Examining Insider Trading Pattern During COVID

Minority Report
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Abstract

There are various investment approaches for wealth accumulation such as stock investments including passive and active strategies, bond investments and real estates. I explore use of insider trading patterns as useful aid for investment. I use COVID-induced market downturn in 2020 March and subsequent recovery as a natural experiment to examine insider trading pattern. I collect insider open-market buy and sale information from Securities and Exchange Commission (SEC) and then calculate buy-to-sell ratio grouped by 19 industries and aggregated on monthly basis from 2020 January to 2021 June. Based on buy-to-sell ratio, I find trading patterns which suggest insiders are mindful of market conditions, and tend to trade when they believe there are disconnects between market and their perception of the companies. Monitoring insider trading patterns can provide insights into the companies.

1. Introduction

Academic research has in general shown insider trading can provide insights into company performance and corresponding share prices [5]. In particular, clustered insider open-market buy is shown to have strong connection with company performance. Following this line of research, I use COVID-induced market downturn as a natural experiment to examine insider trading patterns.

2. Background

There are fewer jobs offering pension (defined-benefit) schemes now and the majority of people use 401K or similar defined-contributions scheme to financially prepare for retirement. As a result, people have taken on the responsiblity of managing and investing their own money regardless whether they are able to handle the responsibility.

There are various investment approaches including stocks, bonds, private equity and real estates. However, since COVID-induced market crash in 2020 March, the financial market and housing market have significantly risen. Unless people have correctly timed the market, the current market appears to be highly valued and do not appear to offer appealing investment opportunities. I review selected investment approaches and show why they may not be appropriate in current conditions.

W. Buffet has suggested people who are not financially savvy should invest in S&P500 index fund because the index fund has low managerial overhead cost, offers diversification and benefits from growing US economy (See W. Buffet annual report and annual shareholder meeting for his opinion on investing and S&P500 index). One drawback for S&P500 index is the method is similar to momentum trading. When Tesla and Moderna were added to the index in 2021, the index bought these companys' stock at high valuation. In general, when a company's stock price rises and its market capitalization increases, the index mandates buying the company's stock to match the increased market capitalization. Similarly, when stock falls, the index sell the stock. While the index method has produced positive past result, it does not guarantee future positive return especially in environment in which easy money is harder to come (rising interest rate and reduced quantatitive easing to contain inflation as indicated by Federal Reserve at end of 2021). The indexing method also does not exploit value investing or contrarian investing mind set in which stocks are bought cheaply and sold dearly. In fact its momentum trading similarities make it appear to be the oppositie of value investing.

J.C. Bogle also suggested stock and bond split each investing in broad market index as long-term investment strategy [2]. While I think the strategy is sound in normal times, it may not be appropriate now because interest rates in US is extremely low. As interest rates will likely rise in future, the bond price and the bond index must lose value. Given the extra-ordinary money printing by the Federal Reserve, there is easy money everywhere resulting in measured inflation, allevated stock price and high housing price. Given this circumstance, broad US stock index is unlikely to have good future returns when cheap money disappears as the Federal Reserve reduce quantatitive easing and raise interest rate.

E. Chanceller argues investment should be made from capital cycle point of view [3]. Future outsized return is more likely when investment is made when capital is flowing out of an industry, and return is likely less when in-

vestment in environment in which capital is flowing into an industry. Applying this idea would suggest investing in oil and gas industry during its downturn in 2020, and avoiding green energy investment because of currently large capital inflow into the industry. Because of the quick rebound in oil and gas price, even investment opportunity in oil and gas industry is reduced.

Real estates is also popular investment approach. But with low interest rate, real estates price has significantly risen in 2020 and 2021. Future increase is less likely as the Federal Reserve increase interest rate and stop quantatitive easing, which includes buying mortgage-backed security. The effect will be increased mortgage interest rate. As mortgage interest rate increases, people can afford to take smaller mortgages, which reduce pressure on housing price.

This leaves the question of what to do for everyone who is forced to manage her money. Should she hire professionals to manage, who may not be able to beat S&P500, be taking risks beyond the comfort level of the client and charge significant fees. Or stick with indexing strategy with money split between bond and stock, with risk that monetary tightening having adverse effects on portfolio. Or stick with cash or low interest saving account and hope that the financial market crashes, offering buy-in opportunities. But no one knows when or if market will crash and rising inflation is constantly reducing cash's effective value. This is serious issue because retirement is dependent more on financial independence than age. Social security benefits may be insufficient to cover people's financial needs, so sound investment strategy is key to ensure financial independence.

My invest approach is centered around while general investment opportunities may be scarce, insider trading activity may provide insights into investment opportunities. When insider trading pattern is combined with other value investing approaches, the combined method may help the public decide when and at what price to buy or sell stocks.

Insiders are defined to be a company's directors, executives and owners with more than 10 percent ownership of the company. They are called insiders because they have material information on the company operations. As a result of their priviledged information, they are required to tell the public of their stock transactions shortly after the transactions. They inform the public by filing documents with US Security and Exchange Commission (SEC), whom then make the filings public and available through SEC website.

3. Related Work

Research on insider trading has generally shown concentrated insider buys correlate with outsized stock gain. Below is summary of some insider trading research.

[9] finds sustained insider purchase is associated with stock rising in the next six months and sustained insider sale is associated with stock falling in the future. [12] finds insiders are able to predict significant future stock price changes and they make informed trades. [8] finds insiders are contrarian investors, who buy when stock has not performed well in the past and sell when stock performance has done well. In addition, [8] finds insider buy is more informative of future stock performance than insider sale, and trades in small-cap companies are more informative. [7] calculates returns earned by insider on their trades and finds insider buy leads to outsized returns whereas sale do not lead to outsized returns. [4] also finds insider trades earn outsized return in Europe. [1] finds insiders tend to cluster their trades when they have informational advantage and their trades earn outsized return.

My approach is to use COVID-induced market crash in 2020 March and subsequent recovery as natural experiment to analyse insider trading patterns, and find insights which may be useful for general public.

4. Data Collection

SEC provide the public with insider trade information on daily or quarterly basis (`https://www.sec.gov/os/accessing-edgar-data`). For example, `https://www.sec.gov/Archives/edgar/full-index/2020/QTR4/index.html` provide year 2020 fourth quarter (Q4) insider trading records. form.idx on the website contain Form 4 (insider trade) form submitted during 2020 Q4. Table 1 is an example of an entry in form.idx.

Table 1: Sample entry in form.idx. CIK stands for Central Index Key which is a unique number assigned to all security issuers and owners by SEC.

Form Type	4
Company Name	1 800 FLOWERS COM INC
CIK	1084869
Date Filed	2020-10-14
File Name	edgar/data/1084869/0001437749-20-021140.txt

File name in form.idx when prefixed with "https://www.sec.gov/Archives/" create URL to access insider trade filing information in a text file. The text file contain XML section which can then be parsed to obtain transaction details such as insider name, security issuer name, transaction price and number of shares in transaction.

Program to parse insider trade form is written in Go programming language. The program parses form.idx and save all Form 4 type entry into database "idx" table. Figure 1 illustrate the data pipeline for collecting data. Table 2 provide database schema design for saving Form 4 entry from

form.idx.

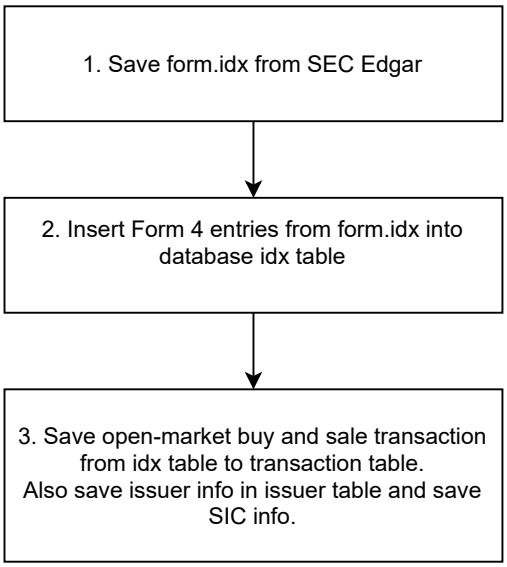


Figure 1: Data pipeline for collecting insider trade info from SEC website. First step is to manually download form.idx such as from `https://www.sec.gov/Archives/edgar/full-index/2020/QTR4/index.html` . Second step is to parse form.idx and save all Form 4 entry into database table named "idx". This is programmatically done using a program called "populateIdx". Third step is then to process all unprocessed Form 4 entry in "idx" table and record all open-market buy and sell transaction in database table called "transaction" using program "collect".

Table 2: Database schema for form.idx entries. Primary key is "accession" which is unique number for each SEC form filing and "processed" field indicate whether the form has been processed and added to database.

Field	Type
accession	varchar(64)
formType	varchar(32)
company	varchar(128)
cik	int unsigned
date	date
url	varchar(256)
processed	tinyint(1)

For each unprocessed row in "idx" table, program follows "url" field to parse transaction details. Table 3 show database "transaction" table.

Table 3: Database schema for Form 4 filings. Only open-market purchase ("P") and open-market sale ("S") are recorded (indicated by "tranCode" column). Only "stock" securityType is used for data analysis. "tranShare", "tranPrice", "tranAgg" indicate number of shares, transaction price per share and aggregate value of transaction ("tranPrice" multiplied by "tranSahre"). Note number of shares only applies if securityType is "stock". And "tranPrice" and "tranAgg" are recorded by multiplying the value by 100 to remove decimal. "sic" field is Standard Industry Classification Code (SIC) provided by SEC for each company. Some company may not have SIC code because SEC does not provide a value, in which case the company's SIC code is 0 (Unknown)

Field	Type
accession	varchar(64)
issuerCik	int unsigned
date	date
securityTitle	varchar(128)
securityType	enum('stock','notes','fund')
tranCode	enum('P','S')
tranShare	bigint unsigned
tranPrice	bigint unsigned
tranAgg	bigint unsigned
sic	int unsigned

Every issuer has database "issuer" table as shown in Table 4.

Table 4: Database schema for security issuer. Each issuer is identified by its CIK, name, security symbol and SIC code

Field	Type
cik	int unsigned
name	varchar(255)
symbol	char(15)
sic	int unsigned

Each SIC code has a database "sic" table which connect code to the industry name (Table 5)

Table 5: Database schema for Standard Industry Classification. Every code has a name description

Field	Type
sicCode	int unsigned
sicName	varchar(255)

4.1. Data Collection Problems

I enumerate the data collection problems I encountered.

4.1.1 Contradicting Transaction Code

[13] is a Form 4 submission in which Section 3 Transaction Code is "P" (open-market buy) but Section 4 Securities is "D" (Disposed). This is confusing because open-market buy is typically associated with "A" (Acquired). To resolve this confusion, my program only use Transaction Code to determine whether stock is acquired or disposed in transaction.

4.1.2 Security Transaction Price Do Not Match Open-Market Price

Another question raised by [13] is secuirty transaction price is different from open-market transaction price. In the refered filing, transaction price per security is $5. But the open-market closing price is $9.35 on the day of transaction. The reason is the company had entered into security purchase agreement and reported the agreement in Form 8-K filing `https://www.sec.gov/Archives/edgar/data/1709682/000121390021019985/ea138891-8k_customtruck.htm`. Without knowing the purchase agreement and reviewing 8-K filing, Form 4 insider trade filing does not make sense. I learned this by contacting SEC [11]. My program assumes transaction price is correct and does not attempt to verify the transaction price unless the price is too high as explained in Section 4.1.3.

4.1.3 Aggregate Trade Value is Entered as Price Per Share

`https://www.sec.gov/Archives/edgar/data/1084475/0001760319-21-000040.txt` show transaction of penny stock (share trade around $0.1), but the total aggregate trade value is wrongly entered as price per share to be $10,179.95. To detect this error, I create rule for maximum price per share of $5000 with exception made for "Berkshire Class A common stock" and "NVR, Inc. common stock", both of which exceed maximum price per share limit. Additionally I create limit for maximum buy and sell aggregate value.

4.1.4 Fractional Share Trading

Shares can be traded in fractional amount such as in `https://www.sec.gov/Archives/edgar/data/26058/000120919121042032/0001209191-21-042032.txt`, in which 0.9014 share is sold through open market. I truncate all partial share in data collection, so that the share sold in the sample case is 0 instead of 0.9014.

4.1.5 Penny Stock

Penny stock are securities issued by small companies typically trading below $5.00 per share [6] [10]. An example of penny stock insider trade is `https://www.sec.gov/Archives/edgar/data/854608/000172186821000368/0001721868-21-000368.txt`. The filing contained 3 open-market purchases at $0, $0.001 and $0.16 per share. Because the first two transaction had price per share less than a cent, I ignored the transactions in my data collection.

4.1.6 Wrong Transaction Date

`https://www.sec.gov/Archives/edgar/data/1013934/0001179110-20-005463.txt` contain 10 open-market sales with 6 trades occuring on 2020-05-01, 3 trades on 2020-05-04 and 1 trade on 2029-05-04. The trade on 2029-05-04 must have been typo and should be 2020-05-04. It's difficult for me to programmatically detect such error in filings, and I do not check for such errors.

4.1.7 Security Price Have More Than 2 Decimal Digit of Accuracy

Security price may have more than 2 decimal digit of accuracy such as $25.2428 in `https://www.sec.gov/Archives/edgar/data/947484/000117911021006739/0001179110-21-006739.txt`. In such case, only 2 decimal digit of accuracy is kept so $25.2428 become $25.24.

4.1.8 Identifying Different Security Type

There are different security types in Form 4 filings. For example, `https://www.sec.gov/Archives/edgar/data/1777529/000139834420008068/0001398344-20-008068.txt` is trading "fund" security. There are also "bond" or "notes" security such as in `https://www.sec.gov/Archives/edgar/data/1495222/000110465921052121/0001104659-21-052121.txt`. Because I am only interested in "stock" security, I need to differentiate security types. I differentiate security types by looking for keyword occurances in security title.

5. Data Analysis

I collect insider trade data from beginning of 2020 to end of June, 2021. My aim is to analyze insider trade patterns based on industry. To do this, I found list of S&P500 constituents companies [14]. For each S&P500 company, I find its SIC from SEC website using program "update_sp500_classification". I then group the companies into major industrial groups broadly following the groups

defined by Dow Jones (19 total industries). This way I create mapping from SIC to industrial groups (Table 6). For every company involved in an insider trade, I use the company's SIC from SEC to catagorize it to an industry group.

I then use SQL query to get monthly aggregate open-market buy and sell value per industry from beginning of 2020 January to end of 2021 June. I use open-market buy-to-sell ratio as indicator for insider's stock sentiment and only consider stock security transactions, excluding bonds or funds. For comparison, I also create figure for S&P500 index during same period (Figure 5 source: `https://fred.stlouisfed.org/series/SP500`). S&P500 index was abruptly down from approximately 3400 in 2020 Febuary to 2200 in 2020 March due to COVID induced economic slow down. Since then S&P500 has strongly rebounded and reached 4300 by end of June 2021.

I find the buy-to-sell patterns for various industries can be broadly broken into 3 groups (Table 7): "Contrarian", "Bought-then-Got-Scared" and "Things-are-Looking-Up".

The "Contrarian" (6 industries) group exhibits significantly higher buy-to-sell ratio in 2020 March and April. It seems the insiders in these industries recognized value investing opportunities and did not panic sell during market downturn. For example, "Oil and Gas" industry insider buy-to-sell ratio is highest in 2020 April when the economy was locked down. It seems the insiders felt bullish about "Oil and Gas" prospect at that time while the market felt pessimistic (Figure 2e). Another example is "Automotives" industry in which insider buy-to-sell ratio was significant from 2020 March to June (Figure 2a). It appears the insiders are convinced the market is undervaluing the industry.

Another group, which I call "Bought-then-Got-Scared" (9 industries), has high buy-to-sell ratio early in 2020, but significantly reduced buy-to-sell ratio after the economic lockdown began. I think the insiders, who did not realize the extent of the COVID impact, were genuinely fearful after lockdown began. An example would be "Transportations and Logistics" industry which had high buy-to-sell ratio in 2020 January and February and much lower ratio in subsequent months (Figure 3h). This can be explained because the "Transportations and Logistics" insiders were genuinely fearful of the COVID lock down effect on their industry, which was significantly impacted. Another example is "Software and IT" industry, which benefited from lock down induced remote working (Figure 3g). While buy-to-sell ratio is significantly lower in April 2020 compared to March 2020, as insiders realized the benefits of remote working for their industry, their fear subsided and buy-to-sell ratio gradually increased.

The final group called "Things-are-Looking-Up" (4 industries) is where buy-to-sell ratio started peaking after June 2020. It seems insiders in this group took a wait-and-see approach and started buying when there was more clarity to the pandemic. For example, "Finance" industry buy-to-sell ratio is largest in 2020 July, several month after COVID lock down began and the Federal Reserve started its unprecedented move to support the economy (Figure 4a). "Heath Care" industry buy-to-sell ratio is relatively steady and largest in 2020 October, which may reflect insiders' optimism about their industry's essential role during pandamic, and positive vaccine development progress (Figure 4b).

Not all buy-to-sell ratios are easy to explain. For example, "Industrial Goods" (Figure 4c) and "Utilities and Waste Services" (Figure 3i) both have significant buy-to-sell ratio around 2021 April, one year after market downturn. One explanation is with COVID vaccination roll out, insiders felt good about their industries' prospect and decided to buy when the general market may have been undervaluing the companies.

6. Conclusion

I've used COVID-induced market downturn and recovery as a natural experiment to explore insider trading patterns. I used insider open-market buy-to-sell ratio grouped by 19 industries and aggregated on monthly basis as the method to analyze insider behaviour. I then try to explain the data by hypothesizing what the insiders may be thinking. While it is impossible to get into insiders head and find out their reasoning behind open-market trades, the data suggest insiders are mindful of market conditions, and tend to increase buying and reduce selling (increasing buy-to-sell ratio) when the market is undervaluing their companies.

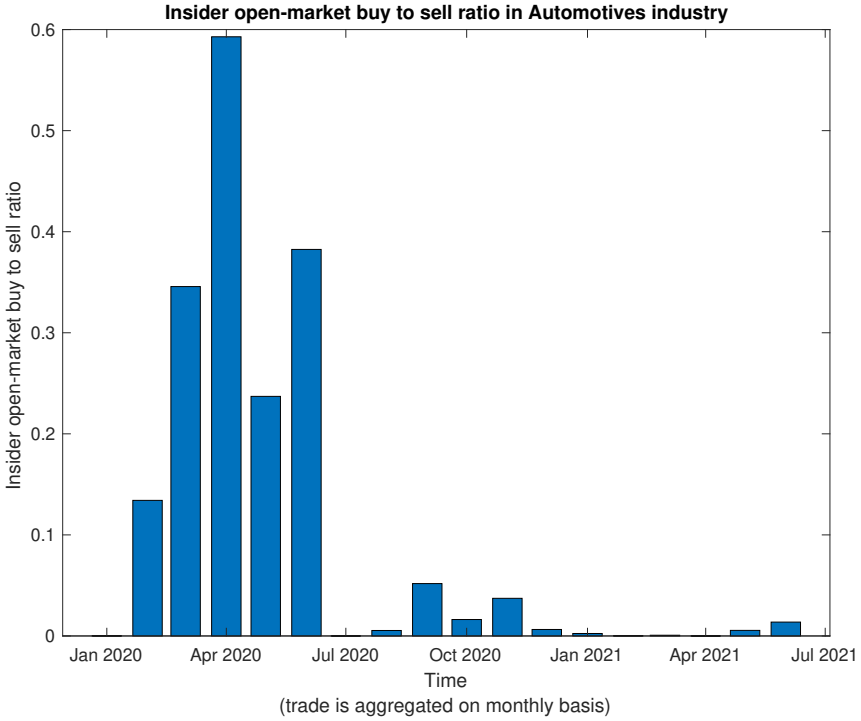
My method of aggregating companies into 19 industries can be over-generalizing and potentially be masking interesting insider trading dynamics at company level. To fully investigate the usefulness of insider trading as an investment signal, the investigation needs to focus at the company level. I have only analyzed time frame from 2020 January to 2021 June. It would be interesting to see how insiders behave over longer periods. Financial crisis (2007-2009) and dotcom bubble (2000-2001) also offer natural experiment opportunities to investigate insider trade pattern.

Table 6: Mapping of SIC to Industry

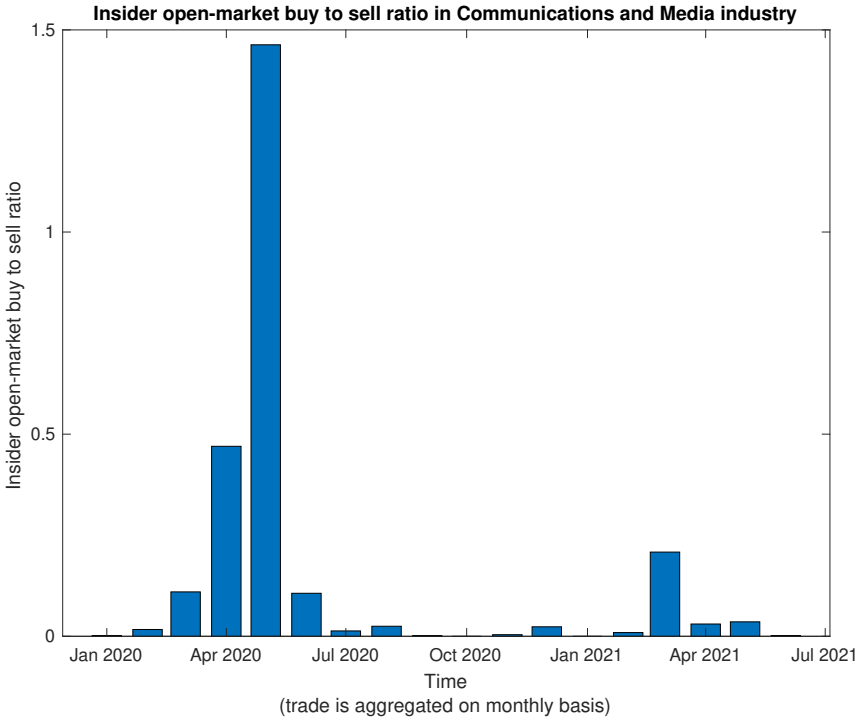
Industry	**SIC**
Aggriculture	100, 2870, 3523
Basic Materials	1000, 1040, 1400, 2621, 2650, 2670, 2800, 2810, 2820, 2821, 2860, 3060, 3312, 3350, 3357, 3411
Industrial Goods	3420, 3490, 3510, 3530, 3531, 3550, 3559, 3560, 3561, 3590, 3600, 3621, 3678, 3823, 3827, 3829, 3990, 7359
Oil and Gas	1311, 1389, 2911, 3533, 4922, 4923
Real Estate and Construction	1520, 1531, 1600, 1731, 2273, 2430, 2851, 3430, 3585, 3822, 5200, 5211, 6500, 6798, 7340
Food	2000, 2011, 2015, 2030, 2033, 2040, 2060, 2070, 2080, 2082, 2086, 2090, 2111, 5140, 5411
Consumer Goods	2300, 2320, 2510, 2840, 2842, 2844, 3021, 3089, 3100, 3630, 3944, 5600, 5621, 5651
Communications and Media	2711, 4812, 4813, 4833, 4841, 7311, 7841
Health Care	2834, 2835, 2836, 3826, 3841, 3842, 3843, 3844, 3845, 3851, 5047, 5122, 5912, 6324, 8062, 8071, 8090, 8731
Electronics and Semiconductors	3570, 3571, 3572, 3576, 3577, 3663, 3674, 3825, 5045, 5065, 5731
Software and IT	7370, 7371, 7372, 7373, 7374
Automotives	3711, 3714, 5010, 5013, 5500, 5531
Aerospace and Defense	3720, 3721, 3724, 3728, 3730, 3760, 3812
Transportation and Logistics	3743, 4011, 4210, 4213, 4400, 4512, 4513, 4700, 4731
Utilities and Waste Services	4911, 4924, 4931, 4932, 4941, 4953, 4991
Retail and Wholesale	5000, 5090, 5331, 5961, 5990
Finance	6021, 6022, 6035, 6141, 6199, 6200, 6211, 6282, 6311, 6321, 6331, 6399, 6411, 7320
Restaurant Leisure and Hospitality	5810, 5812, 7011, 7900, 7990
Business Services	7363, 7380, 7381, 7389, 8700, 8741

Table 7: General Grouping for Insider Buy-to-Sell Trading Pattern

Groups	**Industries**
Contrarian	Automotives, Communications and Media, Electronics and Semiconductors, Food, Oil and Gas, Retail and Wholesale
Bought-then-Got-Scared	Aerospace and Defense, Aggriculture, Basic Materials, Business Services, Consumer Goods, Real Estate and Construction, Software and IT, Transportation and Logistics, Utilities and Waste Services
Things-are-Looking-Up	Finance, Health Care, Industrial Goods, Restaurant Leisure and Hospitality

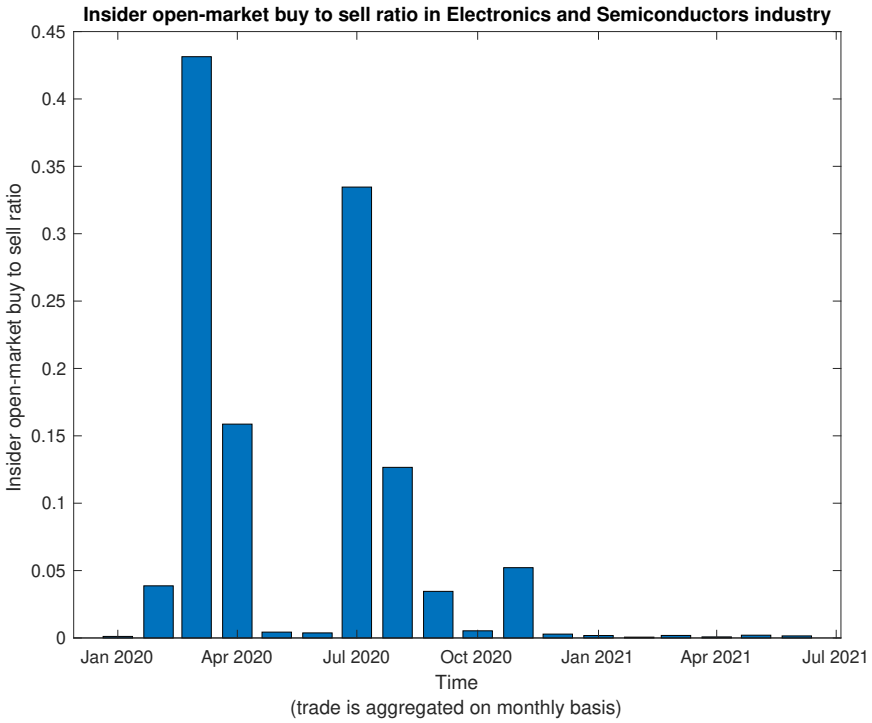


(a) Automotives

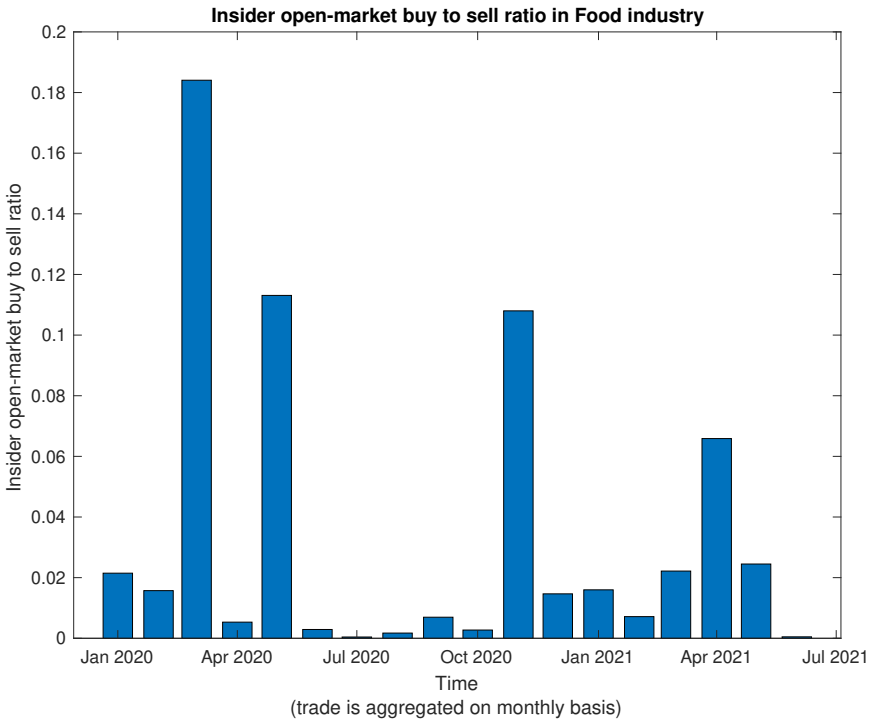


(b) Communications and Media

Figure 2: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Contrarian" Group

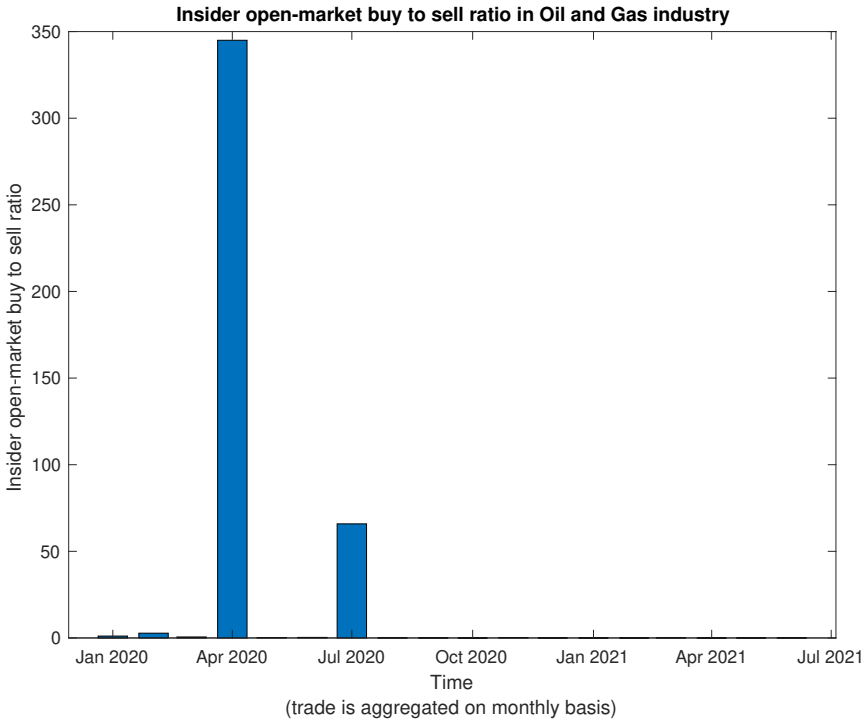


(c) Electronics and Semiconductors

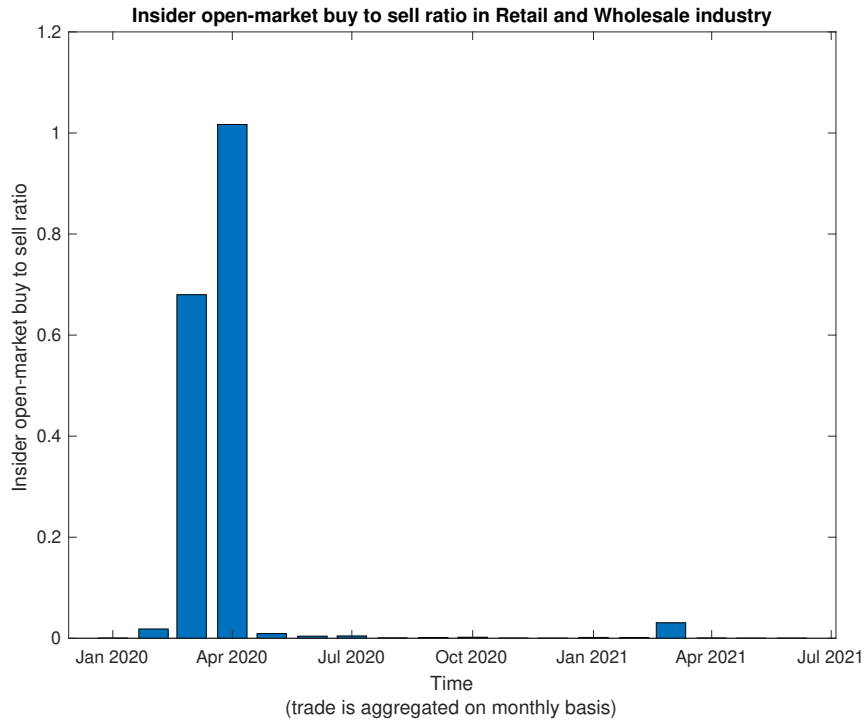


(d) Food

Figure 2: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Contrarian" Group

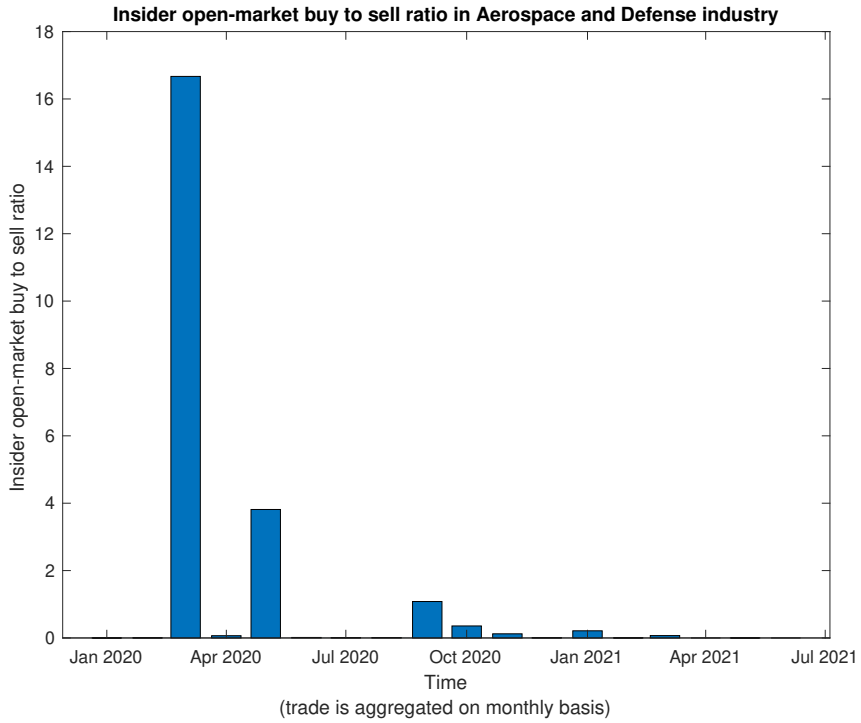


(e) Food, Oil and Gas

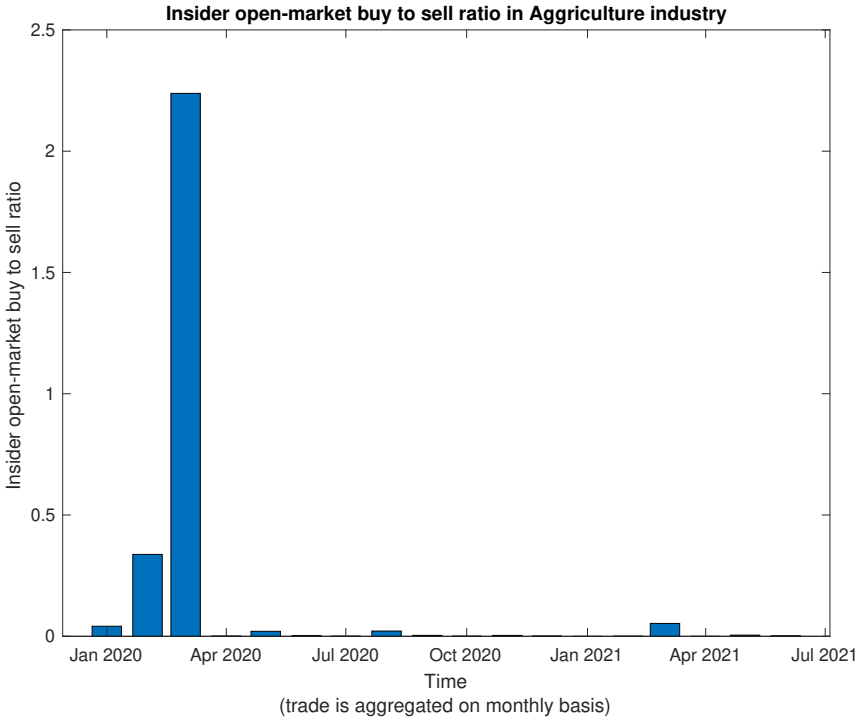


(f) Retail and Wholesale

Figure 2: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Contrarian" Group

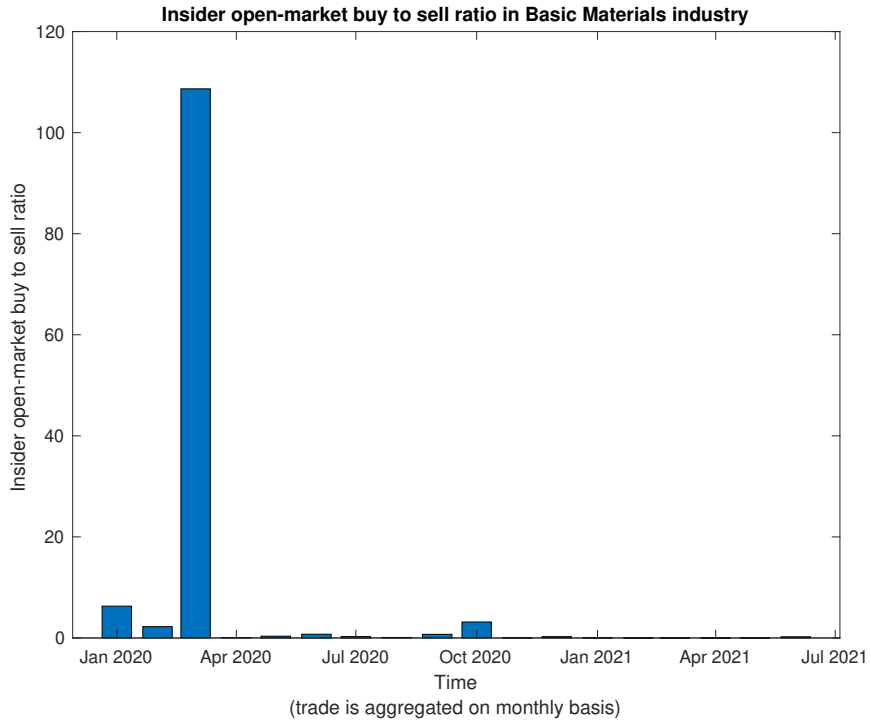


(a) Aerospace and Defense

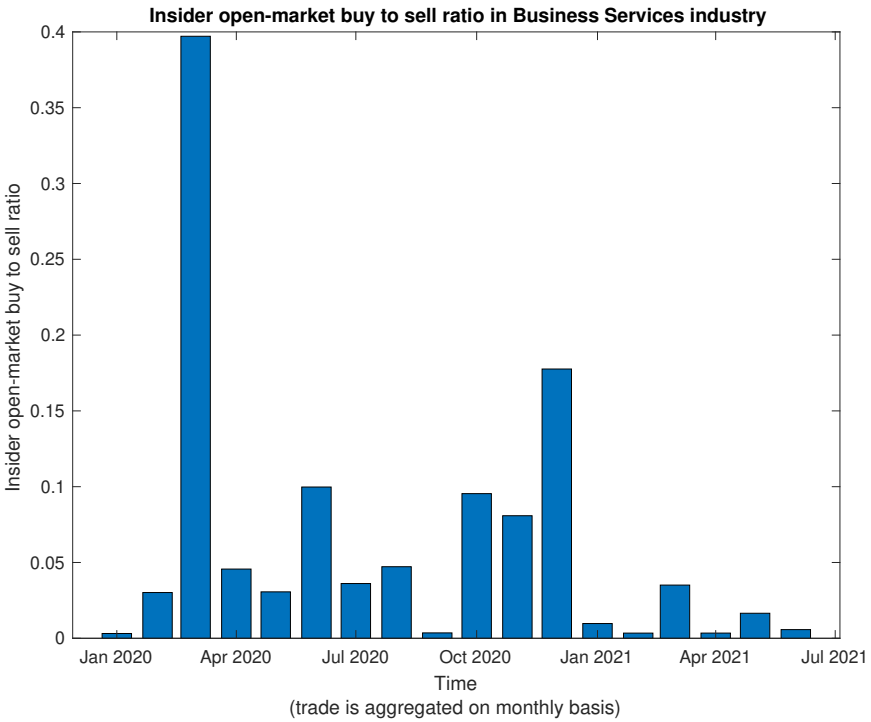


(b) Aggriculture

Figure 3: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Bought-then-Got-Scared" Group

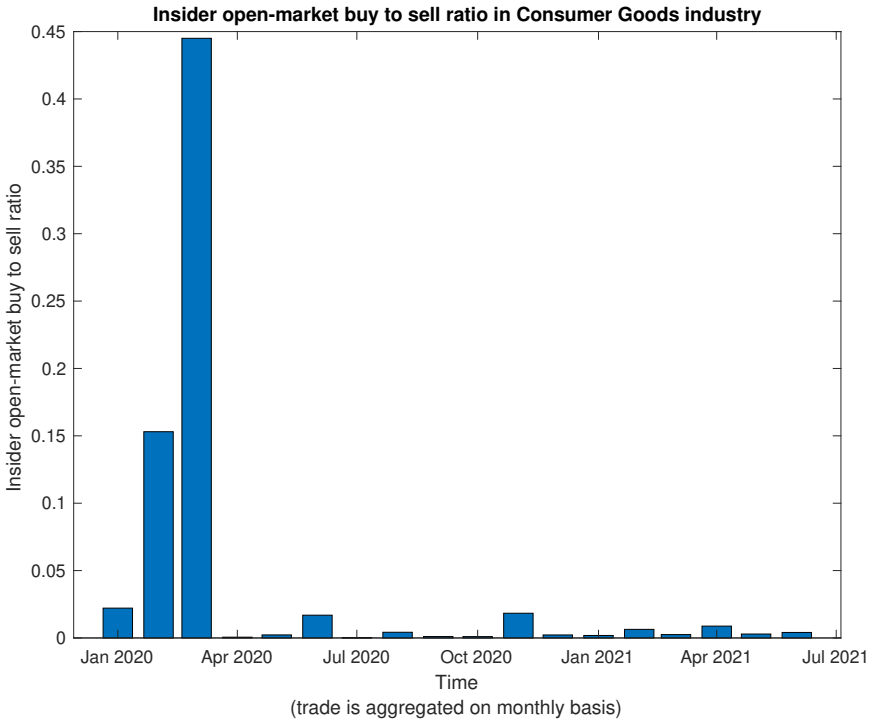


(c) Basic Materials

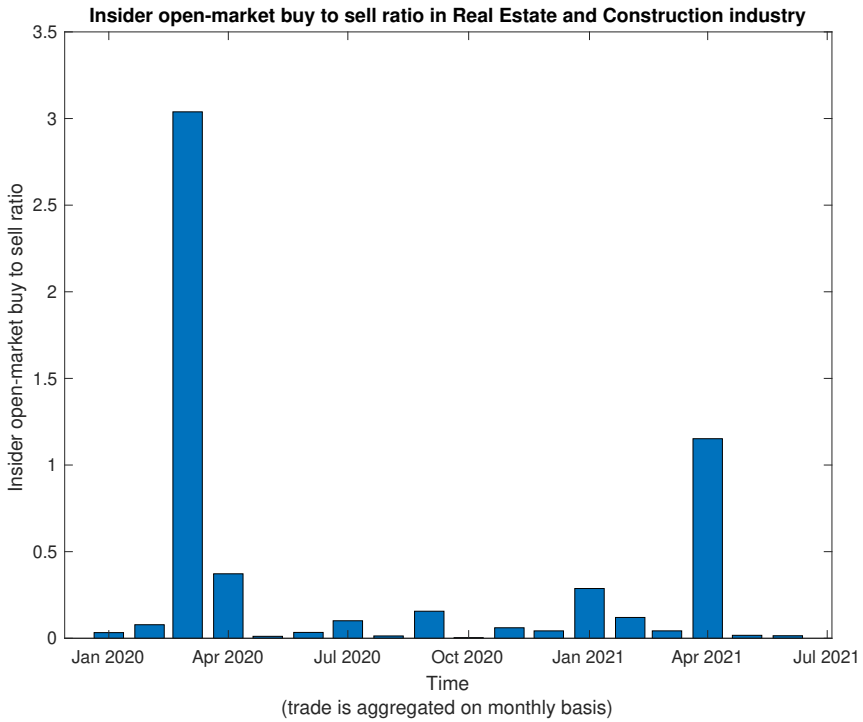


(d) Business Services

Figure 3: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Bought-then-Got-Scared" Group

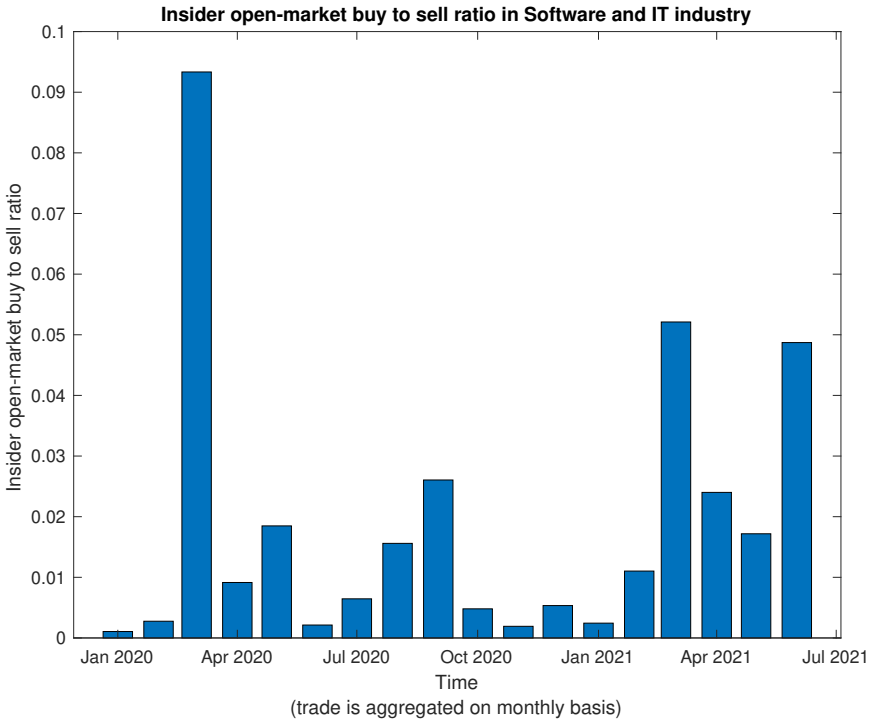


(e) Consumer Goods

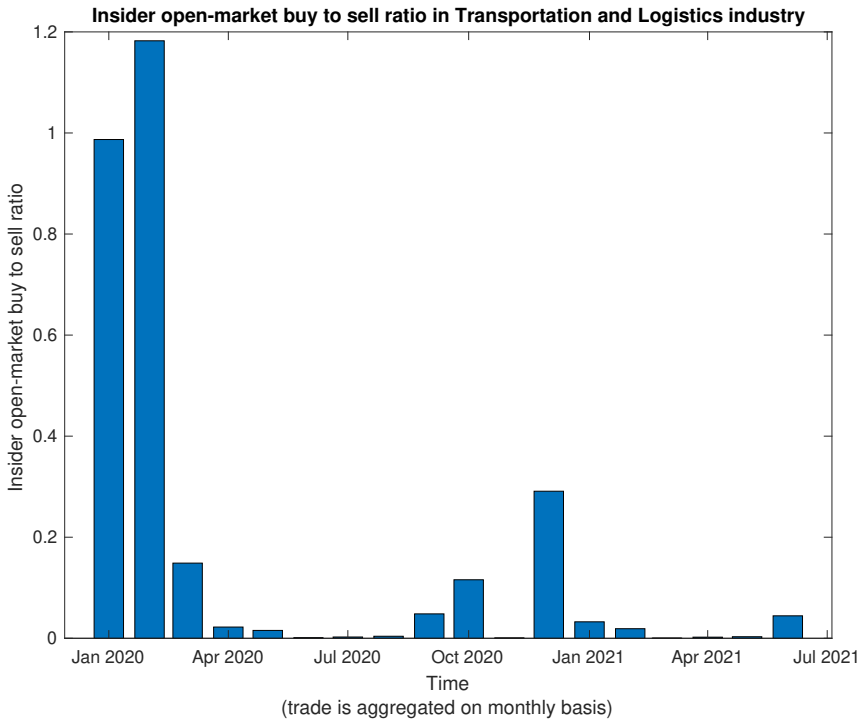


(f) Real Estate and Construction

Figure 3: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Bought-then-Got-Scared" Group

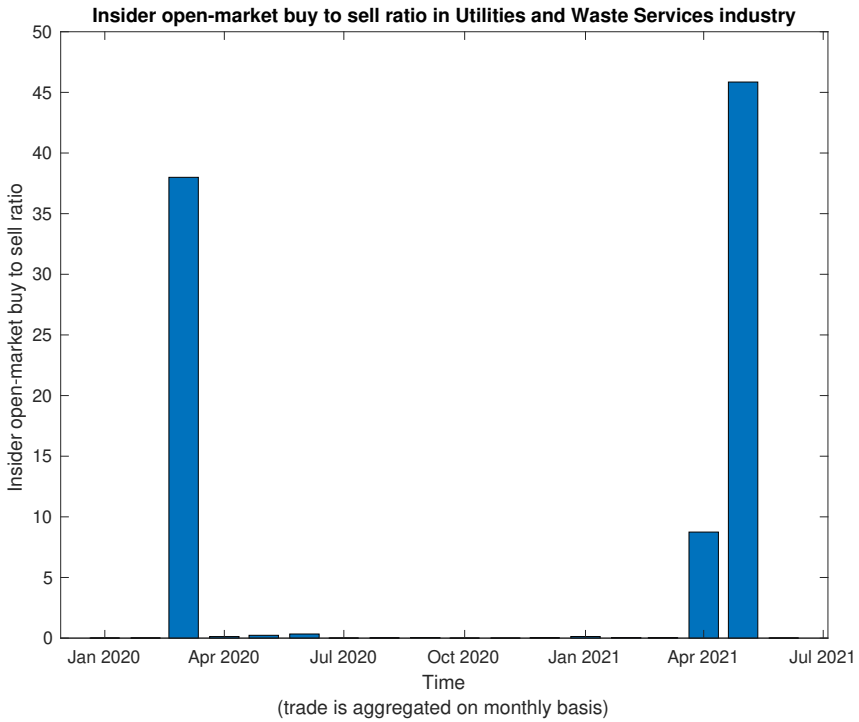


(g) Software and IT



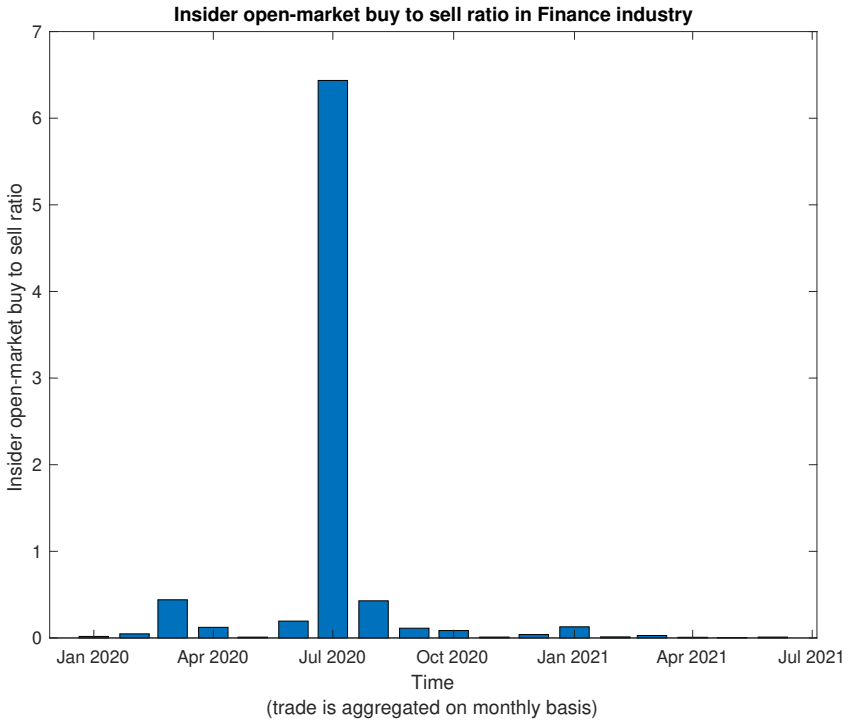
(h) Transportation and Logistics

Figure 3: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Bought-then-Got-Scared" Group

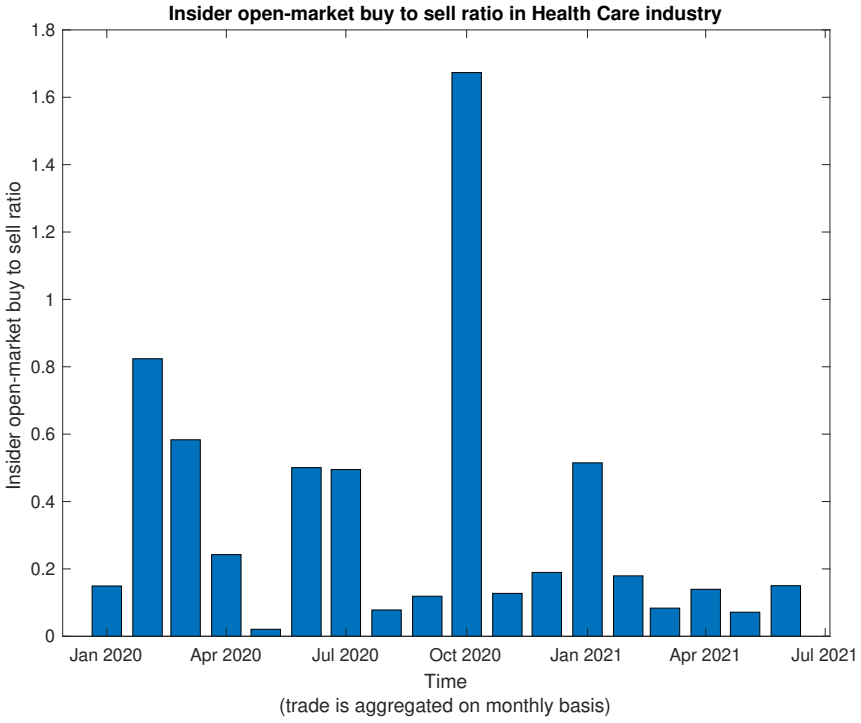


(i) Utilities and Waste Services

Figure 3: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Bought-then-Got-Scared" Group

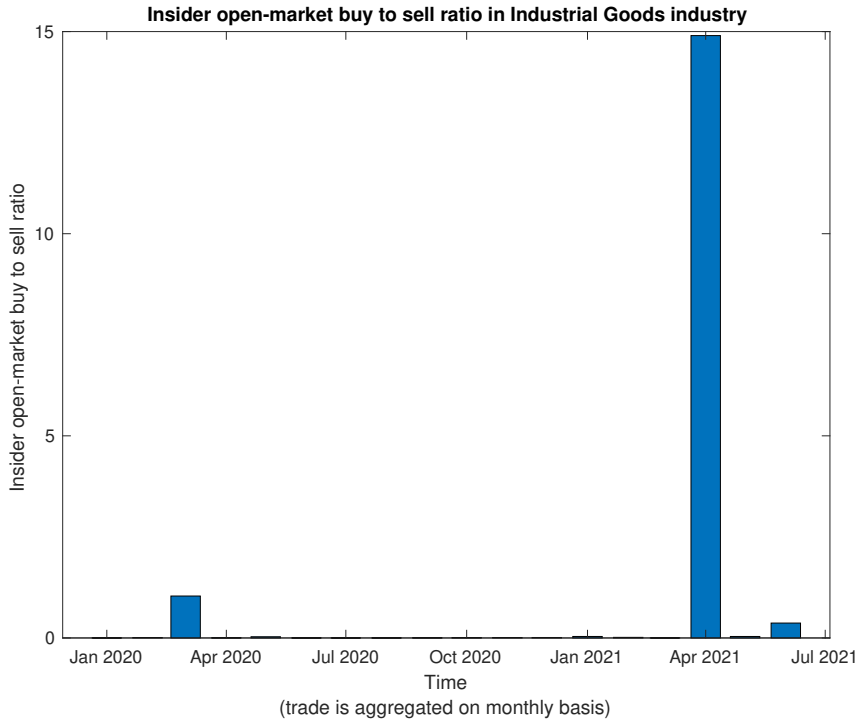


(a) Finance

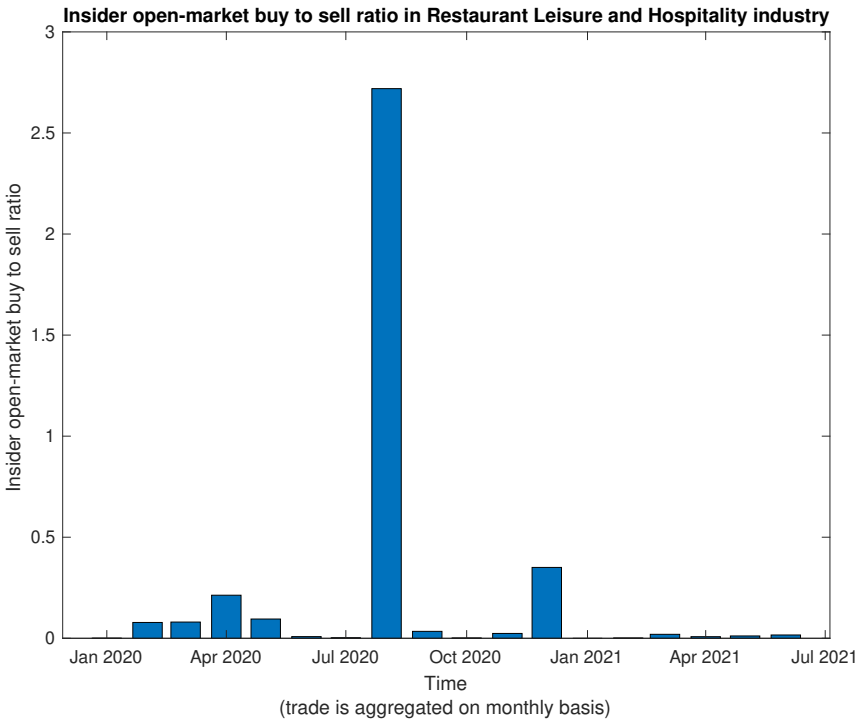


(b) Health Care

Figure 4: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Things-are-Looking-Up" Group



(c) Industrial Goods



(d) Restaurant Leisure Hospitality

Figure 4: Insider Open-Market Buy to Sell Ratio Aggregated on Monthly Basis for "Things-are-Looking-Up" Group

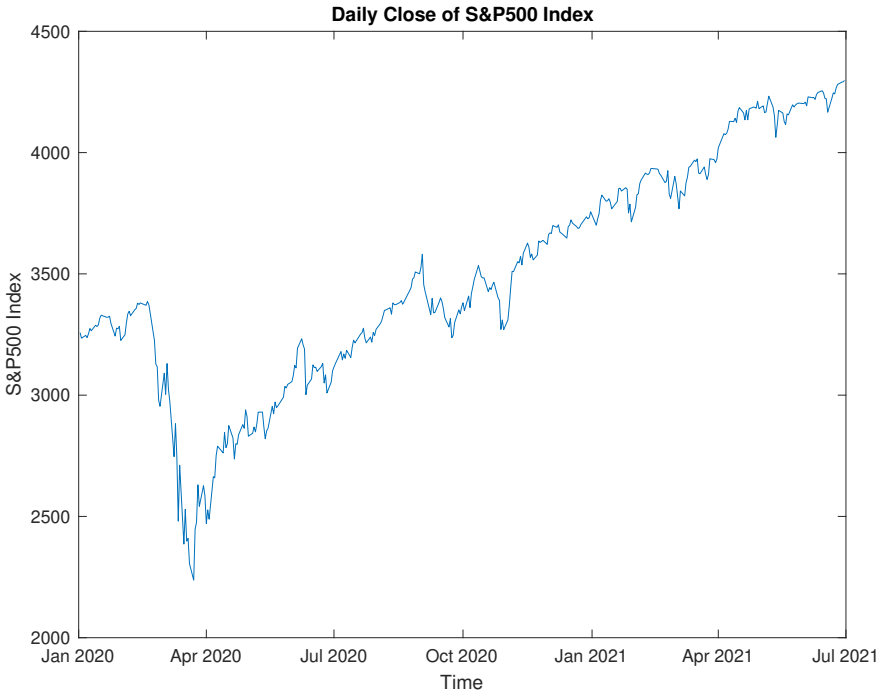


Figure 5: Daily Close of S&P500 Index

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