Did the COVID-19 pandemic (really) positively impact the IPO Market? An Analysis of information uncertainty

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ABSTRACT

Anecdotal evidence seems to suggest that the initial public offering (IPO) market performed remarkably well through the COVID-19 pandemic. To further understand this peculiar observation, we carry out a comprehensive analysis of IPOs during the pandemic vis-a-vis IPOs before the pandemic. Our findings imply that IPOs during the pandemic experience greater information uncertainty compared to those before the pandemic, and this greater uncertainty is mainly driven by the IPOs from the high-technology and the healthcare sectors. Furthermore, we find that an average IPO firm experiences larger underpricing and more post-IPO return volatility as the pandemic and the associated government responses increase in severity before the offering. Overall, our study indicates that the COVID-19 pandemic had an adverse impact on the IPO market.

JEL classifications: G14, G18, G32, H12.

1. Introduction

A growing stream of academic research focuses on analyzing the impact of the COVID-19 pandemic on financial markets. Scholars have, among other things, studied equity markets (Ashraf, 2020; Baker et al., 2020; Zhang et al., 2020; Bretscher et al., 2020; Baig et al., 2021; Ke, 2021), debt markets (Hasan et al., 2021; O'Hara and Zhou, 2021; Zaremba et al 2021a, 2021b), derivative markets (Johnand Li, 2021; Jackwerth, 2020), commodities (Corbet et al., 2020; Lin and Su, 2021), cryptocurrencies (Conlon et al., 2020; Goodell and Goutte, 2021), commercial banks (Çolak and Şenol, 2021; Li et al., 2020), and institutional investors (Pástor and Vorsatz, 2020; Mirza et al., 2020). All in all, there seems to be a consensus that pandemic-induced uncertainty and the associated government responses adversely impacted the quality and performance of markets and institutions.

Surprisingly, however, analysis of initial public offerings (IPOs) during the pandemic remains a largely unexplored topic. This is perhaps due to the general perception that IPOs were not as negatively impacted as the other workings of financial markets. In fact, anecdotal evidence seems to suggest that, despite the severe negative economic effects of the pandemic, the IPO market witnessed an incredible expansion. In the so-called "IPO frenzy", more than $150 billion was raised by new firms in 2020, which marks it as one of

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the best years for IPOs since the dot-com boom era in the late 1990s.[1,2] This growth was primarily driven by the record surge in high-technology and healthcare IPOs.[3,4,5] The only related academic study so far also mentions a remarkable initial performance of IPOs as the average initial return during the first half of 2020 seems to be higher in comparison to IPOs from the last four decades (Mazumder and Saha, 2021). Nevertheless, the authors also find that the initial-return performance is negatively correlated with the pandemic fear during their sample period of January 2020 to July 2020.

In this study, we attempt to comprehensively explore the dynamics of the IPO market during the entire year of 2020 and compare the characteristics of these pandemic IPOs with IPOs launched in the previous two years, i.e., 2018 and 2019. We are motivated by the peculiar perception of a positive impact of the pandemic on the IPO market and by the lack of a comprehensive academic study that analyzes IPOs during the COVID-19 period. More specifically, the objective of this study is to provide rigorous and independent empirical evidence that the IPO market during the pandemic may also be adversely impacted by the pandemic-induced information uncertainty and its associated government responses similar to the other financial markets. Both the pandemic intensity and the government policy responses contributed to uncertainty and enhanced volatility in the equity markets (Zaremba et al., 2020; Baig et al., 2021). Therefore, we expect that the IPO market experienced a similar increase in information uncertainty during the pandemic. In the context of IPOs, seminal work by Rock (1986) and Beatty and Ritter (1986) suggests that increased uncertainty should be associated with higher IPO underpricing.[6] Accordingly, we expect that IPOs during the pandemic should have more underpricing than IPOs before the pandemic. Similarly, Lowry et al. (2010) contend that volatility of initial returns is higher for IPOs with more information asymmetry and during more uncertain times (e.g., the IPO bubble period of the late 1990s). Accordingly, we also expect that IPOs during the pandemic should have higher return volatility due to increased exposure to aggregate uncertainty compared to the previous two years. Furthermore, to the extent that uncertainty enhances underpricing and return volatility, we expect IPO information uncertainty to increase with pandemic intensity and the associated government responses.

Our key results are as follows. First, consistent with the anecdotal evidence, we find that the number of IPOs in 2020 substantially exceeded that in 2018 or 2019. There was an exponential increase in firms going public during the second half of 2020, i.e., the post-market recovery period. The increase was primarily driven by high-technology and healthcare IPOs. Possible explanations could be that these firms went public as their sectors became overvalued, or that firms' demand for capital increased in these sectors, or because of high investor sentiment for firms in these sectors (Myers and Majluf, 1984; Lowry, 2003). Second, IPOs during the pandemic were generally more underpriced and more volatile as compared to those before the pandemic. Furthermore, after controlling for firms' characteristics as well as time-invariant industry effects, pandemic intensity and government restrictions such as lockdowns and stay-at-home requirements significantly contribute to IPO underpricing and volatility. This relation is robust across various types of intervention measures such as economic, health, containment, and general response, and both our IPO volatility measures. Moreover, the industry-level analysis suggests that this relation is primarily driven by technology and healthcare IPOs which seem to have the most pandemic-induced information uncertainty. Lastly, by using the propensity score matching method, we find that after the beginning of the pandemic, IPO firms have greater return volatility than existing firms. Taken together, these results suggest that during the pandemic, IPOs had more uncertainty and instability, and the IPO market was adversely affected by the COVID-19 pandemic in this regard.

Our study extends the recent pandemic-intervention related literature (e.g., Zaremba et al., 2020, 2021a; Aharon et al., 2021; Baig et al., 2021), and suggests that pandemic intensity and government interventions also adversely impacted the IPO market. These findings are also in line with studies which suggest that uncertainty related to government policies harms the stability and quality of financial markets (e.g., Pástor and Veronesi, 2012, 2013). Our findings are of importance to corporate managers who intend to take their firms public during times of high uncertainty such as the pandemic and during periods of intense policy interventions as during these times they may be leaving more money on the table. Our results are also important to policymakers who hope to understand the negative spillover effects of interventions and more generally for investors who wish to invest in IPOs during market stress conditions.

2. Data and methodology

2.1. Data

Our sample consists of 421 IPOs from January 2018 to December 2020. The sample excludes unit offerings, closed-end funds, REITs, ADRs, unit trusts, and firms that are not listed in NYSE American, NYSE, and NASDAQ. We collect the price and accounting data from COMPUSTAT and SEC EDGAR. Monthly S&P 500 level index data is from CRSP. Ages and underwriter's rankings are obtained

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[1] More details at: "https://www.marketwatch.com/story/another-rush-of-ipos-on-tap-for-2021-after-a-year-of-impressive-pandemic-offerings-11608773192"

[2] More details at: "https://www.wsj.com/articles/record-ipo-surge-set-to-roll-on-in-2021-11609324381"

[3] More details at: "https://www.wsj.com/articles/during-covid-19-pandemic-biotech-ipos-already-surpass-record-11597051800"

[4] More details at: "https://www.marketwatch.com/story/ipo-like-its-1999-market-hitting-dot-com-boom-levels-as-snowflake-and-other-cloud-software-stocks-keep-popping-2020-09-17"

[5] More details at: "https://www.wsj.com/articles/flurry-of-biotech-startups-heads-to-public-markets-11623927601"

[6] Consistent with the IPO literature, the terms underpricing, and initial returns are used interchangeably.

from Professor Jay Ritter's website.[7] COVID-19 related indexes are obtained from Oxford COVID-19 Government Response Tracker (OxCGRT).[8]

The IPO market in 2020 generally follows a similar trend as the stock market as shown in Figure 1. Table 1 presents the numbers of IPOs across Fama-French 5 industries.[9] Panel A of Table 1 shows 84 out of 157 firms that went public in 2020 are from the healthcare and drugs industry and the number of high-technology IPO firms in 2020 is the highest among the most recent three years as reported in Panel B of Table 1. Furthermore, most of the firms went public in the second half of the year. This is also evidenced by Figure 2 when we compare monthly numbers of IPOs in 2020 with those in 2018 and 2019. Panel B of Table 1 indicates that despite the pandemic in 2020, the number of IPOs is the largest in 2020 among the recent three years.

2.2. Empirical design

To test whether IPO firms going public during the COVID-19 pandemic have greater information uncertainty, we estimate the following model in Equation (1):

$$\text{InfoUncertainty}_i = \beta \text{Covid}_i + \delta' X_i + \gamma \text{FixedEffects}_i + \varepsilon \qquad (1)$$

where InfoUncertainty_i is one of the proxies for information uncertainty of an IPO firm i. Researchers frequently use underpricing (e.g., Beatty and Ritter, 1986; Rock, 1986) or post-IPO volatility (Lowry et al., 2010; Barth et al., 2017) to measure IPO information uncertainty. Following the literature, we employ three proxies for the measurement of information uncertainty: Underpricing, Volatility, and RangeVol. Underpricing is the initial return from the offering price to the closing price on the first trading date.[10] Volatility is the standard deviation of the first 30 daily returns of an IPO firm. We exclude the initial return to mitigate the effect of the large first-day return on the volatility measure. RangeVol is calculated as the natural log of the daily highest price minus the natural log of the daily lowest price (Alizadeh et al., 2002) and then averaged over the first 30 trading days after the IPO.

The focus of our tests is the coefficient on Covid. In March 2020, World Health Organization (WHO) declared COVID-19 a pandemic. Therefore, we define the variable, Covid, equal to one if the firm's offering date is after March 2020, and zero otherwise.[11] Equation (1) includes control variables relevant to the firm and offering characteristics. In particular, we control for firm asset size, R&D, tangible assets, ROA, offer size, age, venture capital dummy, and underwriter's reputation. Two-digit SIC codes classified industry fixed effects are also included in the model.

We also examine how COVID-19 related indexes affect IPOs' information uncertainty during the pandemic by estimating the following equation:

$$\text{InfoUncertainty}_i = \beta \text{Index}_i + \delta' X_i + \gamma \text{FixedEffects}_i + \varepsilon \qquad (2)$$

The regressions are estimated using the subsample of IPOs during the pandemic. Our key independent variable represents the COVID-19 intensity and intervention indexes for different specifications. The four indexes (obtained from OxCGRT) are the number of cases, the number of deaths, the stringency index, and the containment and health index.[12] For each index, we take the natural log of one plus the index and then calculate the average over the 30-day window before the offering.

2.3. Summary statistics

Table 2 reports the summary statistics of our sample separated by IPOs after the pandemic declaration ("Covid IPOs" hereafter) and IPOs before the pandemic declaration ("non-Covid IPOs" hereafter).[13] The average amount of funds (Proceeds) raised by Covid IPOs is $391 million, which is significantly larger than that of non-Covid IPOs. Besides, 38% of Covid IPOs are venture-capital-backed, which is significantly less than that of IPOs before the pandemic. Table 2 also presents the univariate comparison of the three proxies for information uncertainty. Compared with non-Covid IPOs, Covid IPOs are on average more underpriced by 23 percentage points, and

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[7] "https://site.warrington.ufl.edu/ritter/ipo-data/"

[8] "https://www.bsg.ox.ac.uk/research/research-projects/covid-19-government-response-tracker"

[9] According to the classification of Fama-Frech 5 industry, consumer industry includes firms having business related to consumer durables, consumer nondurables, wholesale, retail, and some services like laundries, or repair shops; manufacturing industry includes manufacturing, energy, and utility firms; high-technology industry includes business equipment, telephone, and television transmission firms; health industry includes healthcare, medical equipment, and drug firms; all other unmentioned firms (e.g. transportation, hotels, business services, entertainment, and finance) are included in the "Other" specification. More details of definitions can be found on Professor Kenneth French's website: "https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_5_ind_port.html".

[10] In unreported tests, we use market-adjusted underpricing for all the remaining tests of this paper. Market-adjusted underpricing is calculated as the initial return subtracted by the market return on the first trading day. We use both CSRP value-weighted daily returns and S&P 500 daily returns as the proxy for market returns. Our results are robust to both these market-adjusted underpricing measures.

[11] In January and February 2020, there are a total of 14 IPOs in our sample. Our results are qualitatively similar if they are excluded.

[12] OxCGRT provides 23 indicators of government responses based on publicly available information. The indexes record the strictness of COVID-19 policies that restrict people's behavior. The higher the index, the stricter the policies. There are two other indexes provided by OxCGRT called Government Response Index and Economic Support Index. As shown in Appendix B.1, results are consistent when using these two indexes.

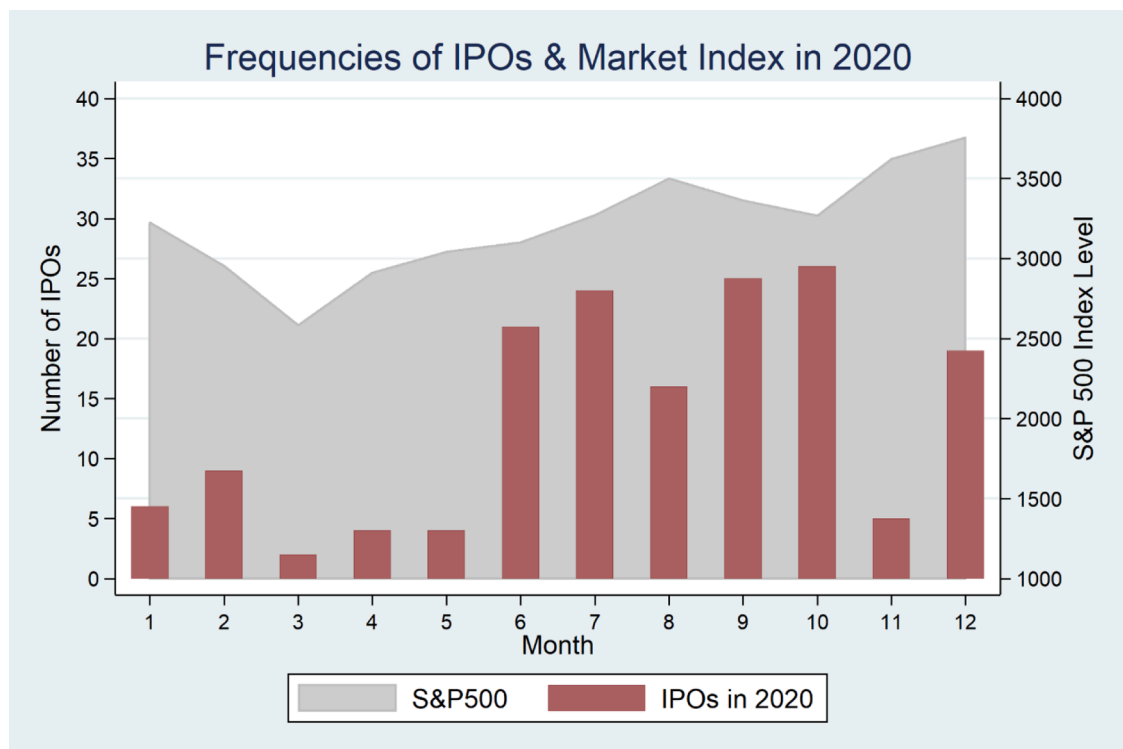[13] Variable definitions are presented in Appendix A.

Fig. 1. Frequencies of IPOs & Market Index in 2020
The red bar chart displays the numbers of IPOs in each month of the year 2020 (using the left y-axis). The gray area in the background plots the monthly S&P 500 market indexes in 2020 (using the right y-axis).

they experience more post-IPO volatility.

3. Empirical results

3.1. Main results

Table 3 presents the estimated results of Equation (1) about testing information uncertainty of Covid IPOs and non-Covid IPOs. The positive coefficients on Covid indicate that IPOs after the pandemic declaration experienced significantly greater underpricing and higher post-IPO stock volatility vis-à-vis IPOs before the pandemic. This finding indicates that IPOs during the COVID-19 pandemic faced increased information uncertainty. These results are robust after controlling for industry fixed effects.

In Table 4, we test how COVID-19 intensity and intervention indexes are related to IPO information uncertainty (see Equation (2)). The estimated results suggest that the pandemic indexes are positively associated with information uncertainty. When the severity of the pandemic increases before a company goes public, e.g., more cases and deaths, more levels of schools or workplaces closed, or stricter travel controls, the information uncertainty of the offering increases on average. The results are consistent across all of our information uncertainty proxies.

3.2. Industry-level analyses

In this section, we carry out an industry-level analysis to explore if certain sectors experience a greater increase in information uncertainty during the pandemic. Our analyses are based on Fama-French 5 industry classifications. Table 5 shows the industry-level comparisons of underpricing and volatility measures between Covid IPOs and non-Covid IPOs. Panel A of Table 5 reports the univariate comparison in their mean values. In Panel B, we re-run the regressions in Equation (1) across the IPOs within each of the five industries. Noticeably, in the high-technology sector (HiTech), firms experience more underpricing and larger post-IPO volatility after the COVID-19. In the healthcare industry (Health), newly issued firms during the pandemic have a significantly higher average initial return.

Table 1

Numbers of IPOs across Industries

This table shows the numbers of IPOs in each of the Fama-French 5 industries. Panel A includes the frequencies of IPOs in each month of 2020. Panel B presents the numbers of IPOs each year. According to Fama-French 5 industry definitions, the Consumer industry includes firms having business related to consumer durables, consumer nondurables, wholesale, retail, and some services like laundries, or repair shops; the Manufacturing includes manufacturing, energy, and utility firms; the HiTech includes business equipment, telephone, and television transmission firms; the Health includes healthcare, medical equipment, and drug firms; all other unmentioned firms are included in the Other category.

Panel A: Numbers of IPOs classified by industries and months in 2020						
Month	Industry					
	Consumer	Manufacturing	HiTech	Health	Other	Total
January	0	1	0	4	1	6
February	2	0	2	3	1	8
March	0	0	0	1	0	1
April	0	0	0	4	0	4
May	0	0	0	3	1	4
June	2	0	4	13	2	21
July	2	0	5	11	6	24
August	1	0	4	8	3	16
September	2	1	8	10	3	24
October	2	0	5	18	1	26
November	0	1	3	1	0	5
December	2	1	5	8	2	18
Total	13	4	36	84	20	157

Panel B: Numbers of IPOs classified by industries and months				
Industry	IPO Year			
	2018	2019	2020	Total
Consumer	8	11	13	32
Manufacturing	9	4	4	17
HiTech	29	29	36	94
Health	69	60	84	213
Other	28	17	20	65
Total	143	121	157	421
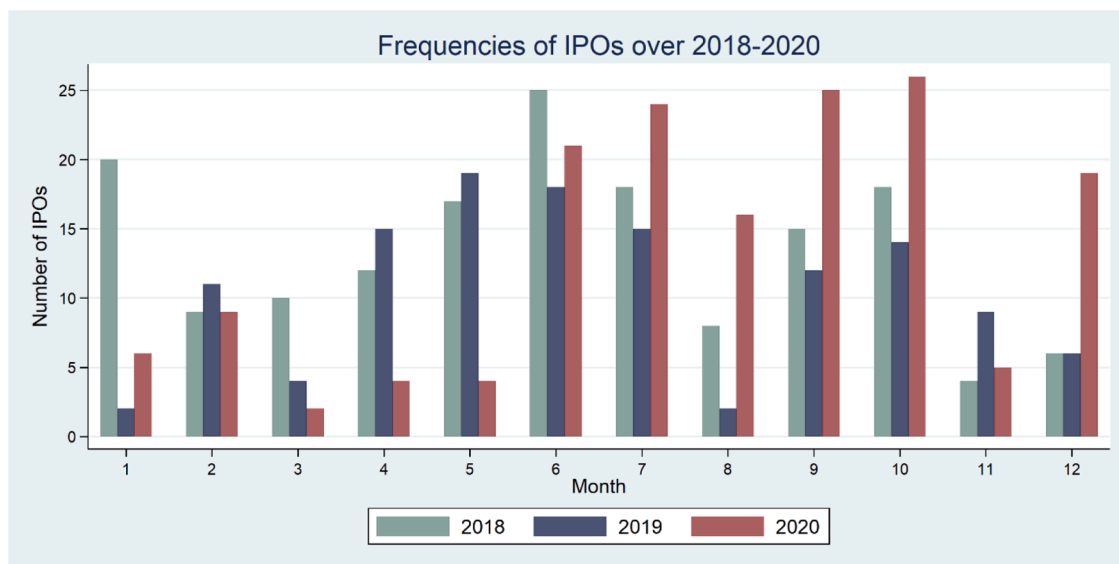
Fig. 2. Frequencies of IPOs over 2018-2020

This graph displays the numbers of IPOs in each month of each year from 2018 to 2020.

Table 2

Summary Statistics

This table presents the summary statistics of the variables. The entire sample includes 421 IPOs from January 2018 to December 2020. The sample is divided into two groups of IPOs: one group includes 143 firms going public after March 2020 named Covid IPOs (where Covid=1), and the other group includes 278 firms going public named non-Covid IPOs before March 2020 (where Covid=0). Assets is the total assets in millions. R&D is the research and development expense scaled by total assets. Tangible is the property, plant, and equipment assets scaled by total assets. ROA is the net income divided by total assets. All accounting information is from the most recent financial statements before the IPO. Proceeds is the total amount of funds in millions that the IPO firm raised in the offering. Age is the IPO year minus the founding year. Venture is a dummy variable that equals one if the offering is venture-capital-backed. Reputation is the Carter and Manaster (1990) ranking of the lead underwriters, ranging from zero of the lowest reputation to nine of the highest reputation. Underpricing is the return from the offer price to the first trading close price. Volatility is the standard deviation of the first 30 daily returns after the IPO. RangeVol is the average difference between the natural log of the daily highest price and the natural log of the daily lowest price in the first 30 trading days after the IPO. LnCase (LnDeath) is the average natural log of the confirmed cases (confirmed deaths) plus one over the 30-day window before the IPO. LnStringency is the average natural log of the stringency index plus one in 30 days before the IPO. LnConHealth is the average natural log of the containment health index plus one in 30 days before the IPO. The last column shows the differences in mean values. ***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	Covid IPOs (N=143)					Non-Covid IPOs (N=278)					Difference in Mean
	Mean	Std	p25	Median	p75	Mean	Std	p25	Median	p75	
Assets	1084.14	3353.69	33.75	102.69	479.72	1631.79	14255.51	41.44	119.49	555.19	–547.653
R&D	1.74	10.06	0.01	0.18	0.57	0.33	0.71	0.00	0.15	0.35	1.409**
Tangible	0.12	0.13	0.02	0.07	0.17	0.11	0.18	0.01	0.04	0.13	0.004
ROA	–2.71	16.57	–0.76	–0.26	–0.02	–0.64	2.25	–0.53	–0.22	0.00	–2.073**
Proceeds	391.10	589.15	100.80	204.00	352.90	275.36	621.24	69.60	108.00	229.60	115.739*
Age	16.06	21.17	5.00	9.00	17.00	15.32	22.16	5.00	10.00	16.00	0.739
Venture	0.38	0.49	0.00	0.00	1.00	0.54	0.50	0.00	1.00	1.00	–0.166***
Reputation	8.15	1.62	8.00	9.00	9.00	7.94	1.80	7.50	9.00	9.00	0.212
Underpricing	0.43	0.55	0.00	0.28	0.66	0.20	0.32	0.00	0.13	0.36	0.229***
Volatility	0.06	0.03	0.04	0.05	0.06	0.05	0.03	0.03	0.04	0.06	0.008**
RangeVol	0.09	0.03	0.07	0.09	0.10	0.08	0.03	0.05	0.07	0.10	0.011***
LnCase	15.15	1.41	14.77	15.60	15.79	-	-	-	-	-	-
LnDeath	11.80	1.26	11.75	12.11	12.24	-	-	-	-	-	-
LnStringency	4.22	0.18	4.19	4.23	4.28	-	-	-	-	-	-
LnConHealth	4.17	0.14	4.17	4.19	4.21	-	-	-	-	-	-

Collectively, high-technology and healthcare firms seem to have greater information uncertainty compared to firms from other industries.[14]

3.3. IPO firms vs. existing firms during the pandemic

In this section, we test whether newly issued firms experience more uncertainty compared to existing firms during the pandemic. Using the propensity score matching method[15], we match each IPO firm after the pandemic with an existing firm and then compare their stock volatility. The estimated results are reported in Appendix B.2. Panel A summarizes the matching variables and insignificant differences in the mean values suggest that our matching procedure is proper. Panel B presents the regression results. We find that compared with existing matched firms during the pandemic, stocks of IPO firms are significantly more volatile.

Our paper extends the study of Mazumder and Saha (2021) and shows that pandemic adversely impacted the overall information uncertainty of IPOs as measured by their underpricing and volatility and this effect was enhanced by the pandemic intensity and government interventions. Moreover, using an extended dataset, we also show that the enhanced information uncertainty was driven by the HealthCare and Technology sectors.

4. Conclusion

In this paper, we explore the impact of the COVID-19 pandemic on the IPO market. Although recent anecdotal evidence suggests that there was a so-called "IPO frenzy" in 2020, thereby hinting at a positive impact on the IPO market during the pandemic. We find that while the number of IPOs is indeed higher in 2020, the IPOs during the pandemic have greater information uncertainty compared

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[14] The relatively small sample sizes of IPOs in Consumer and Manufacturing industries make it difficult to interpret the results in these two industries.

[15] We first run the logit regression of *Covid* on the accounting control variables that we use in Equation (1) (i.e., *LnAssets, R&D, Tangible*, and *ROA*) in addition to *MktCap* which is calculated as the fiscal year-end market capitalization for an existing firm or the proceeds from the offering for an IPO firm. These matching variables are based on the 2019 fiscal year-end financial statement data. Each IPO firm is matched with an existing firm having the closest propensity score without replacement and in the same two-digit SIC industry. Eventually, the propensity-score matched sample contains 140 Covid IPO firms and 140 matched existing firms. The volatility measures (i.e., *Volatility* and *RangeVol*) of an existing firm's stock are calculated over the same trading days as its matched IPO firm.

Table 3

Impact of COVID-19 on IPO Information Uncertainty

This table shows the estimated effect of the COVID-19 on the post-IPO information uncertainty in Equation (1). We use three proxies for information uncertainty as to the dependent variable: Underpricing, Volatility, and RangeVol. The key independent variable is the Covid which equals one if the firm goes public after March 2020 and zero otherwise. Definitions of all variables are provided in Appendix A. Columns (2), (4), and (6) present regression results with controlling for industry fixed effects as classified by two-digit SIC codes. All standard errors are robust. The t-statistics are shown in parentheses. ***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	(1) Underpricing	(2) Underpricing	(3) Volatility	(4) Volatility	(5) RangeVol	(6) RangeVol
Covid	0.240***	0.225***	0.010***	0.011***	0.013***	0.010***
	(4.68)	(4.34)	(2.70)	(2.60)	(4.62)	(3.70)
LnAssets	–0.016	–0.012	–0.003*	–0.002	–0.006***	–0.004***
	(–1.20)	(–0.63)	(–1.94)	(–1.57)	(–6.15)	(–3.31)
R&D	0.006	0.009	–0.000	–0.000	–0.001	–0.000
	(0.63)	(0.79)	(–1.04)	(–1.01)	(–1.34)	(–1.30)
Tangible	0.040	0.135	0.011	0.011	0.007	0.007
	(0.33)	(0.62)	(1.38)	(1.04)	(0.89)	(0.58)
ROA	0.007	0.008	0.000	–0.000	0.000	–0.000
	(1.26)	(1.22)	(0.04)	(–0.17)	(0.11)	(–0.20)
Proceeds	0.000	0.000	0.000	0.000	0.000	–0.000
	(0.77)	(0.51)	(1.34)	(0.96)	(1.15)	(–0.09)
LnAge	0.021	–0.017	–0.003	–0.004	–0.004**	–0.007***
	(0.93)	(–0.63)	(–1.61)	(–1.63)	(–2.10)	(–3.45)
Venture	0.126***	0.110**	0.005	0.006*	0.009***	0.006*
	(2.83)	(2.01)	(1.51)	(1.79)	(2.88)	(1.81)
Reputation	0.027	0.020	–0.004***	–0.004***	–0.002	–0.002*
	(1.56)	(0.91)	(–2.70)	(–2.73)	(–1.58)	(–1.69)
Constant	–0.066	0.069	0.094***	0.089***	0.126***	0.126***
	(–0.47)	(0.42)	(6.54)	(6.55)	(10.46)	(11.23)
N	421	421	421	421	421	421
R-squared	0.11	0.20	0.13	0.30	0.30	0.47
Industry FE	No	Yes	No	Yes	No	Yes

Table 4

Information Uncertainty and Covid Indexes

This table presents the estimated results in Equation (2) using the subsample of 143 Covid IPOs. We use three proxies for information uncertainty as to the dependent variable: Underpricing, Volatility, and RangeVol. The key independent variable is one of the COVID-19 related indexes before the offering: LnCase, LnDeath, LnStringency, and LnConHealth. Definitions of variables are provided in Appendix A. Two-digit SIC industry fixed effects are included, and standard errors are clustered by industries. The t-statistics are shown in parentheses. ***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	(1) Underpricing	(2) Volatility	(3) RangeVol	(4) Underpricing	(5) Volatility	(6) RangeVol	(7) Underpricing	(8) Volatility	(9) RangeVol	(10) Underpricing	(11) Volatility	(12) RangeVol
LnCase	0.031**	0.003***	0.002***									
	(2.22)	(5.01)	(4.53)									
LnDeath				0.035**	0.003***	0.003***						
				(2.53)	(6.58)	(8.40)						
LnStringency							0.409**	0.017***	0.020***			
							(2.45)	(6.17)	(9.20)			
LnConHealth										0.491**	0.024***	0.027***
										(2.52)	(7.64)	(11.88)
LnAssets	−0.006	−0.001	−0.002	−0.007	−0.002	−0.002	−0.008	−0.002	−0.002	−0.008	−0.002	−0.002
	(−0.17)	(−0.84)	(−1.06)	(−0.23)	(−0.97)	(−1.16)	(−0.26)	(−1.07)	(−1.25)	(−0.24)	(−1.04)	(−1.22)
R&D	0.007***	−0.000**	−0.000**	0.006***	−0.001**	−0.000**	0.007***	−0.000**	−0.000**	0.007***	−0.000**	−0.000**
	(4.40)	(−2.37)	(−2.22)	(4.30)	(−2.50)	(−2.41)	(5.31)	(−2.35)	(−2.26)	(5.14)	(−2.38)	(−2.28)
Tangible	0.901**	0.015	0.011	0.903**	0.016	0.011	0.877**	0.016	0.011	0.878**	0.016	0.010
	(2.48)	(1.00)	(0.70)	(2.43)	(1.09)	(0.74)	(2.38)	(1.18)	(0.73)	(2.36)	(1.15)	(0.72)
ROA	0.006***	−0.000***	−0.000***	0.005***	−0.000***	−0.000***	0.006***	−0.000***	−0.000***	0.006***	−0.000***	−0.000***
	(8.66)	(−4.86)	(−9.37)	(7.44)	(−4.87)	(−9.77)	(6.09)	(−4.08)	(−8.88)	(6.36)	(−4.21)	(−9.05)
Proceeds	0.000	−0.000	−0.000*	0.000	−0.000	−0.000*	0.000	−0.000	−0.000*	0.000	−0.000	−0.000*
	(1.25)	(−0.38)	(−1.76)	(1.25)	(−0.32)	(−1.76)	(1.25)	(−0.28)	(−1.78)	(1.25)	(−0.29)	(−1.79)
LnAge	−0.071	−0.001	−0.010***	−0.073	−0.001	−0.011***	−0.078	−0.002	−0.011***	−0.077	−0.002	−0.011***
	(−1.01)	(−0.16)	(−5.52)	(−1.04)	(−0.18)	(−5.78)	(−1.10)	(−0.21)	(−6.48)	(−1.09)	(−0.21)	(−6.35)
Venture	0.131	0.003	0.002	0.133	0.003	0.003	0.138	0.003	0.003	0.139	0.003	0.003
	(0.91)	(0.58)	(0.77)	(0.91)	(0.60)	(0.82)	(0.95)	(0.58)	(0.83)	(0.96)	(0.61)	(0.87)
Reputation	−0.002	−0.001	0.000	−0.001	−0.001	0.000	0.000	−0.001	0.000	−0.000	−0.001	0.000
	(−0.13)	(−0.48)	(0.00)	(−0.07)	(−0.43)	(0.08)	(0.02)	(−0.44)	(0.10)	(−0.01)	(−0.44)	(0.09)
Constant	−0.014	0.022	0.088***	0.047	0.034	0.094***	−1.259*	−0.002	0.039*	−1.587**	−0.030	0.014
	(−0.03)	(0.64)	(3.77)	(0.16)	(1.09)	(4.63)	(−2.02)	(−0.08)	(1.92)	(−2.14)	(−1.12)	(0.71)
N	143	143	143	143	143	143	143	143	143	143	143	143
R-squared	0.20	0.30	0.42	0.20	0.29	0.42	0.22	0.29	0.42	0.21	0.29	0.42
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5

Industry-Level Analyses

Panel A shows the mean Underpricing, Volatility, and RangeVol of Covid IPOs and non-Covid IPOs within each of the Fama-French 5 industries, along with the differences in mean values with stars from paired t-tests. Panel B presents the results from the regression in Equation (1) within each of the Fama-French 5 industries. Standard errors are robust. The t-statistics are shown in parentheses. Definitions of variables are provided in Appendix A. ***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

Panel A: Univariate Comparison										
Industry	N		Underpricing			Volatility			RangeVol		
	Covid = 1	Covid = 0	Covid = 1	Covid = 0	Difference	Covid = 1	Covid = 0	Difference	Covid = 1	Covid = 0	Difference
Consumer	11	21	0.314	0.291	0.023	0.047	0.057	–0.010	0.077	0.083	–0.006
Manufacturing	3	14	0.658	0.042	0.616**	0.050	0.057	–0.007	0.096	0.067	0.029
HiTech	34	60	0.562	0.339	0.223**	0.056	0.044	0.012**	0.088	0.071	0.017***
Health	77	136	0.420	0.189	0.231***	0.054	0.053	0.001	0.093	0.090	0.003
Other	18	47	0.244	0.057	0.187***	0.064	0.030	0.034***	0.076	0.050	0.026***

Panel B: Regression within Each Industry															
	Consumer			Manufacturing			HiTech			Health			Other		
	Underpricing	Volatility	RangeVol	Underpricing	Volatility	RangeVol	Underpricing	Volatility	RangeVol	Underpricing	Volatility	RangeVol	Underpricing	Volatility	RangeVol
Covid	–0.094	0.002	0.007	0.442	0.003	0.032***	0.307***	0.016***	0.021***	0.206***	0.003	0.005	0.105	0.035	0.022***
	(–0.77)	(0.18)	(0.63)	(1.13)	(0.82)	(7.62)	(2.75)	(3.41)	(4.38)	(3.05)	(0.83)	(1.21)	(1.47)	(1.50)	(2.88)
LnAssets	–0.135***	–0.004	–0.006	–0.172	–0.003***	–0.007***	0.015	0.000	–0.004	0.002	0.000	–0.002	–0.030*	–0.002	–0.009***
	(–3.14)	(–0.83)	(–1.14)	(–1.39)	(–3.92)	(–9.98)	(0.27)	(0.03)	(–1.30)	(0.08)	(0.02)	(–1.21)	(–1.72)	(–0.33)	(–3.45)
R&D	–2.154	–0.006	–0.049	–3.650	0.269***	0.089	0.564	0.040*	0.009	0.006	–0.000	–0.000	7.017**	0.042	0.523*
	(–1.67)	(–0.45)	(–0.45)	(–1.00)	(4.86)	(1.70)	(1.17)	(1.77)	(0.57)	(0.56)	(–1.46)	(–1.55)	(2.66)	(0.20)	(1.91)
Tangible	0.153	–0.031	–0.045	–0.528	–0.019*	–0.007	–0.081	0.032*	0.053***	0.275	0.022	–0.001	–0.132	0.014*	0.024***
	(0.60)	(–0.88)	(–1.13)	(–0.67)	(–2.22)	(–0.48)	(–0.22)	(1.89)	(3.54)	(0.98)	(1.50)	(–0.07)	(–1.64)	(1.78)	(2.75)
ROA	0.329	–0.009	–0.000	–0.863	–0.023	–0.023	0.089**	0.011**	0.003	0.006	–0.000	–0.000	0.116	–0.001	0.010
	(1.11)	(–0.24)	(–0.00)	(–0.88)	(–1.59)	(–1.65)	(2.03)	(2.55)	(1.14)	(0.96)	(–1.20)	(–0.97)	(1.35)	(–0.10)	(0.88)
Proceeds	0.000	–0.000	–0.000	0.000	–0.000	0.000	0.000	0.000	–0.000	0.000	–0.000	–0.000	–0.000*	0.000	0.000
	(1.14)	(–0.76)	(–0.73)	(0.43)	(–0.75)	(1.86)	(0.28)	(0.23)	(–0.83)	(1.25)	(–0.29)	(–0.38)	(–1.67)	(0.95)	(0.07)
LnAge	0.065	–0.008	–0.009	–0.025	0.001	0.000	–0.139**	–0.007	–0.006	0.047	–0.003	–0.005*	0.007	–0.001	0.004
	(1.09)	(–0.97)	(–1.04)	(–0.24)	(0.52)	(0.27)	(–2.05)	(–1.51)	(–1.30)	(1.08)	(–1.05)	(–1.73)	(0.32)	(–0.15)	(1.02)
Venture	0.548	0.017	0.023	0.584**	0.019***	0.039***	0.300***	0.003	–0.003	–0.008	0.002	0.004	0.024	0.004	0.016
	(1.32)	(0.57)	(0.83)	(2.86)	(5.59)	(13.54)	(2.90)	(0.52)	(–0.57)	(–0.11)	(0.52)	(0.91)	(0.16)	(0.34)	(1.33)
Reputation	0.070*	–0.003	–0.002	0.196	–0.005***	–0.004**	0.034	–0.009**	–0.001	0.002	–0.003	–0.001	0.066***	–0.003	–0.003
	(1.81)	(–0.55)	(–0.43)	(1.72)	(–5.37)	(–2.93)	(0.78)	(–2.58)	(–1.58)	(0.08)	(–1.45)	(–0.55)	(3.80)	(–1.44)	(–0.93)
Constant	0.248	0.129***	0.167***	–0.254	0.101***	0.123***	0.106	0.128***	0.142***	0.022	0.077***	0.111***	–0.249***	0.066***	0.111***
	(1.58)	(2.85)	(4.19)	(–0.60)	(15.79)	(20.76)	(0.33)	(3.99)	(7.15)	(0.08)	(4.66)	(6.47)	(–2.87)	(2.99)	(4.47)
N	32	32	32	17	17	17	94	94	94	213	213	213	65	65	65
R-squared	0.41	0.39	0.46	0.66	0.98	0.99	0.34	0.43	0.50	0.10	0.05	0.05	0.44	0.15	0.54

to those before the pandemic. We further find that this enhanced uncertainty is primarily driven by the IPOs from the high-technology and healthcare sectors. We also examine the association between IPO information uncertainty and COVID-19 related indexes that capture various aspects of pandemic intensity and government interventions. Our results suggest that as the pandemic increases in severity before an offering, the IPO firm experiences greater underpricing and more post-offering return volatility on average. In further robustness tests, we utilize a propensity-matched sample and show that, compared with existing firms in the same period, stocks of IPOs during the pandemic are more volatile. Overall, this study provides a comprehensive analysis of information uncertainty in the IPO market during the pandemic period, and our findings suggest that the COVID-19 pandemic did not necessarily have a positive impact on the IPO market. One of the limitations of our study is that we do not analyze the long-run performance of the pandemic IPOs. Ritter (1991) suggests that IPOs during high volume years i.e., during the so-called "windows of opportunity" perform poorly in the long run. Accordingly, we expect the "frenzy" IPOs to underperform in the long run. We leave this topic for future research.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.frl.2021.102372.

Appendix A. Variable Definitions

Variable	Definition
Age	The IPO year minus the founding year.
Assets	Total assets (Computstat item: AT) of a firm at the end of the last year before the IPO (in millions).
Covid	An indicator variable which equals one if the IPO date is after March 2020 and zero otherwise.
LnAge	Natural log of the sum of one and a firm's age which is equal to the IPO year minus the founding year.
LnAssets	Natural log of total assets (Computstat item: AT) of a firm at the end of the last year before the IPO.
LnCase	The average natural log of one plus the confirmed cases over the 30-day window before the IPO.
LnConHealth	The average natural log of one plus the containment health index over the 30-day window before the IPO.
LnDeath	The average natural log of one plus the confirmed deaths over the 30-day window before the IPO.
LnEconSupport	The average natural log of one plus the economic support index over the 30-day window before the IPO.
LnGovResponse	The average natural log of one plus the government response index over the 30-day window before the IPO.
LnStringency	The average natural log of one plus the stringency index over the 30-day window before the IPO.
MktCap	The fiscal year-end market capitalization (Item PRCC_F × Item CSHO) if it is an existing firm or the proceeds from the offering if it is an IPO firm
NewFirm	An indicator variable which equals one if it is an IPO firm and zero otherwise.
Proceeds	The total amount of funds that the IPO firm raised in the offering (in millions).
R&D	Research and development expenses (Computstat item: XRD) scaled by total assets (Computstat item: AT) at the end of the last year before the IPO.
RangeVol	The natural log of the daily highest price minus the natural log of the daily lowest price for each stock averaged over the first 30 trading days after the IPO.
Reputation	The Carter and Manaster (1990) ranking of the lead underwriters, ranging from zero of the lowest reputation to nine of the highest reputation.
ROA	Net income (Computstat item: NI) divided by total assets (Computstat item: AT) at the end of the last year before the IPO.
Tangible	Tangible assets, i.e., property, plant, and equipment (Compustat item: PPENT) scaled by total assets (Computstat item: AT) at the end of the last year before the IPO.
Underpricing	The return from the offer price to the first closing price.
Venture	An indicator variable which equals one if the IPO firm is venture-backed and zero otherwise.
Volatility	The standard deviation of the first 30 daily returns after the IPO. The initial return on the first trading day from the offer price is excluded.

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