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Geographic connections to China and insider trading at the start of the COVID-19 pandemic

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Abstract

The sudden and exogenous nature of the COVID-19 crash provides a unique identification opportunity to study insiders' informational advantages. We find that the sales of insiders at firms with connections to China were significantly more profitable during the COVID-19 crisis than the sales of insiders at firms without connections to China. Consistent with greater attentiveness to public information about the COVID-19 pandemic, this result is driven by China connected insiders executing larger (smaller) sales in the early (late) COVID-19 period than non–China connected insiders. We find our results are driven by trades that are not preplanned under Rule 10b5–1 and are consistent with anticipation of the systematic market effects of COVID-19 on an insider's firm as opposed to firm-specific effects. Aggregate China connected insider trades also predict market returns during the COVID-19 period. Our study contributes to the insider trading literature by introducing geographic connection to market-wide information as a source of public information advantage and to regulatory efforts to investigate and understand corporate insider behavior related to the COVID-19 pandemic.

Keywords Insider trading · China operations · Pandemic · COVID-19

JEL classification G14 · G01 · G30 · D80

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1 Introduction

The trades of corporate insiders often generate significant abnormal returns, attracting intense public and media scrutiny, allegations of criminal behavior, and the attention of regulatory bodies. Both the Securities and Exchange Commission (SEC) and the Department of Justice (DOJ) have signaled their intention to investigate potential illegal insider trades made during the COVID-19 pandemic.[1] Importantly though, only trades based on material nonpublic information are illegal under the Securities and Exchange Acts of 1933 and 1934, making the source of information upon which an insider's trades are based a crucial aspect of any investigation. Most studies that focus on the source of information precipitating insider trades examine information that is private in nature, arising from an insider's position within their own firm or from their social, industry, or political networks (e.g., Ahern 2017; Goergen et al. 2019; Jagolinzer et al. 2020). Much less, however, is known about insiders' ability to process and profit from publicly available information ahead of market participants. We introduce geographic connection to the origin of an exogenous stock market crash as a potential public information advantage for insiders.

The COVID-19 pandemic, believed to have originated in Wuhan, China, in late 2019, precipitated a sudden and unexpected global stock market crash. Initial reports from China suggested that COVID-19 was unlikely to affect areas outside of Wuhan's borders. Despite a growing number of confirmed cases and deaths in China in the early weeks of February 2020, reports of stabilized infection rates and optimism among US investors yielded record high closings of the NASDAQ Composite and the S&P 500 indices on February 19, 2020. Five days later, with announcements of COVID-19 outbreaks in South Korea, Italy, and Iran, the S&P 500 fell 3.3%. By mid-March 2020, COVID-19 was deemed a pandemic, and much of the world was placed on, or faced the prospect of, near total lockdown. The halt to global economic activity resulted in a 30% market decline, the fastest fall in worldwide financial markets in history.

We examine whether corporate insiders with a geographic connection to the pandemic's early stages were better able to anticipate the effects of COVID-19 on their firm's stock price. The COVID-19 outbreak was initially characterized by a lack of transparency from the Chinese government until the announcement, in late January 2020, that the virus could be passed between people. Wuhan and several other cities within the province were subsequently placed under immediate lockdown.[2] Although US financial markets reacted to the virus's effects on global supply and demand chains, the reaction did not occur until roughly one month after Wuhan's lockdown and public announcements about the virus's existence.

We posit that insiders of firms with operations, production, or supply-chain activities in China ("China connected insiders") were better able to incorporate and act upon public information related to the COVID-19 outbreak ahead of other equity market

[1] On March 16, 2020, Attorney General William Barr instructed the DOJ to remain vigilant in its detection, investigation, and prosecution efforts related to the pandemic and instructed all US attorneys' offices to prioritize a focus on criminal activities related to the pandemic. On March 23, 2020, the codirectors of the SEC made a public statement emphasizing the importance of market integrity and corporate controls and procedures throughout the pandemic. A summary of these announcements in the context of insider trading may be found here: https://www.thompsonhine.com/publications/insider-trading-compliance-during-covid-19-pandemic.

[2] See https://apnews.com/68a9e1b91de4ffc166acd6012d82c2f9 for further discussion of the information flow, or lack thereof, from official Chinese sources in the early stages of the pandemic.

participants without geographic connection to the pandemic's origins ("non–China connected insiders"). Our expectation is based on the view that China connected insiders were more attuned to the ramifications of COVID-19 on future firm performance and operational disruptions, given that they had relatively more China-specific knowledge and expertise and increased exposure to public information disseminated within China about the virus. Importantly, we do not suggest that China connected insiders possessed and illegally traded upon material nonpublic information about COVID-19. Rather, we posit that China connected insiders were more attentive to and better understood the implications of COVID-19's spread due to the geographic connections of their firm to the initial outbreak.[3]

China connected insiders could observe the virus's toll on municipal and corporate infrastructure, operations, and supply and demand before its eventual spread outside of China. Further, China connected insiders were also better positioned to understand the broader economic implications of the complete lockdown of Wuhan, a transportation hub so large and vital that its disruption significantly affected supply chains originating *anywhere* in China and ending in the US. The shutdown of Wuhan is analogous to a sudden and complete closure of FedEx and UPS domestic operations, which would yield unfathomable supply chain and economic disruptions both in the US and globally.[4] We confirm this expectation by first documenting that COVID-related disclosures by China connected firms occurred much sooner in the pandemic than disclosures by non–China connected firms and that these disclosures precede media and public interest in COVID-19 by approximately one month.

We identify a firm's China connection in three ways, two of which use text-based data developed in Hoberg and Moon (2017) to capture whether a firm purchases inputs from, or sells outputs to, China. We first consider an insider to be China connected if the Hoberg and Moon (2017) data indicates an above median number of mentions of output or input words in proximity to the word "China" in their firm's 10-K. Second, we use the number of mentions of outputs to or inputs from China to capture the intensity of an insider's geographic connection to China. Finally, we consider an insider to have a China connection if their firm discloses a segment in China.

We expect that China connected insiders' awareness of the potential economic severity of COVID-19 began as early as mid-January 2020. To examine whether insiders profited from this awareness, we compare the 30-trading-day raw stock returns following insider sales and sales volume during the COVID-19 crisis to those in a pre-COVID-19 period for both China and non–China connected insiders.[5] We focus only

[3] We view attentiveness gained from geographic connection as one facet of insiders' overall informational advantage. Our arguments are consistent with Alldredge and Cicero (2015), who find that insiders can profit from public financial statement disclosures made by their firm's customers when other investors are inattentive.

[4] A description of Wuhan's significance as a transportation hub and its effect on supply chains originating throughout China can be found here: https://www.scmp.com/economy/china-economy/article/3047426/explained-why-wuhan-so-important-chinas-economy-and-potential.

[5] We measure the profitability of insider sales using raw buy-and-hold returns because we expect COVID-19's effect to be primarily systematic in nature. Further, the use of market-adjusted returns is often based on the implicit assumption that the insider sells their firm's stock for diversification purposes and reinvests the proceeds into the market, which is unlikely to occur in anticipation of a market-wide disruption. However, it is possible that insiders reinvested their proceeds in the market; thus, our profitability analysis may be interpreted as an upper bound of the effects of China connections on COVID-related informed trading.

on sales in anticipation of the stock market crash because of its sudden, exogenous nature.[6] During the pre-COVID-19 period, we find the pattern of returns around insider sales is similar for China and non–China connected insiders, with both exhibiting sales that follow price increases and precede periods of relatively flat returns. In the COVID-19 period, however, non–China connected insiders appear to sell *after* their firm's share price begins to decline, while the sales of China connected insiders are better timed to *precede* larger forthcoming price declines.

In a multivariate difference-in-difference framework, we find robust evidence that sales made by China connected insiders during the COVID-19 period were three to five percentage points more profitable, as they avoided significantly larger price decreases in the 30 trading days following their sales. The economic significance of our result is large, as we estimate the mean profit per sale for China connected insiders increased from a $14,000 loss in the pre-COVID-19 period to a $251,000 profit in the COVID-19 period. By contrast, the mean profit per sale for non–China connected insiders increased from an $8,000 loss in the pre-COVID-19 period to a $160,000 profit. Thus, the profitability of China connected insider sales increased by approximately 58% more than that of non–China connected insiders.

We also examine the extent and timing of insider trading to understand the nature of insiders' underlying selling behavior. We find that the overall change in the number and dollar volume of weekly insider sales at the firm level from the pre-COVID-19 period to the COVID-19 period is not statistically different for China and non–China connected insiders. However, when we partition the COVID-19 period into "early COVID-19" and "late COVID-19" periods, we find that China connected insiders executed a relatively lower (higher) number and dollar volume of sales in the late (early) COVID-19 period than non–China connected insiders. This finding is consistent with the incremental profitability of China connected insider sales being driven by an intertemporal shift of sales within the COVID-19 period, where China connected insider sales better preempt price declines than the sales by non–China connected insiders. In economic terms, we find that the China connected insiders in our sample avoided approximately $375 million in aggregate losses by selling stock before the initial stages of the COVID-19-induced market decline.

Insider sales often occur because the insider expects a decline in their own firm's stock price resulting from any factor that may affect the stock price, whether firm-specific or macroeconomic in nature (Seyhun 1988; Brochet 2018). Our primary results, therefore, have two possible explanations. First, it is possible that COVID-19 had an idiosyncratic effect on China connected firms and that their insiders anticipated this effect. Alternatively, the trades of China insiders anticipated a systematic COVID-19 effect on their firm.[7] We therefore compare the cumulative returns of firms with and without China connections and find they are nearly identical in the COVID-19 period, providing ex post evidence that COVID-19 did not differentially affect the stock prices

[6] In other words, the catalyst for the stock market crash is clear and identifiable, as is the window in which insiders could possess an information advantage. We do not examine insider activity as the stock market recovered because it was gradual and characterized by significant uncertainty about *why* it recovered.

[7] We do not suggest that we can identify whether the insider *knows* the information is idiosyncratic or systematic in nature. Rather, our tests are intended to identify whether the insider trading behavior we document is based on information not yet incorporated into the returns of only China connected firms or the overall market return.

of China connected firms. Next, we separate insiders' raw 30-day buy-and-hold returns into their systematic (i.e., market returns) and idiosyncratic (i.e., market-adjusted returns) components and find that our main result is concentrated in the systematic component of returns. We also perform a market-level analysis where we regress future market returns on aggregate China connected insider sales and find that aggregate sales by China connected insiders are associated with negative market-wide stock performance two, three, and four weeks later. Our results are consistent with China connected insiders anticipating declines in their firm's stock that were driven by the systematic effects of COVID-19 ahead of other market participants.[8]

In further analysis, we partition our sample on whether a trade was executed pursuant to an SEC Rule 10b5–1 trading plan, because these trades are preplanned and less likely to be due to an information advantage at the time of the trade. Consistent with strategic informed trading on the part of China connected insiders, we find that our profitability results are found *only* in the subset of non-10b5–1 trades. Finally, we confirm the robustness of our results to alternative specifications, such as matching on the 30-day pre-trade return of the insider's firm, dropping sales at firms in the medical supply industry, examining purchases, controlling for recent earnings announcements, altering the length and dates of the COVID-19 and pre-COVID-19 periods, understanding whether insider trades precede or follow analysts' revisions, and using month and year fixed effects.

Our study has four key contributions. First, we inform the SEC's current efforts to investigate and understand corporate insider behavior during the COVID-19 pandemic. By documenting that geographic connection to the source of market volatility is one way in which corporate insiders gain an information advantage over other market participants, we provide important insight into how to focus regulatory resources when investigating insider trading. While geographic connections have previously been examined in academic literature as a source of information advantage for institutional investors (Baik et al. 2010; Kang et al. 2021), mutual funds (Coval and Moskowitz 2001), or retail investors (Chi and Shanthikumar 2017; Ivkovic and Weisbenner 2005), geography has not been documented as a source of an insider's information advantage. Our results are consistent with China connected insiders anticipating declines in their firm's stock that were driven by the systematic effects of COVID-19 ahead of other market participants, indicating that China connected insiders were not acting on inherently private information but were more attentive to and better able to process public information about the overall market effects of COVID-19.

Second, our finding that Rule 10b5–1 trading plans limited the ability of insiders to opportunistically profit from their trades should be of interest to the SEC as it works to revise the rules governing Rule 10b5–1 plans. The SEC is currently working to modify

[8] One potential implication of this result is that China connected insiders were better positioned to anticipate the broader market decline and would also sell other stock that they held in their personal investment portfolios. Such an analysis cannot be performed, as the personal portfolio trades of corporate insiders are not observable. However, we do believe insider trades are representative of executives' total personal trades because the personal portfolios of corporate insiders are not fully diversified and are weighted heavily toward own-firm stock (Ben-David et al. 2019).

such plans based on extant research suggesting that some executives use Rule 10b5–1 plans to opportunistically time their insider trades (e.g., Larcker et al. 2021).[9] This result should be of interest to regulators because, to our knowledge, we are one of the first studies to empirically document that Rule 10b5–1 trading plans are effective mechanisms to limit opportunistic insider trading in certain circumstances. However, we acknowledge that our conclusions may not generalize to trades pursuant to Rule 10b5–1 trading plans during normal market conditions.

Third, the idea that corporate insiders can attain macroeconomic information advantages is relatively scant in the insider trading literature. Only Seyhun (1988, 1992) and Brochet (2018) examine the possibility that insider trades can predict market returns. However, these studies examine normal conditions that lack significant, identifiable events that would create the conditions necessary for increased insider trades. We document that the trades made by geographically connected insiders can serve as a leading indicator of overall market returns. This result should be of use to economic forecasters and investors seeking to time market movements.

Finally, we contribute to the literature on the extent to which market participants can anticipate market crashes. Adebambo et al. (2015) and Fahlenbrach and Stulz (2011) examine the financial crisis of 2007–2008 and find no evidence that managers of financial firms anticipated it, despite their insider knowledge of the events affecting their industry. However, these studies only examine the potential for an insider to anticipate his or her own firm's returns and not overall market returns. The COVID-19-induced stock market crash provides conditions that differ from the financial crisis along several dimensions. First, the stock market decline accompanied by the financial crisis was gradual, occurring over a much longer period of 18 months, making it difficult to identify a particular point in time at which insiders should have anticipated its effects ahead of other market participants. By contrast, the COVID-19-induced stock market crash occurred over a period of 1.5 months, the fastest fall into a bear market in history. Second, the stock market decline associated with the financial crisis was endogenous to the financial system because of its origin in the subprime mortgage crisis and the trading of financial derivatives, while COVID-19 represents an exogenous shock to the market, akin to that of a natural disaster. As a result, COVID-19 provides a much stronger identification opportunity to examine insiders' ability to anticipate market-wide effects.

2 Insider trading, geographic connection, and COVID-19

COVID-19 provides an ideal setting in which to examine insider trading behavior both in response to publicly available information and ahead of market-wide declines, because there is a relatively short and clear period over which the information flow about COVID-19 out of China was restricted (providing an information advantage for China connected insiders). Thus, the events of COVID-19 lend themselves to the relatively straightforward identification of a short timeframe in which information

[9] For further discussion, see https://www.wsj.com/articles/secs-gary-gensler-speaks-at-wsj-event-11623070099.

was publicly available but not acutely in the frame of public consciousness. A detailed timeline of relevant dates in the COVID-19 period is provided in Appendix A.

Although infections first occurred in late 2019 and quickly spread beyond Wuhan, very little information was provided to, or reported by, US news sources during the early stages of the pandemic.[10] Chinese institutions were ordered not to publish any information about COVID-19, and the official report from the Wuhan Health Commission, released in early January 2020, indicated that no new COVID-19 cases had been identified. By late January, Wuhan was placed on mandatory lockdown, suggesting that the severity of the disease had been significantly understated. Appendix A illustrates that nearly seven weeks passed between the earliest public indications of the virus in Wuhan and the point when formal action was taken by both the Chinese and US governments to contain its spread. During this period, the NASDAQ Composite and S&P 500 indices reached new highs. The stock market decline began only after more information about the virus became widely available in the US.

Our expectation that corporate insiders with geographic connection to the unfolding COVID-19 crisis in China were better able to anticipate its future stock price effects is based on two distinct lines of research: one examining insider trading and one focused on local informational advantages. It is well documented that insiders possess private information about their firm's prospects and that they often use this information to earn abnormal returns on their trades (e.g., Aboody and Lev 2002; Ke et al. 2003; McVay et al. 2006). This private information can come from an insider's social or sociopolitical connections. For example, Goergen et al. (2019) find that trades of directors with better networks have higher abnormal returns, and Jagolinzer et al. (2020) find that the political connections of board members at certain financial institutions provided an information advantage about distributions pursuant to the Troubled Asset Relief Program (TARP). However, only one study suggests that corporate insiders can also be more attentive to *public* information affecting their own firm's performance and profit from it when other investors are inattentive. Alldredge and Cicero (2015) provide evidence that insiders of suppliers sell more of their own-firm stock when recent public disclosures made by their primary customers indicate poor future performance (i.e., when the supplier's primary customers are likely to make fewer future purchases from them).

While most insider trading studies, including Alldredge and Cicero (2015), identify idiosyncratic firm information as the primary information advantage of corporate insiders, there is some evidence that insider trades can be made based upon broader information related to industry or economy-wide factors. Ben-David et al. (2019) study a proprietary dataset of trades in insiders' personal portfolios and find that insiders are more likely to earn abnormal returns from trading the stock of firms in their own industry due to their greater familiarity with it, as opposed to having private, nonpublic information about these firms. Seyhun (1988, 1992) and Brochet (2018) introduce the possibility that insider trades can predict market returns, consistent with insiders trading based on the expected effect of market-wide events on their firm. However, other evidence suggests that corporate insiders are not well attuned to the effects of market-

[10] For example, the Senate Intelligence Committee was not briefed on the extent of the outbreak until January 24, 2020. See https://www.nytimes.com/2020/03/20/us/politics/kelly-loeffler-richard-burr-insider-trading.html.

wide movements on their own firm's stock. Hutton et al. (2012) find that analysts are better able to predict the effects of macroeconomic factors on firm earnings than a firm's own managers. Further, Adebambo et al. (2015) and Fahlenbrach and Stulz (2011) find no evidence that managers of financial firms anticipated the financial crisis of 2007–2008 despite industry-specific insights.

We expect that insiders at firms with operational connections to China were more attuned to the potential effects of COVID-19 because of their firms' operational and supply chain connections to the country and could profit from this greater attentiveness during the initial stages of the pandemic. Geographic proximity is often cited in the accounting and finance literatures as a source of information advantage (Chi and Shanthikumar 2017). Baik et al. (2010) examine the effect of local and non-local institutional investors' stock trades on future stock returns and find that within-state proximity to their investments results in informed trading by institutional investors that predicts future stock returns. Several studies also show that individual investors earn higher returns when trading in firms local to them (e.g., Ivkovic and Weisbenner 2005; Berry and Gamble 2013), a result that also extends to mutual funds (Coval and Moskowitz 2001). However, there is no evidence that corporate insiders benefit from geographic connections outside their existence within social networks (Ahern 2017).[11]

COVID-19's spread was publicly reported in Chinese and US news sources from the beginning stages of the virus's known existence at the time, so we do not assert that China connected insiders traded illegally on private information about their firm.[12] Instead, our expectation is similar to Alldredge and Cicero (2015) in that the insider trades we expect to observe are in response to publicly available information. Unlike Alldredge and Cicero (2015), we expect that geographic connections, as opposed to economic dependence, result in insider attentiveness to public information. Specifically, we expect that China connected insiders were more attentive to early, publicly available COVID-19-related information and events than non–China connected insiders due to their firsthand exposure to a municipal lockdown, the virus's effects within their own firm's operations and supply chains, and relatively more China-specific knowledge and expertise. We view the week that Wuhan was placed under quarantine as a key period for China connected insiders to gain insights ahead of non–China connected insiders. Even if COVID-19 did not spread beyond Wuhan, it is likely that the stock prices of US firms would be adversely affected (albeit, to a lesser extent), as nearly 21% of US imports come from China, and Wuhan serves as one of China's primary transportation hubs.[13]

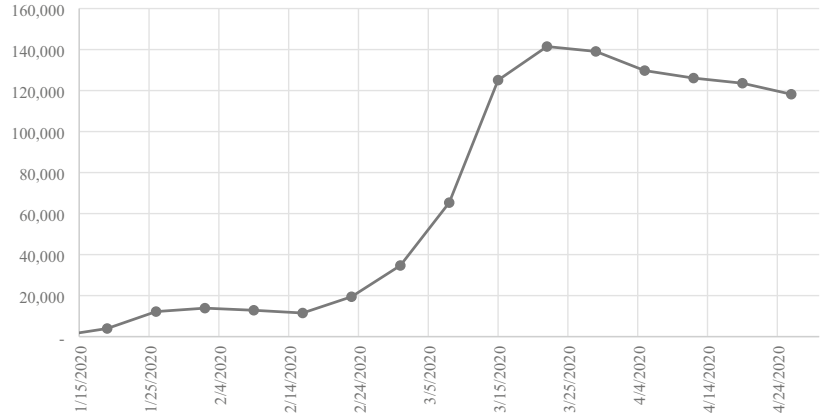
Figure 1 collectively indicates that China connected insiders were attentive to COVID-19 earlier than both the public and non–China connected insiders, as their disclosures about it pre-empted those of non–China connected insiders and large-scale

[11] Ahern (2017) analyzes the effects of social relationships on *illegal* insider trading and finds that geographic proximity is a moderating variable in the relation between social interactions and insider trading. We focus on geographic connection as the primary source of insider attentiveness to public information and do not examine social ties among insiders. Further, we do not explicitly examine illegal insider trades.

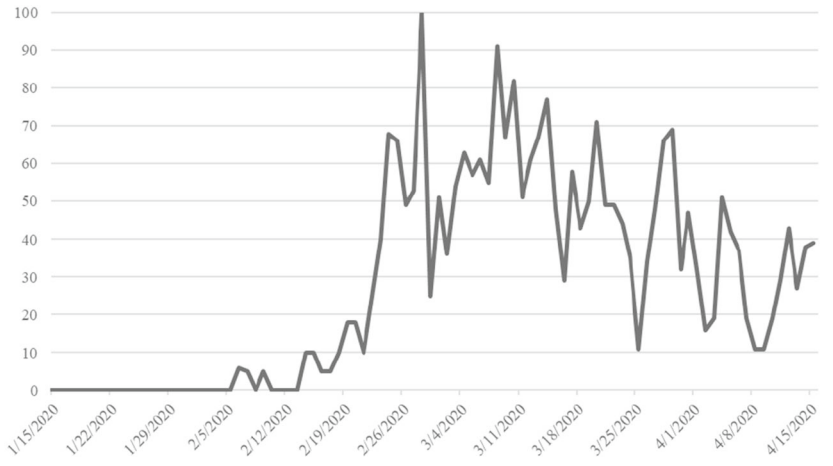
[12] The World Health Organization reported a cluster of pneumonia cases in Wuhan on January 4, 2020, and published their first Disease Outbreak News (their publication disseminated to the health communities and media) on COVID-19 on January 5, 2020. China also publicly shared the genome mapping of COVID-19 on January 12, 2020.

[13] https://qz.com/1654798/these-are-the-products-the-us-is-most-reliant-on-china-for/

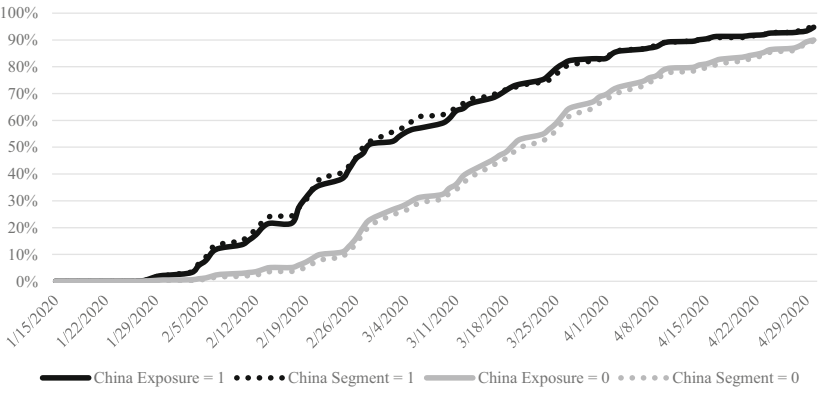
a Number of "Coronavirus" or "COVID" articles published in US newspapers



b Google trends index for "Coronavirus" or "COVID" over time



c Percentage of firms with COVID-related disclosures



◀ **Fig. 1** **A** Number of "Coronavirus" or "COVID" articles published in US newspapers. **B** Google trends index for "Coronavirus" or "COVID" over time. **C**: Percentage of firms with COVID-related disclosures. This figure illustrates the timing of both public and corporate consciousness of the COVID-19 pandemic during the first four months of 2020. **a** plots the number of US news articles containing the word "coronavirus" or "COVID" per ProQuest. **b** plots the Google Trends index for the word "coronavirus" or "COVID." **c** plots the percentage of China and non-China firms with at least one filing on EDGAR mentioning "coronavirus" or "COVID"

media and public interest in the virus. Figure 1a shows that extensive newspaper coverage in the US does not occur until the end of February 2020. Similarly, a plot of the Google Trends index over time for the word "coronavirus" or "COVID" in Fig. 1b suggests that public consciousness was not acutely focused on the pandemic until mid to late March, corresponding with the rapid decline in the US stock market and the implementation of citywide and statewide lockdowns within the US. Figure 1c graphs the cumulative percentage of China connected and non–China connected firms in our sample with at least one SEC filing mentioning "coronavirus" or "COVID" and shows that some firms began to include discussions of COVID-19 in their disclosures as early as January 2020, well in advance of broader public awareness. This figure also shows that China connected firms disclosed COVID-19-related information earlier than non–China connected firms, consistent with our expectation of earlier awareness of COVID-19's effects, and suggests that China connected insider sales were not necessarily the result of trading on undisclosed firm-specific information.[14]

In concurrent work, Anginer et al. (2020) use a machine learning technique that analyzes corporate insiders' names and classifies them into ethnicities to determine whether insiders with cultural affiliation to east Asia profited from the COVID-19 pandemic. While Anginer et al. (2020) focus on personal and cultural connections as their primary theoretical construct, we are the first, to our knowledge, to document geographic connection as a source of insiders' stock market information advantage. Anginer et al. (2020) also argue that cultural connections result in *private* information advantages for individuals assumed to have east Asian ethnicity. We do not argue that insiders gained a private information advantage in advance of the COVID-19 stock market crash, because information about the unfolding pandemic in China was public as early as January 2020. Instead, we posit that geographic connections made insiders of China connected firms more attentive to the already public information about the developing COVID-19 pandemic. Finally, Anginer et al. (2020) focus primarily on insider purchases after the COVID-19 stock market crash to gauge insiders' expectations about the market's recovery period following the crash. By contrast, we focus on the ability of insiders with China exposure to utilize their geographic information advantage to *anticipate* the COVID-19 stock market crash. Thus, our study takes an ex ante approach, while the Anginer et al. study takes an ex post approach to insider trading.

[14] In untabulated analysis, we further test whether the incremental profitability of the trades of China connected insiders over non–China connected insiders is concentrated in trades that occur before or after firms' COVID-19 related disclosures. We find that profitable China connected insider trades are executed after COVID-19 disclosures in both our full sample of trades occurring over the pre-COVID-19 and COVID-19 periods and in the subsample of trades occurring only in the COVID-19 period. We thank a referee for this suggestion.

3 Profitability of insider sales

3.1 Sample and data

The SEC requires corporate insiders to file a Form 4 with information on their stock transactions within two business days of the transaction. Prior literature has found that Form 4 s contain useful information and are a significant component of investors' information sets (e.g., Brochet 2010; Rogers et al. 2016, 2017). We collect data from SeekEdgar on insiders' open market stock sales from Form 4 filings on EDGAR between January 2018 and April 2020. We require the insider to be either an officer or director and that the shares sold were directly owned by the insider (i.e., we exclude trades made by spouses or dependents and trades connected with options and other derivatives).

We focus on sales because COVID-19 precipitated a market decline. We require information on the date, transaction price, and the number of shares sold.[15] We also require the firm to be included in Compustat, CRSP, and the Hoberg and Moon (2017) "coverage" file.[16] Consistent with Shon and Veliotis (2013), we exclude firms in regulated industries and those incorporated outside of the US. Our final sample comprises 51,858 insider-trade observations from January 2018 through March 2020.[17]

We first determine whether a firm is China-connected and then consider all firm insiders to be China connected insiders.[18] We proxy for geographic connection to China in three ways. The first two rely on the Hoberg and Moon (2017) database on offshoring activities, which employs textual analysis to identify mentions of a specific country name and any abbreviations or variations of the country name within 25 words of "output" words (e.g., sell, sales, revenue, consumers, store, export) or "input" words (e.g., supplier, vendor, import, subsidiary, plant, venture, factory).[19] The dataset contains the specific number of output mentions, input mentions, and, separately, input mentions with or without the ownership of assets in a given country in the firm's 2017 10-K.

[15] Each Form 4 can contain information about multiple trades that may occur on different days, and multiple Form 4 s can be filed on the same day. We collapse multiple trades made on the same day into one insider-day observation.

[16] The Hoberg and Moon data is organized within two datasets: 1) OffshoringDatabase_V3_Coverage and 2) OffshoringDatabase_V3_countries. If a firm is included in the "coverage" file but not in the "countries" file, then this firm is a true "zero," in that the firm mentions no foreign activity whatsoever within their Form 10-K. Firms that aren't included in the "coverage" dataset were not manually analyzed by Hoberg and Moon and, as a result, cannot reliably be categorized as China connected or non–China connected. As a result, we include only the insiders of firms represented in the Hoberg and Moon coverage file in our sample.

[17] It is not uncommon for insider sales to occur over multiple days in a short time window. To alleviate concerns that our results are driven by clustered transactions, in untabulated analysis, we collapse all insider sales to the firm-day level and exclude sales with another sale in the following four days. We also examine the profitability of insider sales at the firm-week level, including an indicator for weeks exhibiting positive net insider sales and interacting it with the COVID-19 and China indicator variables. We also perform analogous analyses that do not utilize a three-way-interaction. Our results are robust across all specifications. We thank a referee for this suggestion.

[18] It is very rare for an insider to be an insider at both a China connected firm and a non–China connected firm, and our results are robust to excluding such executives from our analysis.

[19] We are grateful to Gerard Hoberg and S. Katie Moon for providing this data, available for download from their data library here: http://faculty.marshall.usc.edu/Gerard-Hoberg/HobergMoonDataSite/index.html. Further details regarding their process may be found in Hoberg and Moon (2017).

Our first measure of China connection is an insider firm's "China Exposure," which is equal to one if an insider's firm has above median mentions of inputs from or outputs to China in their 2017 Form 10-K compared to all firms that mention China (the median number of mentions is equal to three in our sample) and zero otherwise.[20] Our second measure of China connection is an insider firm's "China Intensity," equal to the natural log of one plus the number of mentions of inputs from or outputs to China from the 2017 Form 10-K. We confirm that the China and non-China classification is sticky from year to year prior to 2017.[21] A firm is considered non–China connected if Hoberg and Moon manually analyze the firm's 10-K and find no mention of an input or output connection to China. Firms that are not covered in the Hoberg and Moon dataset are dropped from our analysis.

The Hoberg and Moon (2017) dataset allows us to identify China connected firms with significantly less error than the Compustat segment data, which is not well populated and is subject to significant reporting discretion. For example, a firm may report geographic segments that do not necessarily correspond to a specific country or report segments based on product lines as opposed to geography. The Hoberg and Moon data is also superior to Exhibit 21 data, which only requires the reporting of "major" subsidiaries. Major subsidiaries, however, are only one aspect of a firm's operational presence in a country. For example, Walmart does not have a Chinese segment reported in the Compustat segment data, nor does it list a major subsidiary in China in Exhibit 21. However, Walmart's website indicates it has been operating in China for over 20 years and has substantial purchasing activity from China manufacturers.[22] As such, Walmart is categorized as a China firm using the Hoberg and Moon data. However, to help ensure that our results are not simply an artifact of the Hoberg and Moon data, our third measure, "China Segment," is an indicator equal to one if an insider firm has a China or Asia segment reported in the Compustat segment database.

We begin the COVID-19 period on January 19, 2020. As reported in the timeline presented in Appendix A, Wuhan officials implemented screening measures for travelers leaving the city through passenger terminals on January 14, 2020, and the US began screening travelers arriving from Wuhan at three airports on January 17, 2020. We begin the COVID-19 period on the following Sunday (i.e., beginning of the following week) to align the COVID-19 period both for our profitability tests, which rely on insider-trade-day data, and for our trade volume tests (presented in Section 4), which rely on firm-week level data. As discussed above, we view the week beginning on January 19 as a key period for China connected insiders to gain insight ahead of non–China connected insiders because it includes the week of the Wuhan lockdown.

[20] In untabulated analysis, we also proxy for a China connection if a firm as at least one mention of imports from or exports to China and find consistent results.

[21] In untabulated analysis, we find that 93% of firms in the Hoberg and Moon (2017) dataset maintained their China/non-China classification from 2016 to 2017. We use the 2017 Hoberg and Moon classification for all years in our sample because it is the last year for which data is available to identify a China connection. It is possible that the US-China trade war tariffs that were enacted in 2018 caused some firms in our sample to abandon their China connection during our sample period. While we cannot identify these firms with the available data, the misclassification of China connections we describe would bias against our finding a significant difference between China and non–China connected firms in the COVID-19 period.

[22] See http://www.wal-martchina.com/english/walmart/.

Table 1 Descriptive statistics – insider sale sample

	N	Mean	Std	P25	P50	P75
China Exposure	51,858	0.358	0.480	0.000	0.000	1.000
China Intensity	51,858	0.946	1.218	0.000	0.000	1.792
China Segment	51,858	0.313	0.464	0.000	0.000	1.000
Profit	51,858	0.334	14.130	−7.282	−0.341	7.634
Profitable Sale	51,858	0.486	0.500	0.000	0.000	1.000
Sale$Value	51,858	948,651	1,969,758	85,214	283,499	855,379
ln(Sale$Value)	51,858	12.468	1.747	11.353	12.555	13.659
lnMVE	51,858	8.271	1.758	7.121	8.214	9.376
MTB	51,858	7.409	8.480	2.584	4.590	8.509
ROA	51,858	0.001	0.050	−0.007	0.011	0.025
Ret_Qtr_t	51,858	8.986	19.893	−2.760	8.155	18.750
RecentEA	51,858	0.292	0.454	0.000	0.000	1.000

This table presents descriptive statistics for our sample of insider sales. *China Exposure* is equal to one if an insider's firm has an above median number of mentions of inputs from or outputs to China in the Hoberg and Moon (2017) dataset compared to all firms mention China and zero otherwise. *China Intensity* is equal to the natural log of one plus the number of mentions of China in proximity to input or output words in the Hoberg and Moon dataset. *China Segment* is equal to one if the firm reports a China or Asia segment in the Compustat Segment database. *Profit* is equal to the percent buy-and-hold return over the 30 trading days following the insider sale multiplied by negative one. *Profitable Sale* equals one if *Profit* > 0. *Sale$Value* (*ln(Sale$Value)*) is the total value of (natural log of the total value of) shares sold in an insider sale. *lnMVE* is the natural log of a firm's market value of equity (PRCCQ*CSHOQ). *MTB* is the market-to-book ratio ((PRCCQ*CSHOQ)/BEQ). *ROA* is equal to income before extraordinary items (IBQ) divided by beginning total assets (ATQ). Ret_Qtr_t is the most recent three-month buy-and-hold return prior to the insider sale multiplied by 100. *RecentEA* is equal to one if the insider's firm released an earnings announcement in the two weeks prior to the insider sale

3.2 Descriptive statistics

In Table 1, we present descriptive statistics for our sample of insider sales. Approximately one-third of sales are made by China connected insiders using our China Exposure or China Segment variables. The mean insider sale experiences a profit of 0.3% over the following 30 days, and 48.6% of all insider sales have a positive 30-day profit. To help alleviate concerns that our results are due to differential stock price performance between China and non–China connected firms, we compare the stock price performance of China and non–China connected firms using our two indicator proxies for China connections during the COVID-19 period in Fig. 2. We find that the cumulative equal-weighted portfolio returns of China connected firms are nearly indistinguishable from those of non–China connected firms in the COVID-19 period, never diverging by more than 2.4%.

Figure 3 suggests that the patterns of returns before and after China and non–China connected insider sales in the pre-COVID-19 period are almost identical for either definition of an insider's China connection. Returns for firms of both insider groups exhibit a systematic run-up prior to a sale, followed by relatively stable prices, similar to the return patterns documented by Jagolinzer (2009). However, the return patterns diverge for China and non–China connected insiders in the COVID-19 period.

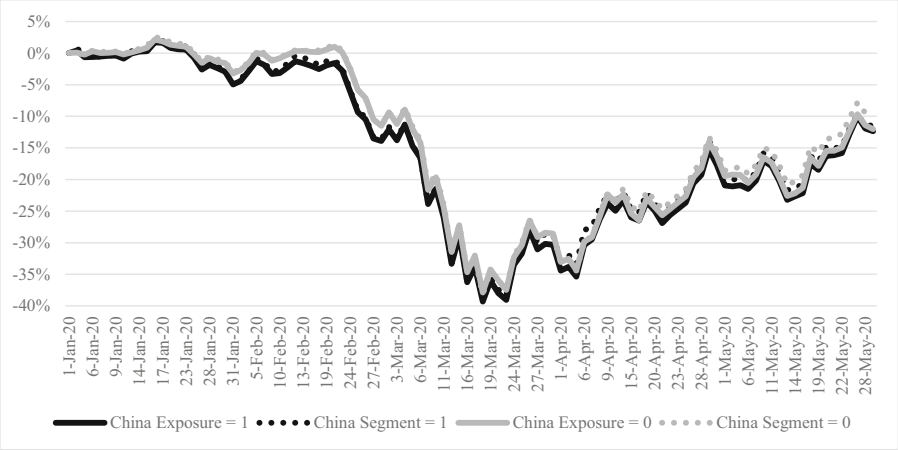


Fig. 2 Portfolio returns for China and non-China connected firms. Figure 2 compares the performance of equal weighted stock portfolios of China connected and non–China connected firms in the COVID-19 period by plotting the weekly cumulative equal weighted portfolio returns during the first four months of 2020

Figure 3a and b both suggest that non–China connected insiders sell in response to an initial price decline and before a continued price drop (i.e., "selling on the way down"), while China connected insiders appear to sell earlier in the decline, preempting a more significant decline in stock price over the following 30 days. We find that the post-trade returns of China and non-China firms are nearly indistinguishable in the days immediately following a trade by a China connected insider. The returns following China and non-China insider sales only begin to deviate in the latter half of the time window, indicating that investors did not initially learn from and respond to China connected insider sales.[23]

In Table 2, we present univariate evidence in a two-by-two matrix comparing differences in sale profitability and the percentage of sales that are profitable. Panel A presents the results for our China Exposure variable, while Panel B presents results for our China Segment variable. Profit is equal to the mean 30-day raw buy-and-hold return following all insider sales, multiplied by negative one so that a positive value indicates a profitable sale (in that it avoids a price decline). In the pre-COVID-19 period, we find no statistical difference between the profitability of China connected insider and non–China connected insider sales. In the COVID-19 period, the average profitability of China connected insider sales significantly exceeds that of non–China connected insider sales by 5.18 (2.51) percentage points when the China connection is measured as China Exposure (China Segment).

While the profitability of sales increased for both China and non–China connected insiders from the pre-COVID-19 to the COVID-19 period, the increase was more pronounced for China connected insiders. We find similar patterns when looking at the percentage of profitable sales, with approximately 46% of all insider sales being profitable in the pre-COVID-19 period. While all sales were more likely to be profitable in the COVID-19 period, the increase in profitability from the pre- to the

[23] We thank a referee for this interpretation.

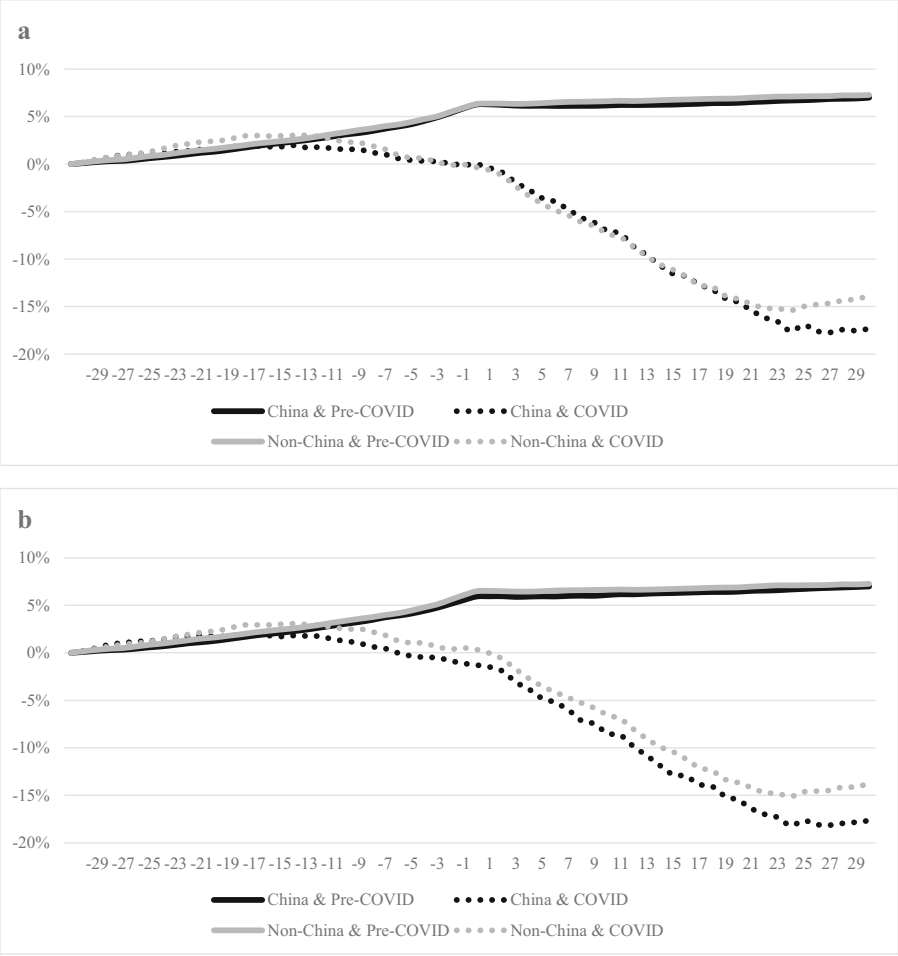


Fig. 3 **a** Returns around insider sales – China exposure. **b** Returns around insider sales – China segment. Figure 3 presents cumulative buy-and-hold returns of China and non-China firms pre and post insider sales. The insider sale date is at day 0 on the x-axis, and negative (positive) values on the x-axis represent dates prior to (following) the insider sale. Firm returns are equal to the cross-sectional mean of each insider trade day's cumulative raw return relative to the sale transaction date

COVID-19 period was significantly larger (between 7 and 13%) for China connected insiders. In dollar terms, our data indicates that the 1520 (1453) trades executed by China Exposure (China Segment) insiders during the COVID-19 period represent $2.8 ($2.0) billion in total trading volume, an average trade size of $1.8 ($1.4) million, and an average profit per trade of $251,000 ($258,000). The average incremental profit of China insider trades relative to non–China insider trades is equal to approximately $90,000. Thus, the volume of all insider trades and the profits earned by China connected insiders are economically significant, particularly when compared to the dollar value of insider trades and profitability surrounding other events documented in prior research. For example, the total trading volume of politically connected insiders during the TARP period equaled $324 million, and the average market adjusted profits

Table 2 Profitability for China connected and non–China connected sales

		Mean Profit			% Profitable Sales		
		Pre-COVID	COVID	*Difference*	Pre-COVID	COVID	*Difference*
Panel A: China Connected=China Exposure							
Not China Connected	Mean	−0.821	11.205	12.026***	46.5%	71.2%	24.7%***
	N	30,643	2,632		30,643	2,632	
China Connected	Mean	−0.699	16.385	17.084***	45.9%	83.6%	37.7%***
	N	17,063	1,520		17,063	1,520	
Difference		0.123	5.180***	5.057***	−0.6%	12.4%***	12.9%***
Panel B: China Connected=China Segment							
Not China Connected	Mean	−0.679	12.223	12.902***	46.7%	73.6%	26.9%
	N	32,902	2,699		32,902	2,699	
China Connected	Mean	−0.997	14.733	15.730***	45.4%	79.6%	34.2%
	N	14,804	1,453		14,804	1,453	
Difference		−0.318	2.510***	2.828***	−1.3%***	6.0%***	7.3%***

This table reports mean *Profit* and *Profitable Sale* for insiders with and without China exposure and with and without a China segment. China Exposure is equal to one if an insider's firm has an above median number of mentions of inputs from or outputs to China in the Hoberg and Moon dataset and zero otherwise. China Segment is equal to one if the insider's firm reports a China or Asia segment as reported in the Compustat Segment database and zero otherwise. Panel A (Panel B) presents mean *Profit* (*Profitable Sale*) for the sample of insider sales for each subset of our insider sale sample. *Profit* is equal to the percent buy-and-hold return over the 30 trading days following the insider sale multiplied by negative one. *Profitable* equals one if *Profit* > 0. The pre-COVID-19 period is from January 2018 through January 18, 2020, and the COVID-19 period is from January 19 through April 30, 2020. Statistical significance of differences across column and row means at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively

earned by those insiders were $22,000 per trade (Jagolinzer et al. 2020). As we note, however, our profit figures are based on raw returns and, therefore, represent an upper bound of the economic significance of the profitability of insider trades during the COVID-19 period.

3.3 Multivariate analysis

We empirically test whether China connected insider sales are more profitable than non-China connected insider sales during COVID-19 in a multivariate framework as follows:

$$Profit_{i,t} = \alpha_0 + \beta_1 China_{i,t} + \beta_2 COVID_{i,t} + \beta_3 China{*}COVID_{i,t} + \beta_4 lnMVE_{i,t} + \beta_5 MTB_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Ret\_Qtr_{i,t} + \beta_8 RecentEA_{i,t}\ \gamma k + \varepsilon_{i,t+1} \quad (1)$$

Our dependent variable, *Profit*, equals the raw buy-and-hold return over the 30 trading days following the insider sale, multiplied by negative one. Our primary measure of profitability uses raw returns, as opposed to abnormal returns, because COVID-19's effect on a firm's return could be idiosyncratic or systematic in nature. Further, the use of market-adjusted returns is often based on the implicit assumption that the insider

sells their firm's stock for diversification purposes and reinvests the proceeds into the market, which is unlikely to be the case in the presence of a market-wide disruption. However, because it is possible that some insiders reinvested the proceeds from the sale of their own-firm stock into the market, the results of estimating Eq. 1 may be interpreted as an upper bound of the incremental profits earned by China connected insiders on sales of own-firm stock ahead of the COVID-19 stock market crash. In additional analyses we bifurcate a firm's post-trade return into its market and market-adjusted components.

China is equal to one of our three China connection proxies (China Exposure, China Intensity, or China Segment), and *COVID* is equal to one for trading days on or after January 19, 2020. Our coefficient of interest is β_3 (*China*COVID*), and we expect it to be positive if China connected insiders profited from their geographic connections and attentiveness to the unfolding COVID-19 pandemic. We include, as control variables, the natural log of a firm's market value of equity (*LnMVE*), market to book ratio (*MTB*) and return on assets (*ROA*), all measured as of the most recent quarter-end to the insider sale. We also include a firm's prior three-month buy-and-hold return (Ret_Qtr_t), and we control for the existence of a recent earnings announcement (*RecentEA*) by including an indicator—equal to one if the firm released an earnings announcement in the two weeks preceding the sale—and industry fixed effects.[24] We include these variables to ensure that our results are driven by trades related to attentiveness to COVID-19-related information and not trades related to sales following positive firm-specific information.

In Table 3, we present the results of estimating Eq. 1. Across all specifications, we find that the profitability of insider sales is significantly larger in the COVID-19 period than in the pre-COVID-19 period. We do not find the pre-COVID-19 sales of China connected insiders to be more profitable than their non-China peers. However, when *China* is measured as one of our two indicator proxies, the estimated value of β_3 indicates that the increase in profitability of China connected insider sales from the pre-COVID-19 to the COVID-19 period is approximately three to five percentage points greater than the change in profitability of non–China connected insider sales. In economic terms, China connected insiders exhibit a 20%–40% relative increase in the profitability of their trades. Further, we find that a one standard deviation increase in China Intensity is associated with an approximately 2% higher profitability of sales in the COVID-19 period. Overall, the results indicate that, while all insider sales were more profitable in the COVID-19 period, the presence and intensity of geographic connections to China are associated with a statistically and economically larger profit.

4 Frequency of insider sales

4.1 Sample and data

The incrementally larger profitability of China connected insider sales is consistent with the anticipation of a COVID-19-precipitated decline in an insider firm's share

[24] In untabulated analysis, we also control for upcoming earnings announcements and find robust results.

Table 3 Profitability of insider sales for China and non–China connected insiders

	Dependent Variable: *Profit*		
	China Exposure	China Intensity	China Segment
	(1)	(2)	(3)
COVID	12.254***	12.330***	13.126***
	(10.611)	(10.571)	(29.901)
China	−0.112	0.022	−0.064
	(−0.329)	(0.151)	(−0.480)
*China*COVID*	5.285***	2.017***	3.027***
	(3.467)	(3.194)	(4.509)
LnMVE	−0.108	−0.109	−0.113***
	(−1.257)	(−1.280)	(−3.054)
MTB	−0.030	−0.029	−0.029***
	(−1.397)	(−1.339)	(−3.579)
ROA	−17.686***	−17.739***	−17.246***
	(−4.358)	(−4.380)	(−9.974)
Ret_Qtr_t	0.048***	0.048***	0.048***
	(4.792)	(4.802)	(12.414)
RecentEA	0.317	0.319	0.346***
	(1.348)	(1.359)	(2.818)
Constant	0.775	0.669	0.940*
	(0.577)	(0.496)	(1.772)
R^2	0.095	0.095	0.093
N	51,858	51,858	51,858
Industry FE?	Yes	Yes	Yes

Table 3 presents OLS regressions of *Profit* on variables capturing whether the insider is geographically connected to China (*China*), an indicator variable for months falling in the COVID-19 period (*COVID*), and the interaction between the two. We measure *China* in three ways: 1) China Exposure, where *China* is equal to one if an insider's firm has an above median number of mentions of inputs from or outputs to China in the Hoberg and Moon dataset and zero otherwise; 2) China Intensity, where *China* is equal to the natural log of one plus the number of mentions of inputs from or outputs to China in the Hoberg and Moon database; and 3) China Segment, where *China* is equal to one if the insider's firm reports a China or Asia segment as reported in the Compustat Segment database and zero otherwise. *Profit* is equal to the percent buy-and-hold return over the 30 trading days following the insider sale multiplied by negative one. Control variables are defined in Table 1. We include industry fixed effects. *t*-statistics are reported in parentheses and are based on standard errors clustered by firm. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively. All variables are winsorized at the 1% and 99% levels

price. To earn these incremental profits, China connected insiders could either intertemporally shift regular sales to preempt an expected stock price decline or hold their trading behavior constant prior to the stock market decline but cancel planned sales scheduled for later in the pandemic. Either scenario would indicate an information advantage for China connected insiders relative to non–China connected insiders. In this section we provide context to our overall profitability result by testing the volume and timing of observed insider sales.

We utilize a sample of 208,964 firm-week observations subject to the same data constraints as our trade-level sample and examine two dependent variables that capture the extent of insider trading activity: the number of sales made by insiders in a week (*#Sales*), and the natural log of the dollar value of sales made in a week (*Sales$Value*). The frequency analysis we perform does not require post-sale returns, so our firm-week sample ends with the last full week of April 2020. Table 4 provides descriptive statistics for our firm-week sample. Similar to our sample of sales, we find that 27%–36% of observations are China connected firm-weeks.

4.2 Multivariate analysis

In our multivariate analysis of trading frequency, we estimate Eq. 1 using *#Sales* and *Ln(Sales$Value)* as dependent variables to examine the change in frequency for China and non-China connected insiders from the pre-COVID-19 to the COVID-19 period. We estimate the sales volume tests separately when *China* is based on China Exposure, China Intensity, and China Segment. In addition, we augment Eq. 1 by evenly splitting the COVID-19 period into an "early" and a "late" period to examine the timing of insider sales. We define an indicator, *EarlyCOVID*, as equal to one for the seven weeks between January 19 and March 8, and another, *LateCOVID*, as equal to one for the seven weeks after March 8. In this specification, the baseline for each post-COVID-19 period is the pre-COVID-19 period. If China connected insiders intertemporally shifted

Table 4 Descriptive statistics – firm-week sample

	N	Mean	Std	P25	P50	P75
China Exposure	208,964	0.364	0.481	0.000	0.000	1.000
China Intensity	208,964	0.984	1.236	0.000	0.000	1.946
China Segment	208,964	0.270	0.444	0.000	0.000	1.000
# Sales	208,964	0.222	0.690	0.000	0.000	0.000
ln(Sale$Value)	208,964	1.664	4.409	0.000	0.000	0.000
lnMVE	208,964	7.665	1.695	6.382	7.531	8.766
MTB	208,964	5.151	7.380	1.625	2.895	5.506
ROA	208,964	−0.006	0.057	−0.009	0.008	0.021
Ret_Qtr_t	208,964	0.504	22.094	−12.294	0.376	12.633
RecentEA	208,964	0.141	0.348	0.000	0.000	0.000

This table presents descriptive statistics for our sample at the firm-week level. *China Exposure* is equal to one if an insider's firm has an above median number of mentions of inputs from or outputs to China in the Hoberg and Moon dataset compared to all firms mentioning China and zero otherwise. *China Intensity* is equal to the natural log of one plus the number of mentions of China in proximity to input or output words in the Hoberg and Moon dataset. *China Segment* is equal to one if the firm reports a China or Asia segment in the Compustat Segment database. *#Sales* is equal to the number of sales by insiders in a given firm-week. *Sales$Value* is the dollar value of all insider sales occurring in a given firm-week. *lnMVE* is the natural log of a firm's market value of equity (PRCCQ*CSHOQ). *MTB* is the market-to-book ratio ((PRCCQ*CSHOQ)/BEQ). *ROA* is equal to income before extraordinary items (IBQ) divided by beginning total assets (ATQ). Ret_Qtr_t is the most recent three-month buy-and-hold return prior to the insider sale multiplied by 100. *RecentEA* is equal to one if the insider's firm released an earnings announcement in the two weeks prior to the insider sale. All variables are winsorized at 1% and 99%

sales in anticipation of a decline in their firm's stock price, we will observe more insider sales in the early COVID-19 period (which preceded the beginnings of the stock market crash) and fewer sales in the late COVID-19 period (during and after the stock market crash).

In Table 5, we present the results from a Poisson regression when *#Sales* is the dependent variable and an OLS regression when *ln(Sales$Value)* is the dependent variable. Panel A compares sales volume for China connected and non–China connected insiders in the pre-COVID-19 period to the COVID-19 period, and Panel B compares sales volume in the early and late COVID-19 periods to the pre-COVID-19 period. In Panel A, we find that the change in frequency of China insider sales from the pre-COVID-19 period to the COVID-19 period is not statistically different than the change in non-China insider sales across the two periods (i.e., the coefficient on *China*COVID* is insignificant). This suggests that China connected insiders did not sell more, or less, on average, than non-China connected insiders throughout the entire COVID-19 period. Further, the insignificant coefficient on *China*COVID* indicates that the incremental profitability of China connected insider sales is not due to differences in the total volume or extent of sale activity during the COVID-19 period.

In Panel B, for both our China Exposure and China Segment proxies, we find evidence consistent with China connected insiders executing incrementally more sales and a larger increase in dollar volume than non–China connected insiders in the early COVID-19 period. We note that the sum of the *EarlyCOVID* coefficient and the *China*EarlyCOVID* coefficient is near zero. This suggests that the sales of China insiders did not economically differ from the sample mean, but that non–China insiders executed fewer sales in the early COVID-19 period. Further, for both our China Exposure and China Segment proxies, we find that China connected insiders executed incrementally fewer sales and a larger decrease in dollar volume than non–China connected insiders in the late COVID-19 period. Specifically, China connected firms experienced a 10%–15% incremental increase in dollar volume of sales in the early COVID-19 period, followed by a 7%–14% incremental decrease in dollar volume in the late COVID-19 period, compared to the sample mean.[25]

This analysis provides some evidence that the higher profitability we observe for China insider sales in the COVID-19 period is at least partially driven by an earlier incorporation of information about the impending effects of COVID-19 and increased dollar sales ahead of stock price declines and is consistent with insiders' geographic connections allowing them to intertemporally shift trades to profit from expected stock price declines. However, we interpret these results with caution, given that the sign of the estimated coefficient for *China*EarlyCOVID*, though directionally consistent across all specifications, is not consistently statistically significant when the China connection is measured using the intensity of an insider's China connection.

[25] Column 4: 0.180/1.664 = 10.8%, −0.236/1.664 = −14.2%. Column 6: 0.256/1.664 = 15.4%, −0.127/1.664 = −7.6%.

Table 5 Sales volume for China connected and non–China connected insiders

DV:	*#Sales*			*Ln(Sales$Value)*		
China =	China Exposure	China Intensity	China Segment	China Exposure	China Intensity	China Segment
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Comparing sales in the pre-COVID period to the COVID Period						
COVID	−0.130***	−0.109***	−0.172***	−0.174***	−0.168***	−0.201***
	(−3.354)	(−2.818)	(−4.714)	(−3.691)	(−3.584)	(−4.859)
China	0.003	0.003	−0.036	−0.009	−0.001	−0.098
	(0.046)	(0.122)	(−0.454)	(−0.109)	(−0.026)	(−0.960)
*China*COVID*	−0.030	−0.033	0.096	−0.024	−0.015	0.067
	(−0.505)	(−1.347)	(1.567)	(−0.342)	(−0.557)	(0.816)
LnMVE	0.192***	0.192***	0.193***	0.373***	0.373***	0.377***
	(10.811)	(10.802)	(11.345)	(15.255)	(15.225)	(15.564)
MTB	0.012***	0.012***	0.012***	0.032***	0.032***	0.031***
	(4.290)	(4.288)	(4.308)	(5.000)	(5.001)	(5.003)
ROA	1.855***	1.855***	1.860***	3.045***	3.041***	3.051***
	(3.617)	(3.610)	(3.579)	(4.904)	(4.891)	(4.883)
Ret_Qtr_t	0.013***	0.013***	0.013***	0.018***	0.018***	0.018***
	(24.271)	(24.282)	(24.368)	(23.838)	(23.824)	(23.883)
RecentEA	0.831***	0.832***	0.831***	1.614***	1.614***	1.614***
	(34.675)	(34.673)	(34.656)	(32.463)	(32.460)	(32.465)
Constant	−3.976***	−3.978***	−3.978***	−2.374***	−2.376***	−2.395***
	(−18.897)	(−18.929)	(−18.985)	(−10.331)	(−10.359)	(−10.500)
R^2	0.098	0.098	0.099	0.080	0.080	0.081
N	208,964	208,964	208,964	208,964	208,964	208,964
Industry FE?	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Early and Late COVID Period						
EarlyCOVID	−0.118***	−0.095**	−0.123***	−0.213***	−0.191***	−0.217***
	(−2.785)	(−2.253)	(−2.998)	(−3.540)	(−3.167)	(−3.973)
LateCOVID	−0.154**	−0.132**	−0.264***	−0.137**	−0.148**	−0.188***
	(−2.477)	(−2.051)	(−4.337)	(−2.359)	(−2.532)	(−3.664)
China	0.003	0.003	−0.036	−0.009	−0.001	−0.098
	(0.046)	(0.122)	(−0.453)	(−0.109)	(−0.026)	(−0.959)
*China*EarlyCOVID*	0.104*	0.017	0.132**	0.180*	0.045	0.256**
	(1.625)	(0.646)	(2.032)	(1.839)	(1.207)	(2.332)
*China*LateCOVID*	−0.335***	−0.153***	0.007	−0.236***	−0.077**	−0.127*
	(−3.090)	(−3.293)	(0.060)	(−2.740)	(−2.360)	(−1.766)
LnMVE	0.192***	0.192***	0.193***	0.374***	0.373***	0.377***
	(10.780)	(10.772)	(11.311)	(15.256)	(15.226)	(15.564)
MTB	0.012***	0.012***	0.012***	0.032***	0.032***	0.031***
	(4.303)	(4.302)	(4.317)	(5.004)	(5.005)	(5.006)

Table 5 (continued)

DV:	*#Sales*			*Ln(Sales$Value)*		
China =	China Exposure (1)	China Intensity (2)	China Segment (3)	China Exposure (4)	China Intensity (5)	China Segment (6)
ROA	1.850***	1.851***	1.856***	3.046***	3.043***	3.051***
	(3.606)	(3.602)	(3.571)	(4.904)	(4.893)	(4.884)
Ret_Qtr_t	0.013***	0.013***	0.013***	0.018***	0.018***	0.018***
	(23.294)	(23.302)	(23.345)	(22.701)	(22.682)	(22.731)
RecentEA	0.827***	0.827***	0.827***	1.611***	1.611***	1.611***
	(34.656)	(34.645)	(34.730)	(32.518)	(32.511)	(32.521)
Constant	−3.970***	−3.972***	−3.973***	−2.374***	−2.376***	−2.394***
	(−18.855)	(−18.888)	(−18.941)	(−10.329)	(−10.357)	(−10.498)
R^2	0.099	0.099	0.099	0.081	0.080	0.081
N	208,964	208,964	208,964	208,964	208,964	208,964
Industry FE?	Yes	Yes	Yes	Yes	Yes	Yes

Panel A presents Poisson regressions of *#Sales* and OLS regressions of *Ln($SalesValue*) on three measures of China connection (*China*), an indicator for weeks falling in the COVID-19 period (*COVID*), and the interaction between the two. Panel B partitions the *COVID* period indicator into early and late COVID-19 periods, where *EarlyCOVID* (*LateCOVID*) is equal to one for weeks falling between January 19 and March 8, 2020 (March 8, 2020, and April 30, 2020). Control variables are defined in Table 4. We include industry fixed effects. *t*-statistics are reported in parentheses and are based on standard errors clustered by firm. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively. All variables are winsorized at the 1% and 99% levels

5 Additional analyses

5.1 Firm-specific vs. economy-wide factors

Our primary focus is on whether China connected insiders' sales of their own firm's stock anticipated future stock price declines due to their geographic connection to China and their resulting increased attention to COVID-19 information. What is unclear from our primary tests is whether the insider trading behavior we document reflects an idiosyncratic effect of COVID-19 on China connected firms or market-wide effects that were not yet reflected in all firms' share prices (Seyhun 1992). In other words, insiders could anticipate a decline in their firm's share price due either to factors that affect only their firm or factors that are macroeconomic in nature and have broader effects.

We perform several additional analyses to better understand why China connected insiders' trades predict future returns in the COVID-19 period. Specifically, we test whether the main results we document in Sections 3 and 4 are consistent with an *idiosyncratic effect* of COVID-19 on China connected firms or with insider sales in advance of a *systematic effect* of COVID-19 on all firms. Importantly, we do not suggest that it is possible to identify whether the insider *knows* the information is idiosyncratic or systematic in nature before trading. Rather, the analyses presented in this section are intended to identify whether the insider trading behavior we document is based on information not yet incorporated into the returns of only China connected

firms or into the overall market return.[26] In addition to providing context to our primary results, this analysis allows us to directly contribute to the insider trading literature by examining whether insiders appear to anticipate a general stock market decline as opposed to idiosyncratic events occurring within their firm.

To formally test whether our results are consistent with market-wide versus firm-specific effects, we decompose *Profit* into *Profit_Market*, equal to the 30-day market return following an insider sale, and *Profit_Firm*, equal to the firm's market-adjusted 30-day buy-and-hold return following the insider sale. We present the results of estimating Eq. 1 with *Profit_Firm* and *Profit_Market* as separate dependent variables for each of the three definitions of *China* in Table 6. In Columns 1 through 3, we find no evidence that China connected insiders were able to earn incremental market-adjusted abnormal returns in the COVID-19 period, as the estimated coefficient on *China*COVID* is insignificant in each specification. By contrast, we find that our overall profitability result is concentrated in the market-wide component of China connected insiders' incremental returns, as the estimated coefficient on *China*COVID* is positive and significant in Columns 4 through 6 with *Profit_Market* as the dependent variable.

The finding that our profitability results are largely driven by the market component of returns and not by abnormal returns provides some evidence that the incremental profitability of China connected insiders is due to their earlier incorporation of information about COVID-19's market-wide effects that was not currently reflected in their firm's share price. However, given that a stock market crash is characterized by a high correlation among firm returns within the overall stock market, we cannot rule out that the results in this section are being driven by power issues related to the majority of raw returns capturing market-wide effects in this period. As a result, we also test whether *aggregate* China connected insider trading is associated with future market returns in the COVID-19 period.

Our market-level tests are similar to those in both Seyhun (1988) and Brochet (2018), who examine the information content of aggregate insider trades for monthly market returns. Because our COVID-19 period contains only 3.5 months, we perform our aggregate analysis at the weekly level. We compute aggregate China connected insider trades as the ratio of all China connected insider sales in a week to all insider sales occurring in the week ($PctChina\_Week_t$).[27] We then examine whether aggregate China connected insider trades in a week are associated with weekly market returns up to four weeks ahead and, separately, market returns in the following month. We include an interaction between *PctChina_Week* and the COVID-19 period indicator ($PctChina\_Week_t$*COVID). We also include, as control variables, contemporaneous weekly and prior monthly market returns. Our aggregate sample consists of 121 trading weeks.

The results of regressing future market returns on aggregate China connected insider trades are reported in Table 7. Panel A (B) reports the results when China connected insider sales are determined using China Exposure (China Segment). In each panel, we

[26] See Seyhun (1988) for a detailed explanation of how insider trades can occur in response to firm-specific versus macroeconomic information.

[27] In untabulated analyses, we also confirm the robustness of our conclusions to using the aggregate percentage of China connected insider sales to total insider sales in dollars.

Table 6 Firm-specific vs. market-wide insider sale profitability

DV:	*Profit_Firm*			*Profit_Market*		
China =	China Exposure	China Intensity	China Segment	China Exposure	China Intensity	China Segment
	(1)	(2)	(3)	(4)	(5)	(6)
COVID	−1.281	−1.168	−0.994	14.577***	14.540***	15.139***
	(−1.454)	(−1.312)	(−1.077)	(23.886)	(23.222)	(25.928)
China	0.085	0.062	0.302	−0.179**	−0.038	−0.332***
	(0.280)	(0.491)	(0.972)	(−2.096)	(−0.977)	(−3.244)
*China*COVID*	1.389	0.432	0.619	3.430***	1.400***	1.987*
	(1.060)	(0.859)	(0.510)	(3.764)	(3.803)	(1.880)
LnMVE	−0.198**	−0.199***	−0.214***	0.097***	0.096***	0.106***
	(−2.571)	(−2.585)	(−62.771)	(3.146)	(3.132)	(3.447)
MTB	−0.038**	−0.038**	−0.038**	0.005	0.005	0.005
	(−2.152)	(−2.108)	(−2.080)	(0.771)	(0.868)	(0.812)
ROA	−16.877***	−16.893***	−16.696***	0.269	0.237	0.508
	(−4.368)	(−4.373)	(−4.306)	(0.219)	(0.189)	(0.397)
Ret_Qtr_t	0.013	0.013	0.013	0.034***	0.034***	0.034***
	(1.432)	(1.436)	(1.447)	(10.181)	(10.226)	(10.235)
RecentEA	−0.260	−0.257	−0.248	0.527***	0.527***	0.542***
	(−1.251)	(−1.236)	(−1.191)	(5.384)	(5.384)	(5.557)
Constant	2.737**	2.700**	2.886***	−2.204***	−2.264***	−2.194***
	(2.517)	(2.472)	(2.666)	(−4.561)	(−4.681)	(−4.430)
R^2	0.024	0.024	0.024	0.387	0.387	0.385
N	51,858	51,858	51,858	51,858	51,858	51,858
Industry FE?	Yes	Yes	Yes	Yes	Yes	Yes

This table examines whether insider trades are consistent with firm-specific or market-wide factors and presents OLS regressions of *Profit_Firm* and *Profit_Market* on *China*, *COVID*, and the interaction between the two. *Profit_Firm* is equal to the 30-day market adjusted buy-and-hold return following the insider trade, multiplied by −1 so that a positive coefficient represents a profitable sale/avoidance of a loss. *Profit_Market* is equal to the 30-day market return following the insider trade, multiplied by −1. *COVID* is equal to one for the COVID-19 period and zero otherwise. Control variables are defined in Table 1. We include industry fixed effects. *t*-statistics are reported in parentheses and are based on standard errors clustered by firm. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively. All variables are winsorized at the 1% and 99% levels

find that the estimated coefficient on $PctChina\_Week_t$ is insignificant for all future market return horizons, suggesting that aggregate China connected insider sales do not predict market returns in the pre-COVID-19 period. We also find that aggregate China connected insider sales during the COVID-19 period are negatively and significantly associated with future market returns for all future return horizons beyond one week when China connection is based on China Exposure and beyond two weeks when China connection is based on China Segment. This result is consistent with the aggregate sales of China connected insiders in the COVID-19 period reflecting information not yet incorporated into market prices and with the insider trading behavior of

Table 7 Aggregate China connected insider sales and future market returns

Market Return in:	Week $t+1$ (1)	Week $t+2$ (2)	Week $t+3$ (3)	Week $t+4$ (4)	Month $t+1$ (5)
Panel A: China Exposure					
COVID	0.092	12.502***	7.315*	10.604***	18.161**
	(−2.776)	(3.165)	(1.849)	(2.724)	(2.539)
$PctChina\_Week_t$	−0.026	0.004	−0.037	−0.025	−0.087
	(−0.486)	(0.067)	(−0.705)	(−0.489)	(−0.913)
*PctChina_Weekt*COVID*	0.286**	−0.403***	−0.276**	−0.366***	−0.724***
	(2.438)	(−3.542)	(−2.425)	(−3.263)	(−3.515)
$Mkt\_Ret\_Week_t$	−0.095	0.102	−0.014	−0.231***	−0.222
	(−1.053)	(1.170)	(−0.156)	(−2.674)	(−1.400)
$Mkt\_Ret\_Month_t$	−0.109**	−0.055	−0.119**	−0.045	−0.326***
	(−2.203)	(−1.136)	(−2.472)	(−0.939)	(−3.729)
Constant	1.243	0.066	1.600	1.170	4.119
	(0.644)	(0.035)	(0.853)	(0.634)	(1.215)
R^2	0.092	0.155	0.157	0.190	0.297
N	121	121	121	121	121
Panel B: China Segment					
COVID	−15.200**	7.328	10.285*	24.503***	26.632**
	(−2.481)	(1.174)	(1.696)	(4.342)	(2.380)
$PctChina\_Week_t$	−0.015	0.052	0.034	0.002	0.072
	(−0.266)	(0.879)	(0.596)	(0.033)	(0.678)
*PctChina_Weekt*COVID*	0.396**	−0.249	−0.359**	−0.762***	−0.959***
	(2.217)	(−1.369)	(−2.033)	(−4.635)	(−2.943)
$Mkt\_Ret\_Week_t$	−0.132	0.108	0.011	−0.154*	−0.152
	(−1.414)	(1.143)	(0.122)	(−1.802)	(−0.892)
$Mkt\_Ret\_Month_t$	−0.081	−0.099*	−0.158***	−0.092**	−0.424***
	(−1.644)	(−1.965)	(−3.242)	(−2.032)	(−4.714)
Constant	0.781	−1.395	−0.747	0.244	−1.119
	(0.427)	(−0.749)	(−0.413)	(0.145)	(−0.335)
R^2	0.083	0.058	0.116	0.241	0.233
N	121	121	121	121	121

This table examines whether the aggregate sales of China connected insiders predict market returns and presents regressions of weekly market returns up to four weeks ahead and one-month-ahead market returns on the percentage of total insider sales in a given week made by China connected insiders ($PctChina\_Week_t$) and the interaction with *COVID*. Panel A defines an insider's China connection based on China Exposure. Panel B defines an insider's China connection based on whether the insider's firm reports a China or Asia segment in the Compustat Segment database. The market return is equal to the 30-day market return following the insider trade, multiplied by −1. We control for the weekly market return contemporaneous to the week in which the proportion of China connected insider sales is measured ($Mkt\_Ret\_Week_t$) and market returns over the four weeks prior to the insider sale week ($Mkt\_Ret\_Month_t$). We use robust standard errors and report *t*-statistics in parentheses. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively. All variables are winsorized at the 1% and 99% levels

China connected insiders during the COVID-19 period preceding the macroeconomic effect of COVID-19 on their firm, as opposed to a differential idiosyncratic effect of COVID-19 on China connected firms.

5.2 Rule 10b5–1 trading plans

SEC Rule 10b5–1 was enacted in October 2000 to reduce opportunistic trading and provide clarity with respect to whether trades are made based on material nonpublic information. The rule was intended to deter illegal insider trading by allowing insiders a safe harbor for preplanned trades ahead of when they might possess material nonpublic information (Jagolinzer 2009). Typically, trades pursuant to Rule 10b5–1 plans are passive in nature, as insiders must not exert subsequent influence over whether specific planned trades are executed. Trades pursuant to Rule 10b5–1 plans therefore represent trades entered into with some degree of advance notice (although there is no uniformly specified time requirement). However, Rule 10b5–1 trading plans have recently faced increased scrutiny due, in part, to suspicions about their abuse during the COVID-19 pandemic.[28]

Because of how rapidly the COVID-19 crisis unfolded and the nature of Rule 10b5–1 trades, we do not expect trades executed pursuant to a Rule 10b5–1 plan to occur based on attentiveness to COVID-19 related information. As a result, we expect non-Rule 10b5–1 trades to be more representative of trades arising from a sudden and short-lived informational advantage. However, this expectation is not without tension, as Jagolinzer (2009) finds evidence that trades pursuant to Rule 10b5–1 plans are not, on average, solely due to uninformed trading. We use textual analysis to parse the footnotes of Form 4 to identify Rule 10b5–1 trading plans and partition our profitability analyses on whether trades were executed under a 10b5–1 trading plan.[29]

The results of our analysis are provided in Table 8. We find that the profitability of trades made both pursuant to and not pursuant to a Rule 10b5–1 plan are not significantly more profitable for China connected insiders in the pre-COVID-19 period. We find that only non-preplanned sales made outside of Rule 10b5–1 trading plans are incrementally more profitable for China connected insiders in the COVID-19 period using all three measures of an insider's China connection. We perform Chi-squared tests comparing the coefficients on *China*COVID* for Rule 10b5–1 trades and non-Rule 10b5–1 trades and find they are significantly different across all three China proxies. These results shed light on the efficacy of Rule 10b5–1 in deterring opportunistic trading by corporate insiders. While we believe the particular information advantage we study is related to public information, our evidence is broadly consistent with managers not manipulating Rule 10b5–1 trading plans to exploit short-lived information advantages.

[28] The SEC's chairman, Gary Gensler, announced that he and the SEC staff are currently considering several potential reforms to rules surrounding 10b5–1 plans: https://www.jdsupra.com/legalnews/sec-chairman-s-comments-signal-likely-8810114/ https://www.sec.gov/news/speech/gensler-cfo-network-2021-06-07. We do acknowledge that criticism of Rule 10b5–1 plans is not a new phenomenon; however, COVID-19 provided a catalyst for evaluation and reform of these plans.

[29] To verify the accuracy of our algorithm, we manually classify 500 random trades and find that our algorithm has a 98.2% accuracy rate.

Table 8 Profitability of preplanned rule 10b5–1 trades

DV = *Profit*	Non-Rule 10b5–1 Trades			Rule 10b5–1 Trades		
China =	China Exposure	China Intensity	China Segment	China Exposure	China Intensity	China Segment
	(1)	(2)	(3)	(4)	(5)	(6)
COVID	12.046***	12.130***	13.091***	12.317***	12.458***	13.078***
	(6.065)	(6.086)	(6.859)	(10.797)	(10.954)	(10.899)
China	−0.146	0.103	−0.851**	−0.045	−0.033	0.682
	(−0.405)	(0.638)	(−2.129)	(−0.090)	(−0.164)	(1.298)
*China*COVID*	7.532***	2.917***	5.225**	2.883	0.968	0.597
	(3.226)	(3.020)	(2.136)	(1.591)	(1.358)	(0.354)
LnMVE	−0.093	−0.108	−0.083	−0.110	−0.104	−0.150
	(−0.796)	(−0.926)	(−0.725)	(−0.968)	(−0.930)	(−1.274)
MTB	0.003	0.006	0.002	−0.050*	−0.049*	−0.047
	(0.124)	(0.238)	(0.092)	(−1.760)	(−1.734)	(−1.578)
ROA	−19.037***	−19.239***	−18.234***	−16.992***	−16.874***	−16.968***
	(−2.995)	(−3.052)	(−2.856)	(−3.519)	(−3.503)	(−3.489)
Ret_Qtr_t	0.037***	0.037***	0.037***	0.056***	0.056***	0.056***
	(2.784)	(2.833)	(2.784)	(4.399)	(4.392)	(4.365)
RecentEA	0.210	0.202	0.237	0.492	0.497	0.514
	(0.673)	(0.647)	(0.754)	(1.464)	(1.480)	(1.534)
Constant	0.151	0.006	0.442	1.956	1.936	2.195
	(0.093)	(0.004)	(0.277)	(0.995)	(0.977)	(1.137)
Non-Rule 10b51 minus Rule 10b5–1			4.649	1.949	4.628	
Chi-squared test				2.79*	3.11*	2.80*
R^2	0.123	0.123	0.120	0.080	0.080	0.080
N	23,390	23,390	23,390	28,468	28,468	28,468
Industry FE?	Yes	Yes	Yes	Yes	Yes	Yes

This table presents the results of estimating the profitability tests of trades not pursuant to a Rule 10b5–1 trading plan in Columns 1, 2, and 3 and of trades pursuant to a Rule 10b5–1 trading plan in Columns 4, 5, and 6. We use textual analysis to identify whether a trade reported on Form 4 is executed pursuant to such a plan. We present OLS regressions of *Profit* on a variable equal to one if the insider is geographically connected to China (*China*), an indicator variable for months falling in the COVID-19 period (*COVID*), and the interaction between the two. We measure *China* in three ways: 1) China Exposure, where *China* is equal to one if an insider's firm has an above median number of mentions of inputs from or outputs to China in the Hoberg and Moon dataset and zero otherwise; 2) China Intensity, where *China* is equal to the natural log of one plus the number of mentions of inputs from or outputs to China in the Hoberg and Moon database; and 3) China Segment, where *China* is equal to one if the insider's firm reports a China segment as reported in the Compustat Segment database and zero otherwise. *Profit* is equal to the percent buy-and-hold return over the 30 trading days following the insider sale multiplied by negative one. Controls are defined in Table 1. We include industry fixed effects. *t*-statistics are reported in parentheses and are based on standard errors clustered by firm. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively. All variables are winsorized at the 1% and 99% levels

5.3 Other robustness tests

A potential alternative explanation for our results is that the incremental profitability we document for China connected insiders in the COVID-19 period is due to differences in pre-sale price runups for China versus non–China connected firms. While our findings that China connected insider sales precede the macroeconomic effects of COVID-19 on their firm and predict market returns in aggregate help reduce this concern, we perform a matched sample analysis to further address this issue. In Table 9, we estimate our profitability analysis matching each insider sale at a China connected firm to an insider sale at a non–China connected firm with the closest 30-day pre-trade return.[30] In each matched sample specification, we find results consistent with our non-matched sample estimations. Specifically, β_3 indicates that the increase in profitability of China insider sales from the pre-COVID-19 to the COVID-19 period is between 1.7 and 3.5 percentage points greater than the change in profitability of non–China insider sales, and the results in Columns 3 through 6 indicate that this was driven by the overall market return and not idiosyncratic firm returns. In untabulated analysis, we find that our results examining the volume of insider sales are similarly unchanged using a matched sample.

We further address this concern by dropping insiders of firms in the medical supply industry.[31] Manufacturers and suppliers of general medical supplies and protective equipment for medical use experienced a significant surge in demand for their products very early in the pandemic.[32] Thus, firms in this industry likely experienced positive returns during the months captured by our COVID-19 indicator, and it is possible that insiders of these firms profited by selling shares in their own firm stock following announcements of good news related to positive demand shocks. However, our results are substantially unchanged when we drop insiders of an industry that experienced good news during the COVID-19 period.

Our primary arguments focus on China insiders' anticipation of stock market declines because of their increased attentiveness to early COVID-related information. As a result, we expect and find that corporate insiders profited from executing sales in advance of the COVID-19 market crash. An alternative expectation would be that China connected insiders did not execute more, or even executed fewer, purchases based on their geographic information advantage. In untabulated analysis, we run Eq. 1 but instead examine returns following insider purchases; we find no evidence that China connected insiders earned significantly greater profits than non–China connected insiders on their purchases. Further, we also examine purchase volume and find no consistent evidence of China connected insiders having different purchase behavior. Our collective results therefore suggest that the information advantage of China connected insiders resulted in profitable sales in anticipation of the stock market decline.

We perform several untabulated additional analyses to ensure the robustness of our results. First, we use detailed information available in the Hoberg and Moon dataset to

[30] Specifically, we perform nearest neighbor matching on the pre-sale price runup holding the period (pre-COVID-19 and COVID-19) constant. We restrict our analysis to our two binary China proxies to allow for cleaner matching.

[31] Specifically, we drop trades by insiders at firms in the two or three digit SIC codes 38 and 384.

[32] See Cohen and van der Meulen Rodgers (2020) for further discussion.

Table 9 Profitability of insider sales – matched sample

DV:	*Profit*		*Profit_Firm*		*Profit_Market*	
China =	China Exposure	China Segment	China Exposure	China Segment	China Exposure	China Segment
	(1)	(2)	(3)	(4)	(5)	(6)
COVID	14.068***	14.528***	−0.933	−0.346	15.806***	15.840***
	(12.455)	(25.773)	(−1.060)	(−0.812)	(29.118)	(45.528)
China	0.044	0.003	0.227	0.259*	−0.162*	−0.222***
	(0.124)	(0.016)	(0.708)	(1.816)	(−1.842)	(−3.635)
*China*COVID*	3.480**	1.723**	0.911	0.057	2.339***	1.308***
	(2.302)	(2.270)	(0.699)	(0.106)	(2.718)	(2.649)
Controls?	YES	YES	YES	YES	YES	YES
R^2	0.116	0.120	0.026	0.026	0.430	0.421
N	37,096	32,512	37,096	32,512	37,096	32,512
Industry FE?	Yes	Yes	Yes	Yes	Yes	Yes

This table presents OLS regressions of *Profit*, *Profit_Firm*, and *Profit_Market* on an indicator variable for whether the insider has China Exposure or a China Segment, an indicator variable for months falling in the COVID-19 period (*COVID*), and the interaction between the two. Controls are included, and we include industry fixed effects. *t*-statistics are reported in parentheses and are based on standard errors clustered by firm. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively. All variables are winsorized at the 1% and 99% levels

examine an insider's geographic connection to China with increased granularity. Specifically, we separately identify three categories of insiders with geographic connections to China based on whether, according to the Hoberg and Moon methodology, their firm 1) sells output to China, 2) purchases inputs from China with ownership of assets within China, or 3) purchases inputs from China without ownership of assets within China. Ex ante, we expect the weakest geographic connections to exist for insiders of firms that purchase inputs from China but whose public financial statements do not indicate ownership of assets within China. A lack of physical presence in China or direct relationship with a customer indicates a lack of a "boots on the ground" presence in China, which is our primary mechanism for the attentiveness gained from a geographic connection. The connection to China for this subset of firms is likely weakest because their physical connection to China is low; these firms do not have productive assets in China, nor do their revenues depend on China buyers. We find the geographic connections of insiders of firms that either output or input to China are associated with significantly higher profitability in the COVID-19 period than insiders of firms without geographic connections to China. Consistent with our expectations, we find that insiders whose geographic connections arise only from inputs from China (without ownership of assets) do not earn abnormal profits on their sales in the COVID-19 period.

To examine whether insider profits are driven by trades made before or after analyst revisions, we re-estimate our main profit analysis on subsamples of firms with and without an analyst forecast revision in the prior week We find, in untabulated analysis, that the interaction between COVID-19 and China connections is only significant for the subsample of trades made in the week *after* an analyst revision. This result is consistent with insiders not

front-running information that causes analysts to revise their forecasts but instead trading in response to public news not already incorporated into their firm's stock price during the COVID-19 period. This result further corroborates our expectation that insiders did not trade on material, non-public information, but instead better understood the implications of already public COVID-19-related information.

We re-estimate all our results using year and month fixed effects and find that they are substantively unchanged, suggesting our results are not driven by the cyclicality of insider sales. We use a two-year pre-COVID-19 period in our primary analyses but find that our results are not sensitive to the use of a one-year or a three-year pre-COVID-19 period. Finally, we vary the dates used to define both the COVID-19 and the early/late COVID-19 periods by one week in either direction and find that our results are substantially unchanged.

6 Conclusion

Baker et al. (2020) empirically document that no disease outbreak has affected the stock market more than COVID-19. In the aftermath of such significant market swings, public consciousness and media analyses typically focus on identifying the ex post winners and losers, often in the context of guiding future trading and investing opportunities.[33] In contrast to this ex post attention, we find that the stock sales of China connected insiders were more profitable ex ante than those of non–China connected insiders during the COVID-19 pandemic and that China connected insiders executed their sales earlier in COVID-19 pandemic than non–China connected insiders. Our results suggest that China connected insiders were better able to pre-empt stock price declines precipitated by COVID-19 because of their greater awareness of, and attentiveness to, public information about the virus and its potential effects on the supply chains and operations of firms. Further, we find that this result is predominantly driven by trades occurring outside of Rule 10b5–1 trading plans.

The results of this study contribute to the insider trading literature, specifically studies identifying the type of information acted upon by insiders in legal insider trades and the sources of information used by insiders. We extend this literature by documenting a geographic component to insiders' information advantage and by showing that the geographic connections of insiders to the early stages of catastrophic events may be used to glean insights about the events' impending effects. Our study is the first, to our knowledge, to find results consistent with a broad sample of insiders acting upon their private insights into an upcoming market crash in a predictable manner.

We also contribute to concurrent research examining firm and market behavior during the COVID-19 pandemic. These studies collectively describe that while firms did not anticipate a pandemic-related risk while preparing their 2019 annual reports (Loughran and McDonald 2020), firms were proactive in providing information to investors about the pandemic in the first quarter of 2020 (Wang and Xing 2020a,

[33] See, for example, articles published by the *Wall Street Journal* (https://www.wsj.com/articles/the-stock-market-is-finally-beginning-to-accept-reality-11589535001), *Fortune* (https://fortune.com/2020/02/24/coronavirus-stock-market-winners-losers/) and MarketWatch (https://www.marketwatch.com/story/stock-winners-and-losers-in-the-post-covid-19-work-from-home-world-2020-04-24).

2020b), going so far as to articulate specific pandemic-related risks they faced as a result of COVID-19 in their corporate disclosures (Hassan et al. 2020). Our results show that corporate insiders were better positioned to profit from their insights into this publicly disclosed information.

Appendix A

COVID-19 timeline through declaration of US national emergency

Dec. 1, 2019	Earliest known date of virus symptom onset in Wuhan, China.
Dec. 31, 2019	Chinese health officials inform the WHO about a cluster of 41 patients with a mysterious pneumonia. Most are connected to the Hunan Seafood Wholesale Market.
Jan. 1, 2020	Hunan Seafood Wholesale Market closes. Wuhan public security bureau brings in eight doctors for questioning who posted information about the illness on WeChat.
Jan. 3, 2020	Chinese institutions ordered not to publish any information related to the disease. US government is notified.
Jan. 9, 2020	China announces it has mapped the coronavirus genome.
Jan. 11, 2020	China records its first death.
Jan. 11 – Jan. 17, 2020	Prescheduled CCP meeting held in Wuhan. Wuhan Health Commission insists there are no new cases
Jan. 13, 2020	First coronavirus case outside of China reported in Thailand.
Jan. 14, 2020	WHO announces Chinese authorities have seen no clear evidence of human-to-human transmission of the virus. Wuhan implements screening measures for travelers leaving the city through passenger terminals.
Jan. 17, 2020	The US begins screening travelers arriving from Wuhan at three airports.
Jan. 21, 2020	First US case confirmed in Snohomish County, Washington. A top Chinese doctor announces virus can be passed between people.
Jan. 23, 2020	Wuhan is placed under quarantine. WHO announces that the Wuhan coronavirus does not yet constitute a public health emergency of international concern.
Jan. 24, 2020	China extends the lockdown to cover 36 million people and starts to rapidly build a new hospital in Wuhan.

Jan. 30, 2020	WHO declares a global public health emergency.
Jan. 31, 2020	US declares a public health emergency. President Trump bans foreign nationals from entering the US if they were in China within the prior two weeks.
Feb. 9, 2020	Death toll in China passes that of the 2002-2003 SARS epidemic.
Feb. 19, 2020	Iran outbreak begins. Record high closings of NASDAQ Composite and S&P 500.
Feb. 21, 2020	Italy outbreak begins. Shutdowns in South Korea begin.
Feb. 23, 2020	Lockdowns in Italy begin.
Mar. 3, 2020	Spain outbreak begins.
Mar. 8, 2020	Nationwide lockdown in Italy.
Mar. 9, 2020	Beginning of 2020 stock market crash.
Mar. 11, 2020	WHO declares the outbreak a pandemic. President Trump bans all travel from 26 European countries.
Mar. 13, 2020	A US national emergency is declared over the novel coronavirus outbreak.

Sources: BusinessInsider.com https://www.businessinsider.com/coronavirus-pandemic-timeline-history-major-events-2020-3, Axios.com https://www.axios.com/timeline-the-early-days-of-chinas-coronavirus-outbreak-and-cover-up-ee65211a-afb6-4641-97b8-353718a5faab.html, the *New York Times* https://www.nytimes.com/article/coronavirus-timeline.html, CNN https://www.cnn.com/2020/02/06/health/wuhan-coronavirus-timeline-fast-facts/index.html, *National Review* https://www.nationalreview.com/the-morning-jolt/chinas-devastating-lies/, Wikipedia, and The World Health Organization https://www.who.int/news-room/detail/08-04-2020-who-timeline%2D%2D-covid-19. Solid white boxes represent dates in the pre-COVID-19 period, while shaded boxes represent dates falling in the COVID-19 period

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