention positively affects first-day underpricing. Media coverage (Bhattacharya et al., 2009; Chen et al., 2020a; Guldiken et al., 2017; Pollock and Rindova, 2003) and media tone (Bajo and Raimondo, 2017; Zou et al., 2020) for the IPO also influence the initial day return. Twitter sentiment can also explain the IPO underpricing, especially the pre IPO dates tweets (Liew and Wang, 2016). In one study, Loughran and McDonald (2013) claim that negative sentiment embedded in the S-1 forms is positively associated with underpricing.

Behavioral finance studies reveal that investors’ negative sentiment and mood affect the decision-making and asset pricing. For example, Kaplan and Levy (2010) find that the market loses more than $60 billion for each of the aviation disasters. Schmeling (2009) finds that consumer confidence as a proxy of investors sentiment can predict stock returns for 18 industrialized countries. This study concentrates on how a pure exogenous shock, COVID-19, affects the IPO initial day return during the pandemic period. The number of COVID-19-related cases and deaths has become an integral part of media coverage, which causes fear among investors and
shapes their sentiment. Da et al. (2015) measure households’ fear index based on textual search and find that fear is negatively associated with stock returns. According to Salisu and Akanni (2020), the fear sentiment is associated with a decline in stock price. Thus, we hypothesize the following:

Hypothesis 1. The higher the fear index, the lower the initial return for IPO stocks.

We further expect that the impact of pandemic fear is more pronounced in the subsequent daily returns of the newly listed firms. IPO firms are typically young, immature, and relatively informationally opaque (Ljungqvist, 2007). Dasgupta, Gan, and Gao (2010) show that information asymmetry exists to a greater degree in newly listed firms because information availability is more for older firms. Kelly and Ljungqvist (2012) show that stock prices fall as asymmetry of information increases. Further, Dierkens (1991) shows that information asymmetry negatively affects stock price when firms announce a seasoned equity offering. Given the existence of more significant information asymmetry for newly listed firms and the fear adversely affecting investor sentiment, we hypothesize the following:

Hypothesis 2. The higher the fear index, the lower the subsequent daily return for IPO stocks.

3. Data and sampling

3.1. Sample construction

In this section, we describe how we construct two samples for our empirical analysis. Our first sample consists of initial public offerings from January-2020 to July-2020. On December 31, 2019, China reported to the World Health Organization (WHO) a string of pneumonia-like cases in Wuhan. In the United States, the first COVID-19 case was confirmed on January 20, 2020. Even though there was no official pandemic declaration before March-2020, the fear related to the disease prevailed before March, especially during January and February. Thus, we added the IPOs of January and February in our study. Since the fear index has been calculated based on reported cases and deaths, the index value is zero if there is no reported case or death. Moreover, we include January and February in the sample to get enough variation in the explanatory variable, the fear index.

Consistent with the IPO-pricing literature, we exclude IPOs that have an offer price of less than 5, are in financial and utility sectors, are not traded in NYSE, NASDAQ, and AMEX, and are ADRs. This leaves us with a final sample of 81 firms for initial return analysis in baseline regression. We collect price and financial data from the COMPUSTAT, SEC EDGAR, and Professor Jay Ritter’s website. To construct a proxy for market return, we use the return data of the S&P 500. Following convention, we calculate the initial return and adjusted initial return for each firm as follows:

\[ \text{Initial Return}_i = \frac{CP_i - OP_i}{CP_i} \]

where, \( CP_i \) is the closing price on the first day of trading and \( OP_i \) is the offer price.

\[ \text{Adj Initial Return}_id = \text{Initial Return}_id - R_{md} \]

where, \( \text{Initial Return}_id \) is the first-day return and \( R_{md} \) is the market return on that day.

Our second sample consists of listed firms’ daily returns from January-2020 to August-2020, collected from the COMPUSTAT daily database. Following asset pricing literature, we exclude firms if the price is less than $1, if it is an ADR, or if it is not traded in NYSE, NASDAQ, and AMEX. This gives us 358,593 (346,337) firm-day observations in panel regression (panel regression with entropy balancing approach). Daily return is the difference between today’s price and yesterday’s price, scaled by yesterday’s price. Daily adjusted return is the difference between daily return and market return. For baseline (cross-sectional) and panel regression analyses, we control for the year 2019 firm-level characteristics.

3.2. Summary statistics

Table 1 presents the summary statistics of the initial and adjusted initial return for IPOs from January-2019 to July-2020.6 In Panel A, we show the distribution of initial and adjusted initial returns by year. Careful analysis shows that both initial and adjusted initial return distributions in 2020 lean further to the right than that in 2019. The mean adjusted initial return is 27.5% in 2020, as opposed to 13.7% in 2019. In Panel B, we show the mean of initial and adjusted initial returns by month. Panel C reports the mean initial and adjusted initial returns of 2020 IPO firms segregating into two samples: before and after February 15, 2020.

Table 2 Panel A provides descriptive statistics for the control variables used in the baseline regression.7 The mean log of proceeds is 18.88. The average asset size for 2020 IPO firms is $438.16 million, when the 50th-percentile value is 44.05 million. The mean offer price for 2020 IPO firms is $15.18.8 Around 78% of the IPO firms in our sample are traded in NASDAQ.

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6 We construct the panel sample if daily returns of IPO firms are available for at least one month after the IPO date.
7 IPOs of the year 2019 are used only for the propensity score matching.
8 Appendix A.1 reports variable descriptions in detail.
9 All statement variables and price data are in US dollars.
IPO firm is 4.93 years. The mean market capitalization of IPO firms is $1288.19 million. In Panel B, we show the descriptive statistics for the panel regression variables, separated by IPO and Non-IPO firms.

**Table 1**
Summary statistics: IPO initial return

This table presents the summary statistics for the initial return and adjusted initial return of initial public offerings from January-2019 to July-2020. The sample consists of 216 firms. Initial return is the ratio of the difference between the closing price on the first day of trading and the offer price divided by the offer price. Adjusted initial return represents a market-adjusted return, which is the difference between the initial return and the S&P500 return on the same day. Panel A shows the return distribution of IPO firms by their year of IPO. Panel B shows the mean of initial and adjusted initial returns of IPO firms by their year and month of IPO. Panel C shows the mean of initial and adjusted initial returns of 2020 IPO firms by segregating them into two samples.

| Panel A: Summary Statistics of IPO returns |
|-------------------------------------------|
| **Year: 2019**                            |
| Initial Return                            |
| Mean   | 0.138 | 0.295 | -0.192 | 0.000 | 0.006 | 0.284 | 0.794 | 135 |
| Adj. Initial Return                       |
| Mean   | 0.137 | 0.295 | -0.190 | 0.005 | 0.009 | 0.283 | 0.802 | 135 |
| **Year: 2020**                            |
| Initial Return                            |
| Mean   | 0.273 | 0.464 | -0.073 | 0.002 | 0.051 | 0.458 | 1.237 | 81  |
| Adj. Initial Return                       |
| Mean   | 0.275 | 0.461 | -0.082 | 0.005 | 0.056 | 0.432 | 1.235 | 81  |

Panel B: Monthly IPO mean returns

| Month     | Initial Return | Adj. Initial Return | # IPOs | Month     | Initial Return | Adj. Initial Return | # IPOs |
|-----------|----------------|---------------------|--------|-----------|----------------|---------------------|--------|
| January   | 0.000          | 0.001               | 1      | January   | 0.387          | 0.397               | 7      |
| February  | -0.052         | -0.051              | 15     | February  | 0.099          | 0.098               | 14     |
| March     | 0.129          | 0.128               | 7      | March     | -0.006         | 0.048               | 3      |
| April     | 0.256          | 0.254               | 15     | April     | 0.195          | 0.185               | 6      |
| May       | 0.181          | 0.182               | 16     | May       | 0.177          | 0.178               | 10     |
| June      | 0.323          | 0.318               | 17     | June      | 0.283          | 0.284               | 21     |
| July      | 0.114          | 0.114               | 17     | July      | 0.456          | 0.455               | 20     |
| August    | 0.065          | 0.069               | 8      |           |                |                     |        |
| September | 0.177          | 0.176               | 9      |           |                |                     |        |
| October   | 0.107          | 0.104               | 8      |           |                |                     |        |
| November  | 0.042          | 0.040               | 16     |           |                |                     |        |
| December  | 0.118          | 0.115               | 6      |           |                |                     |        |

Panel C: IPO mean returns before and after February 15, 2020

| Month     | Initial Return | Adj. Initial Return | # IPOs |
|-----------|----------------|---------------------|--------|
| Before February 15 | 0.223 | 0.226 | 17 |
| After February 15   | 0.286 | 0.287 | 64  |

| Month     | Initial Return | Adj. Initial Return | # IPOs |
|-----------|----------------|---------------------|--------|
| January   | 0.387          | 0.397               | 7      |
| February  | 0.099          | 0.098               | 14     |
| March     | -0.006         | 0.048               | 3      |
| April     | 0.195          | 0.185               | 6      |
| May       | 0.177          | 0.178               | 10     |
| June      | 0.283          | 0.284               | 21     |
| July      | 0.456          | 0.455               | 20     |
| August    | 0.069          | 0.069               | 8      |
| September | 0.176          | 0.176               | 9      |
| October   | 0.104          | 0.104               | 8      |
| November  | 0.040          | 0.040               | 16     |
| December  | 0.115          | 0.115               | 6      |

4. Empirical results

4.1. Fear and initial returns

In Table 3, we regress the initial returns on the fear index and control variables by using the following model:

$$\text{IR}_t = \beta_0 + \beta_1 \text{HighFear}_{t-1} + \beta_2 \text{X}_{t-1} + d_f + \epsilon_t$$  \hspace{1cm} (3)

Where, $\text{IR}_t$ is the initial returns or adjusted initial returns of the IPOs. $\text{HighFear}_{t-1}$ is a dummy variable 1 if the fear index is more than the median value at lag IPO day, and 0 otherwise. $\text{X}_{t-1}$ is a vector of control variables in the year 2019. We control IPO offer size, asset size, offer price, NASDAQ dummy, age, Hi-Tech dummy, underwriter reputation, market capitalization, price revision, syndicate size, venture capital dummy, CEO founder dummy, board independence, R&D, and log volume (following Brav and Gompers, 1997; Chahine et al., 2020; Krishnan et al., 2011; Loughran and Ritter, 2004; Vong and Trigueiros, 2010; Zhou and Sadegh, 2019). $d_f$ is the Fama and French 49 industry dummies and $\epsilon_t$ is the white noise when standard errors are heteroscedasticity-consistent robust.

Table 3 presents the baseline cross-section regression results of 81 IPO initial returns on the fear index. We consider four proxies for the initial returns. In columns 1 and 2 of Table 3, we use two different initial returns as dependent variables, following Eqs. (1) and (2).
This table presents the descriptive statistics for variables used in the baseline and panel regression. Panel A presents the descriptive statistics for all independent variables used in baseline regression. OfferSize is the natural log of total proceeds of IPOs. AssetSize is the total asset size in millions. Price is the IPO offer price. NASDAQ, a dummy variable, takes 1 if the firm is traded in NASDAQ and 0 otherwise. Age is the issuer age from incorporation. Hi-tech is a dummy variable equal to 1, if a firm has a certain SIC code (see Loughran and Ritter, 2004), and 0 otherwise. Underwriter reputation is the lead underwriter’s reputation collected from Professor Jay Ritter’s website. Market capitalization is calculated based on post-IPO shares and first-day closing price. Price revision is the percentage increase in the final IPO offer price from the midpoint of the high and low prices in the initial filing. Syndicate size is the number of venture capital co-investors in IPO. Venture capital (VC), a dummy variable, takes 1 if VC backs the IPO, and 0 otherwise. CEO founder, a dummy variable, takes 1 if the CEO is also a founder, and 0 otherwise. Board independence is the fraction of independent directors on the board. R&D represents R&D expenditures scaled by total assets. Log (Volume) is the log of the first-day trading volume. FearIndex is an equally weighted index of both new cases and death related to the COVID-19 pandemic. Panel B presents the descriptive statistics for the variables (Non-IPO and IPO firms) used in the panel regression. Daily return is the difference between today’s and yesterday’s price scaled by yesterday’s price. Adj. daily return is the market-adjusted return where S&P500 is the market. Log (Asset) is the natural log of total assets. Leverage is the sum of long-term and short-term debt scaled by total assets. ROA represents net income scaled by total assets.

| Panel A: Descriptive Statistics of the Baseline Sample | Mean | Std. Dev | p5 | p25 | Median | p75 | p95 | N |
|-------------------------------------------------------|------|----------|----|-----|--------|-----|-----|---|
| OfferSize                                             | 18.880 | 1.092  | 16.520 | 18.380 | 19.110 | 19.370 | 20.660 | 81 |
| AssetSize                                             | 438.160 | 1552.028 | 0.050 | 0.390 | 44.050 | 156.100 | 1602.300 | 81 |
| Price                                                 | 15.180 | 14.687 | 6.000 | 10.000 | 16.000 | 19.000 | 26.000 | 81 |
| NASDAQ                                                | 0.780 | 0.441 | 0.000 | 1.000 | 1.000 | 1.000 | 1.000 | 81 |
| Age                                                   | 1.784 | 0.8810 | 0.693 | 1.099 | 1.792 | 2.303 | 3.219 | 81 |
| Hi-Tech                                               | 0.098 | 0.300 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 81 |
| Underwriter Reputation                                | 7.408 | 2.254 | 3.001 | 7.001 | 8.501 | 9.001 | 9.001 | 81 |
| Market Capitalization                                  | 1288.190 | 2385.072 | 42.600 | 154.070 | 540.270 | 1078.550 | 5519.850 | 81 |
| Price Revision                                         | 0.049 | 0.044 | 0.000 | 0.000 | 0.000 | 1.000 | 3.000 | 81 |
| Syndicate Size                                         | 1.506 | 1.762 | 0.000 | 0.000 | 1.000 | 3.000 | 4.000 | 81 |
| Venture Capital                                        | 0.469 | 0.502 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 81 |
| CEO Founder                                            | 0.481 | 0.503 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 81 |
| Board Independence                                     | 0.785 | 0.152 | 0.500 | 0.750 | 0.833 | 0.875 | 0.889 | 81 |
| R&D                                                   | 0.207 | 0.154 | 0.000 | 0.000 | 0.341 | 0.804 | 1.000 | 81 |
| Log(Volume)                                            | 15.209 | 1.130 | 13.030 | 14.439 | 15.321 | 15.846 | 17.024 | 81 |
| FearIndex                                              | 0.490 | 0.283 | 0.000 | 0.420 | 0.490 | 0.580 | 0.990 | 250 |

| Panel B: Descriptive Statistics of the Panel sample | Mean | p5 | p25 | Median | p75 | p95 | N |
|-----------------------------------------------------|------|----|-----|--------|-----|-----|---|
| Daily Return                                         | 0.001 | -0.069 | -0.019 | 0.000 | 0.020 | 0.074 | 352,878 |
| Adj. Daily Return                                     | 0.001 | -0.056 | -0.017 | -0.001 | 0.015 | 0.060 | 352,878 |
| Log(Asset)                                            | 7.407 | 4.151 | 6.182 | 7.462 | 8.637 | 10.620 | 352,878 |
| Leverage                                              | 0.205 | 0.000 | 0.112 | 0.284 | 0.439 | 0.697 | 352,878 |
| Hi-Tech                                               | 0.175 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 352,878 |
| R&D                                                   | 0.062 | 0.000 | 0.000 | 0.006 | 0.062 | 0.312 | 352,878 |
| ROA                                                   | -0.015 | -0.443 | -0.013 | 0.035 | 0.075 | 0.168 | 352,878 |

Fig. 1. This figure displays the average initial return, the adjusted initial return of IPOs, and the fear index. The sample period ranges from January-2020 to July-2020. The sample consists of 81 IPO firms from the year 2020.
Table 3
Baseline regression

This table presents regression results of COVID-19 fear on initial returns and adjusted initial returns of IPOs from January-2020 to July-2020. Initial return is the ratio of the difference between the closing price on the first day of trading and the offer price divided by the offer price. Adjusted initial return represents a market-adjusted return, where S&P500 is the proxy of the market. Initial delta return is the difference between the year 2020 IPO firms' initial return and that of matched 2019 IPO firms using the PSM approach. Adj. Initial delta return is the difference between the market-adjusted initial return of the year 2020 IPO firms and that of matched 2019 IPO firms using the PSM approach. HighFear is a dummy variable if the FearIndex is more than the median value, and 0 otherwise. FearIndex is an equally weighted index of both new cases and deaths related to the COVID-19 pandemic. OfferSize is the natural log of total proceeds of IPOs. Log(Assets) is the natural log of total assets. Price is the IPO offer price. NASDAQ, a dummy variable, takes 1 if the firm is traded in NASDAQ and 0 otherwise. Age is the issuer age from incorporation. Hi-tech is a dummy variable equal to 1, if a firm has a certain SIC code (see Loughran and Ritter, 2004), and 0 otherwise. Underwriter reputation is the lead underwriter's reputation collected from Professor Jay Ritter's website. Market capitalization is calculated based on post-IPO shares and first-day closing price. Price revision is the percentage increase in the final IPO offer price from the midpoint of the high and low prices in the initial filing. Syndicate size is the number of venture capital co-investors in IPO. Venture capital (VC), a dummy variable, takes 1 if VC backs the IPO, and 0 otherwise. CEO founder, a dummy variable, takes 1 if the CEO is also a founder, and 0 otherwise. Board independence is the fraction of independent directors on the board. R-squared is the coefficient of determination. Industry FE is an indicator for industry fixed effects. The results are economically significant, meaning that the fear index's dummy increase from zero to one is associated with an 18.6% (17.70%) decrease of initial (adjusted initial) return. The result is consistent with the notion that fear sentiment negatively affects the initial IPO returns for the year 2020. Next, we match each of the 2020-IPO firms with similar 2019-IPO firms to construct peer adjusted initial returns using the propensity score matching technique. Column 3 reports peer adjusted initial returns, while column 4 reports peer and market-adjusted initial returns. We find robust t-statistics are displayed in parentheses. Significance levels are denoted by *, **, *** which correspond to the 10%, 5%, and 1% levels, respectively.

| VARIABLES            | Initial Return (1) | Adj. Initial Return (2) | Initial Delta Return (3) | Adj. Initial Delta Return (4) |
|----------------------|--------------------|-------------------------|--------------------------|------------------------------|
| HighFear, \( t \)    | -0.1861***         | -0.1770***              | -0.2388**                | -0.2293*                     |
| (2.1964)             | (-2.0818)          | (-2.0017)               | (-1.9396)                |                              |
| OfferSize, \( t \)   | -0.0493            | -0.0614                 | -0.1685                  | -0.1799                      |
| (0.3850)             | (-0.4818)          | (-1.1551)               | (-1.2378)                |                              |
| Log(Assets), \( t \) | 0.0224             | 0.0257                  | 0.0444                   | 0.0451                       |
| (0.5864)             | (0.6355)           | (1.0050)                | (1.0511)                 |                              |
| Price, \( t \)       | 0.0847***          | 0.0844***               | 0.0716**                 | 0.0715**                     |
| (3.1277)             | (3.1625)           | (2.1193)                | (2.1348)                 |                              |
| NASDAQ, \( t \)      | -0.3474***         | -0.3404***              | -0.4299**                | -0.4233**                    |
| (2.2534)             | (2.1790)           | (2.2775)                | (2.2199)                 |                              |
| Age                  | 0.0590             | 0.0576                  | 0.0254                   | 0.0246                       |
| (0.6981)             | (0.6954)           | (0.2038)                | (0.1994)                 |                              |
| Hi-Tech              | 0.0913             | 0.0521                  | 0.6341*                  | 0.5939*                      |
| (0.4092)             | (0.2354)           | (1.9386)                | (1.8272)                 |                              |
| Underwriter Reputation| -0.0091            | -0.0057                 | 0.0119                   | 0.0151                       |
| (0.3185)             | (-0.1962)          | (0.3016)                | (0.3806)                 |                              |
| Market Capitalization| 0.0000             | 0.0000                  | 0.0001                   | 0.0001                       |
| (0.1395)             | (0.1578)           | (1.5690)                | (1.5916)                 |                              |
| Price Revision       | 0.1223***          | 0.1330**                | 0.2434***                | 0.2549***                    |
| (2.1414)             | (2.3575)           | (3.6099)                | (3.8125)                 |                              |
| Syndicate Size       | -0.0506            | -0.0474                 | -0.0825                  | -0.0803                      |
| (0.8855)             | (-0.8456)          | (-1.5160)               | (-1.4995)                |                              |
| Venture Capital      | 0.0888             | 0.0898                  | 0.1839                   | 0.1830                       |
| (0.7321)             | (0.7506)           | (0.8843)                | (0.8877)                 |                              |
| CEO Founder          | -0.0738            | -0.0781                 | -0.0932                  | -0.0973                      |
| (0.7306)             | (-0.7841)          | (-0.7825)               | (-0.8233)                |                              |
| Board Independence   | 0.4112             | 0.4515                  | 0.1309                   | 0.1738                       |
| (1.1501)             | (1.2827)           | (0.2597)                | (0.3509)                 |                              |
| R&D                  | -0.0046            | -0.0046                 | -0.0037                  | -0.0036                      |
| (1.0761)             | (-1.0758)          | (-1.0110)               | (-1.0212)                |                              |
| Log(Volume)          | -0.0739            | -0.0734                 | -0.1106                  | -0.1104                      |
| (0.6607)             | (-0.6628)          | (-0.9466)               | (-0.9495)                |                              |
| Constant             | 1.1196             | 1.2776                  | 4.0168**                 | 4.1474**                     |
| (0.8008)             | (0.9311)           | (2.2846)                | (2.3832)                 |                              |
| Observations         | 81                 | 81                      | 81                       | 81                           |
| R-squared            | 0.6892             | 0.6904                  | 0.6686                   | 0.6690                       |
| Industry FE          | YES                | YES                     | YES                      | YES                          |

(2) The results show that the HighFear dummy is negatively and significantly associated with initial returns and adjusted initial returns after we control for firm-level variables and industry fixed effects. The results are economically significant, meaning that the fear index's dummy increase from zero to one is associated with an 18.6% (17.70%) decrease of initial (adjusted initial) return. The result is consistent with the notion that fear sentiment negatively affects the initial IPO returns for the year 2020. Next, we match each of the 2020-IPO firms with similar 2019-IPO firms to construct peer adjusted initial returns using the propensity score matching technique. Column 3 reports peer adjusted initial returns, while column 4 reports peer and market-adjusted initial returns. We find robust

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11 To match the treatment sample with the control sample, we consider Pre-IPO total assets, IPO offer size, leverage, and offer price to create the propensity.
associated with a 23.9% (22.9%) decrease of peer adjusted initial (peer and market-adjusted initial) return.

| VARIABLES               | (1)       | (2)       | (3)       | (4)       |
|-------------------------|-----------|-----------|-----------|-----------|
| Daily Return            |           |           |           |           |
| FearIndex\_d \_t-1     | 0.0018*** | 0.0018*** | -0.0017***| -0.0017***|
|                         | (4.6139)  | (4.5984)  | (-4.4325) | (-4.4815) |
| NewFirm                 | 0.0024    | 0.0024    | -0.0012   | -0.0012   |
|                         | (0.9500)  | (0.9644)  | (-0.5311) | (-0.5112) |
| FearIndex\_d \_t-1 \_NewFirm | -0.0120***| -0.0120***| -0.0065*  | -0.0065*  |
|                         | (-2.8763) | (-2.8505) | (-1.6977) | (-1.6843) |
| Log(Assets)             | -0.0006***| -0.0006***| -0.0006***| -0.0006***|
|                         | (-8.9369) | (-8.8354) | (-8.5997) | (-8.4494) |
| Leverage                | 0.0019*** | 0.0018*** | 0.0019*** | 0.0018*** |
|                         | (3.8037)  | (3.4253)  | (3.7816)  | (3.3549)  |
| Hi-Tech                 | -0.0000   | -0.0001   | -0.0000   | -0.0001   |
|                         | (0.1739)  | (0.2283)  | (0.0907)  | (0.2999)  |
| R&D                     | 0.0035**  | 0.0039*** | 0.0033**  | 0.0037**  |
|                         | (2.4909)  | (2.3182)  | (2.3284)  | (2.2823)  |
| ROA                     | -0.0004   | -0.0004   | -0.0004   | -0.0004   |
|                         | (-0.5402) | (-0.5432) | (-0.5243) | (-0.5319) |
| Constant                | 0.0045*** | 0.0046*** | 0.0052*** | 0.0053*** |
|                         | (7.2071)  | (7.0492)  | (8.3862)  | (8.1501)  |
| Observations            | 358,593   | 358,593   | 358,593   | 358,593   |
| R-squared               | 0.0005    | 0.0006    | 0.0005    | 0.0006    |
| Industry FE             | NO        | YES       | NO        | YES       |

Table 4 presents regression results of COVID-19 fear on subsequent day return of IPO and non-IPO firms from January-2020 to August-2020. Daily return is the difference between today’s and yesterday’s price scaled by yesterday’s price. Adj. daily return is the daily market-adjusted return. FearIndex is an equally weighted index of both new cases and deaths related to the COVID-19 pandemic. NewFirm is a dummy variable equal to 1 if the firm’s IPO year is 2020, and 0 otherwise. Log (Asset) is the natural log of total assets. Leverage is the sum of long-term and short-term debt scaled by total assets. Hi-Tech is a dummy variable equal to 1, if a firm has a certain SIC code (see Loughran and Ritter, 2004), and 0 otherwise. R&D represents R&D expenditures scaled by total assets. ROA represents net income scaled by total assets. Industries are defined as Fama–French 49 industries. Standard errors are clustered by firm-level. t-statistics are displayed in parentheses. Significance levels are denoted by *, **, *** which correspond to the 10%, 5%, and 1% levels, respectively.

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4.2. Fear and post IPO performance

Next, we extend our analysis to examine how the fear of COVID-19 affects the subsequent performances of IPO firms. Our panel dataset consists of daily stock returns data for the new and existing firms from January 2020 to August 2020. In Table 4, we regress the subsequent daily returns on the fear index and control variables by using the following model:

$$\text{DailyReturn}_{i,d} = \beta_0 + \beta_1 \text{FearIndex}_{d-1} + \beta_2 \text{NewFirm} + \beta_3 \text{NewFirm} \times \text{FearIndex}_{d-1}$$

$$+ \beta_4 X_{i,t-1} + d_j + \epsilon_{i,d}$$  (4)

Where, \(\text{DailyReturn}_{i,d}\) is the daily return or market-adjusted daily returns, \(\text{FearIndex}_{d-1}\) is the fear associated with the COVID-19 at lag day, \(\text{NewFirm}\) is a dummy variable if the firm is an IPO firm in year 2020, and \(X_{i,t-1}\) is a vector of control variables. We take the following controls: log asset size, leverage, Hi-Tech dummy, R&D, and ROA. \(d_j\) is the Fama and French 49 industry dummies and \(\epsilon_{i,d}\) is the white noise when standard errors are clustered at the firm level.

Table 4 presents the regression results of daily returns on the fear index. We consider two alternatives for daily returns. In columns 1 and 2, the daily return is the difference between today’s and yesterday’s price, scaled by yesterday’s price. The columns are different in industry fixed effect treatment. In columns 3 and 4, we use market-adjusted returns as dependent variables. The only difference between the columns is the industry fixed effect. Here, the interaction term, \(\text{FearIndex} \times \text{NewFirm}\), captures the impact of fear sentiment on new firms. In column 3, the coefficient for \(\text{FearIndex}\) is negative and statistically significant, which confirms that fear sentiment negatively affects non-IPO firms’ expected return. Importantly, our variable of interest, \(\text{FearIndex} \times \text{NewFirm}\), negative and statistically significant. The result is economically significant, meaning that a one standard deviation increases in the \(\text{FearIndex}\) (0.2836) is associated with a 0.18% decrease in expected return. Our result is identical in column 4. Overall the results confirm that if there is no fear, old firms perform better than new firms suggesting that information asymmetry is lower for older firms (Dasgupta et al., 2010). When the fear sentiment is non-zero, its impact is more pronounced on the newly listed firms, which is consistent with our hypothesis.

4.3. Robustness: matching through entropy balancing techniques

To better identify how fear impacts daily returns of IPO and Non-IPO firms, we utilize a robust multivariate matching technique,
known as entropy balancing (Hainmueller, 2012). This method ensures proper covariate balancing between treated (IPO firms) and control (Non-IPO firms) samples by weighing observations such that the post-weighting means and variance of treated and control firms are similar for each matching dimension. We match all the control variables used in Table 4. Table 5 Panel A represents the mean and variance of covariates of IPO and Non-IPO firms after entropy balancing. The difference in means and variances of covariates are minimal and statistically insignificant, suggesting that proper entropy balancing was achieved. Using the balanced sample with a post-weighting total of 346,337 firm-day observations, we re-run Eq. (4). We expect that the regression coefficient is free from any biases because the distribution of both treated and control samples are identical. Table 5 Panel B presents the regression results. Our key variable of interest, the interaction effect, is negative and statistically significant across all specifications. The result strongly supports our hypothesis that the impact of fear sentiment is more pronounced on the newly listed firms’ subsequent performances.

5. Conclusion

We investigate the impact of fear associated with the pandemic on initial IPO returns, motivated by the nearly 9.30% higher IPO initial returns in 2020 than in the previous 40 years. We evaluate whether initial returns are sensitive to fear of the pandemic given the outperformance of the initial return. Using the fear index, we find that the initial return is negatively associated with the fear of the pandemic. The results are robust when we match the IPO firms with the previous year’s IPO firms. Moreover, for post-IPO initial returns, public fear and sentiment affect newer firms more than older firms, even after entropy balancing. While this study is a preliminary analysis of the impact of pandemic fear on short-term IPO performance, the long-term performance of IPOs launched during the pandemic is a subject for future research.
Declarations of Competing Interest

We declare that we have no material financial interests that relate to the research described in this paper.

Appendix A.1. Variable description

| Variable name       | Description                                                                 | Source                        |
|---------------------|-----------------------------------------------------------------------------|-------------------------------|
| Adj. Daily Return   | Adj. daily return is the daily market-adjusted return. The market is defined as the S&P 500. | COMPUSTAT (Daily)            |
| Adj. Initial Return | Market return adjusted Initial Return. The market is defined as the S&P 500. | COMPUSTAT (Daily)            |
| Adj. Initial Delta Return | Adj. Initial delta return is the difference between the market-adjusted initial return of the year 2020 IPO firms and that of matched 2019 IPO firms using the PSM approach. | COMPUSTAT (Daily)            |
| Age                 | The natural log of 1 + the age (in years) of the issuer at the time of the offering, as computed from the firm’s first incorporation to the date of the offering. | Jay Ritter’s Website          |
| RCI                 | Board independence is the fraction of independent directors on the board.      | SEC EDGAR                     |
| RCI                 | CEO Founder is a dummy variable, takes 1 if the CEO is also a founder, and 0 otherwise. | SEC EDGAR                     |
| RCI                 | Daily Return is the difference between today’s and yesterday’s price scaled by yesterday’s price. | COMPUSTAT (Daily)            |
| RDI                 | FearIndex is an equally weighted index of both new cases and deaths related to the COVID-19 pandemic. | HealthData.Gov & Salisu and Akanni (2020) |
| RDI                 | Hi-Tech is a dummy variable that equals 1 if the IPO is a high-tech firm and zero otherwise. In line with Loughran and Ritter (2004), high-tech firms are those with SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3671, 3672, 3674, 3675, 3677, 3678, 3679 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services), 7371, 7372, 7373, 7374, 7375, 7376, and 7379 (software). | HealthData.Gov & Salisu and Akanni (2020) |
| RDI                 | Initial Delta Return is the difference between the initial return of the year 2020 IPO firms and that of matched 2019 IPO firms using the PSM approach. | COMPUSTAT (Daily)            |
| RDI                 | Initial Return is the ratio of the difference between the closing price on the first day of trading and the offer price divided by the offer price. | COMPUSTAT (Daily), SEC EDGAR |
| RDI                 | Leverage is the ratio of the sum of the book value of long-term (dtlt) and short-term debt (dlc) divided by the total assets. | COMPUSTAT (Annual)           |
| RDI                 | Log(Volume) is log volume is the log of the first-day trading volume.         | COMPUSTAT (Daily)            |
| RDI                 | Market Capitalization is calculated based on post-IPO shares and first-day closing price. | COMPUSTAT (Daily)            |
| RDI                 | NASDAQ is a dummy variable equal to 1 if the firm is traded in NASDAQ and 0 otherwise. | COMPUSTAT (Daily)            |
| RDI                 | NewFirm is a dummy variable equal to 1 if the firm’s IPO year is in 2020 and 0 otherwise. | COMPUSTAT (Daily)            |
| RDI                 | OfferSize is the natural log of total proceeds collected through IPOs.        | SEC EDGAR                     |
| RDI                 | Price is the offer price of IPO.                                             | SEC EDGAR                     |
| RDI                 | Price Revision is the percentage increase in final IPO offer price from the midpoint of the high and low prices in the initial filing. | SEC EDGAR                     |
| RDI                 | R&D is a dummy variable that equals 1 if the IPO is in the category of R&D. | COMPUSTAT (Annual)           |
| RDI                 | ROA is a dummy variable that equals 1 if the IPO is in the category of ROA. | COMPUSTAT (Annual)           |
| RDI                 | Underwriter is the lead underwriter reputation score.                        | Jay Ritter’s Website          |
| RDI                 | Reputation is the number of VC co-investors in the IPO.                     | SEC EDGAR                     |
| RDI                 | Venture Capital is a dummy variable that takes 1 if the IPO is backed by VC, and 0 otherwise. | Jay Ritter’s Website          |

Appendix A.2. Description of the fear index for US

Following Salisu and Akanni (2020) and Salisu et al. (2020), we construct the fear index as the equally-weighted measure of reported case index (RCI) and reported death index (RDI). According to Salisu et al. (2020), “RCI measures how far people’s expectations from reported cases in the preceding 14 days period (incubation period) veered from the present days’ reported cases.” So, RCI for a given day is calculated by the following equation:

$$ RCI = \frac{\text{Reported cases}}{\text{Reported cases} + \text{Reported cases at the start of the incubation period}} $$

The second component, RDI, measures how far peoples’ expectations from reported deaths in the preceding 14-days veered from the present day’s reported deaths. Similar to RCI, RDI is calculated as follows:

$$ RDI = \frac{\text{Reported deaths}}{\text{Reported deaths} + \text{Reported deaths of 14 days ago}} $$

After constructing the two indices, we create the fear index assigning equal weight to both indices. The higher the value of FearIndex, the greater the fear about the pandemic. The fear index captures the fear of the pandemic in the US.
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