

Empirical analysis of the impact of stock splits on stock performance in the American stock market during the COVID-19 sanitary crisis (2020-2022)

Analyse empirique de l'impact des fractionnements d'actions sur la performance des actions sur le marché boursier américain durant la crise sanitaire du COVID-19 (2020-2022)

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Abstract:

Stock splits refer to a corporate action taken by management and approved by shareholders that aims to boost a stock's liquidity and therefore its accessibility to a wider pool of investors through making said stock available in a lower denomination, but otherwise has no impact on the company's market cap nor does it dilute the ownership stakes of existing investors.

For these reasons, stock splits have been known to broadcast positive signals to a splitting company's environment as it carries with it a sense of confidence in the company's prospects, and therefore stock splits are assumed to influence stock performance in a variety of ways, through them taking effect or simply by the mere fact of their announcement, such comprises the base hypothesis that this paper aims to study.

A comprehensive research paper published in 1996 by David L. Ikenberry, Graem Rankine and Earl K. Stic entitled: "What do stock splits really signal?" which examined 1250 stock splits in the 1990s and studied their impact on stock performance compared to the overall market has concluded that over a one-year interval, splitting companies have outperformed the market by close to 8% on average, and therefore came to the conclusion that a strong link exists between stock splits and positive excess return for stock splitting companies over the market reference index.

This paper covers a different context, one that takes place over 2 decades later and has been marked by the COVID-19 pandemic crisis, and through the analysis done as part of this paper - which covered 55 companies over 2 and a half years (split into three data sets and put against the S&P 500 market index) - has come to the conclusion that no such meaningful relationship exists between splits and excess returns during the studied period, both on announcement and effective dates, with average short-term results ranging from 1.8% to 2.9% at best, and negative long-term average returns ranging from -8.1% to -2.3%. (It is also worth mentioning that, on their own, stock splitting companies achieved a 12.7% average return after one year, but still failed to beat the market index).

The large cap-only analysis set shows a reversed picture: inferior short-term average returns (both for effective and announcement dates) but superior long-term average returns (In the case of the effective date they still fell short of the market index, but managed to slightly outperform it by a 2.6% margin).

Keywords: Stock Splits, American stock market, Stock performance, S&P 500, COVID-19

JEL Classification : G10, G14, G3

Paper type : Empirical analysis

1. Introduction :

In theory, stock splits are supposed to be a rather unremarkable corporate action that merely results in a company's stock being traded at a lower denomination, without diluting or affecting the ownership stakes of existing shareholders in any way, the market value also remains unchanged. Over the years however, empirical studies have produced mixed results as to how stock splits affect stock performance in the United States, the world's largest stock market.

Some relatively early research (Fama, Fischer, Jensen and Roll, 1969) had come to the conclusion that no significant connection exists between stock splits and stock performance, while more recent studies dating from the 1980s, 1990s and early 2000s (Grinblatt, Masulis and Titman, 1984; McNichols and Dravid, 1990; Maloney and Mulherin, 1992; Ikenberry, Rankine and Stice, 1996; Ikenberry and Ramnath, 2002; and Byun and Rozeff, 2003) have concluded that a consistent positive correlation does in fact exist between stock splits and stock performance, thus questioning the "trivial" and "cosmetic" nature of the corporate action alluded to earlier.

Outside the United States, only a handful of research papers exist: Canada (Kryzanowski, Zhang, 1993), Switzerland (Kunz, Majhensek, 2004), Hong Kong (Leung, Rui, Wang, 2006) and India (Chavali, Zahid, 2011).

Multiple hypotheses have been put forward in an attempt to explain the connection between stock splits and stock returns: the signaling hypothesis, the optimal trading range hypothesis, the liquidity hypothesis, the tax option hypothesis and the managerial entrenchment hypothesis.

Empirical studies aside, stock splits have long been considered a strong sign of positive performance and growth for the companies that issue them.

While the decision to split a public company's shares does not inherently affect their value nor does it alter the overall market capitalization of the company, it does transmit to the market a certain signal of confidence which lies in the company's desire to make its shares more accessible to investors, especially retail investors that may not be able to afford entry into the company's equity in a significant way.

For this reason it has been assumed that announcements of stock splits hint at a strong probability that the shares of the companies in question may be likely to rise following said corporate action, encouraging some investors to purchase the stock after the announcement in the hopes of pocketing a significant profit when the split goes through and the value of the share rises, thus stock splits have acquired a reputation as a sign of good returns to come.

This behavior can be justified by the relatively recent pattern of companies (especially in the technology space) recording significant share price hikes following decisions to carry out stock splits, such companies include Alphabet, Amazon, Tesla, Apple and Shopify, to name a few.

This paper aims to explore the impact of stock splits on stock performance, with the American stock market as reference (being the largest stock market on the planet) during the retained timeframe, which extends from January 1st 2020 to April 30th 2022: approximately the two and half years marking the heights of the Coronavirus pandemic global crisis.

The only variable studied in this paper shall be the stock price of the companies whose shares were subject to a stock split during the aforementioned timeframe.

This paper aims to enrich the existing literature by covering an exceptional time period (that of the pandemic).

It also provides additional insight into the relative explanatory power of the research hypotheses presented above and further detailed in section 2.

This paper is structured as follows: section 2 covers the theoretical proposition as well as an empirical literature review, section 3 explains in detail the methodology followed and the data

used in the analysis, section 4 covers the analysis results and finally section 5 discusses the analysis results and concludes the paper.

2. The concept of stock splits in financial markets and empirical literature review of the connection between splits and returns:

In financial markets, a stock split designates a corporate action taken by the board of directors of a publicly traded company and approved by its shareholders to split the value of the current stock of the company by a pre-approved factor, which results in the number of shares outstanding (also known as the float of the company) increasing by the value of the factor, while their price decreases also by the value of said factor.

This decision does not inherently affect the market value (or market cap) of the company, as the “lost” value is counterbalanced by the increase in newly issued equity.

Stock splits also do not lead to stock dilution, as ownership stakes remain the same after the split goes into effect.

Therein lies the main draw - or effect - of stock splits on stock prices: accessibility to a larger pool of investors on the market, which stands to positively affect a stock's liquidity.

Liquidity in financial markets refers to the ease with which an asset can be traded between a buyer and seller without significantly affecting its price.

Since the publication of the paper “The Adjustment of Stock Prices to New Information” in 1969 by Eugene Fama and Lawrence Fisher, Michael Jensen and Richard and Roll, which is noted as one of the earliest academic empirical research papers that studied the connection between stock splits and stock performance, multiple research studies have been published and several hypotheses have been proposed in an attempt to explain how financial markets respond to stock splits.

The signaling hypothesis argues that stock splits broadcast a signal to the splitting company's environment with regards not only to its current performance but also its future prospects.

According to a research paper published in 1984 by Mark Grinblatt, Ronald Masulis and Sheridan Titman, entitled “The valuation effects of stock splits and stock dividends”.

The confirmation of significant positive returns around the stock split announcement\effective dates which have been demonstrated in a number of research papers (Ikenberry, Rankine and Stice, 1996; Mukherji, Kim and Walker, 1997; Ikenberry and Ramnath, 2002), which provides key evidence for the signaling hypothesis.

As for the optimal trading range hypothesis, stock splits represent a tool used to artificially realign the share price to a desired price bracket in order to render it more accessible to a wider pool of investors, notably retail ones.

If the current share price is deemed too high and restricting, then a stock split may be justified in an effort to boost its marketability (Baker and Gallagher, 1980; Lakonishok and Lev, 1987; McNichols and Dravid, 1990).

Furthermore, Angel (1997) argues that stock splits may be resorted to in order to adjust the share price into the price range where the institutionally mandated minimum absolute tick size is optimal relative to the share price in question.

Closely tied to the optimal trading range hypothesis, we have the liquidity hypothesis.

The latter argues that corporate liquidity is affected by the per-share trading price (Maloney and Mulherin, 1992; Muscarella and Vetsuypens, 1996).

If the current price reaches a certain height, then the liquidity may suffer as a result.

The hypothesis also highlights that lower per-share trading prices may be more optimal as they draw more investors and consequently reduce trading costs as a result of the increased liquidity.

Unlike the signaling and optimal trading range hypotheses, the evidence to the liquidity hypothesis has been quite mixed: Conroy, Harris and Benet (1990) display an increase in bid-ask spreads after stock split announcements while Ferris, Hwang and Sarin (1995) present the polar opposite.

Moreover, Maloney and Mulherin (1992) and Desai, Nimalendran and Venkataraman (1998) note an increase in trading volume after the splits have taken effect, and as such provide empirical evidence in favor of the liquidity hypothesis.

Next is the tax-option hypothesis, put forward by Lamoureux and Poon (1987), which suggests that shareholders may take advantage of tax-timing options in the event of an increase in the return volatility of the stock.

The last hypothesis covered in this section is the managerial entrenchment hypothesis, proposed by Demsetz and Lehn (1985), Morck, Shleifer and Vishny (1988), McConnell and Servaes (1990), and Krole (1995), which presents the argument that high share trading prices “entrench” non-wealth maximizing behavior in management, by not contributing to align the interests of top management with those of the investors.

According to managerial entrenchment proponents Lakonishok and Lev (1987), management resorts to stock splits to enlarge the ownership base so that the percentage of shares owned by large institutional investors is reduced, thus making it much harder for said investors to challenge them using their stakes as leverage.

On the flip side, it is worth noting that some companies avoid stock splits as much as possible in order to achieve the opposite effect: reducing the trading volume (liquidity) by maintaining the share price as high as possible.

The effects of stock splits may extend beyond liquidity and into the psychology of investors: if enough investors hold the belief that stock splits are indicative of a future significant rise in their value they may be tempted to rush to buy the stock, thus pushing up its price.

Stock splits may also influence the trading of options, since options-based trading strategies are considerably more accessible with cheaper stocks.

Given all the previous points, one might be led to assume that stock splits are inherently positive to a stock’s performance and that they indicate stronger performance to come.

However, while stock splits have historically had a material impact on a stock’s liquidity, nowadays many innovations have been introduced that likely dampen this impact, most notably the introduction of fractional shares, which are now provided by most online brokers (notably Robinhood has provided them since 2020) and allow investors to place as much money as they wish in a particular stock without having to abide by the obligation to commit to owning a full unit of stock, so while there may have been an impact to stock splits in the past, the current marginal benefit is likely to be less significant, even considerably so.

This paper aims to quantify the impact of these factors on the value of stocks that were subject to a stock split between January 2020 and May 2022 in order to conclude whether or not they can be considered a strong indicator of boosted returns while also providing evidence either in favor of or against the different research hypotheses detailed above.

3. Methodology and analysis data:

The study consists of collecting information related to every stock active on the American stock market that was subject to a stock split during the studied timeframe, which extends from January 1st 2020 to May 31st 2022.

The time frame was selected due to its relevance, as it recorded many significant stock splits carried by large corporations and was also the period during which the COVID-19 pandemic came

about, spread, hit its peak and then gradually withered, this period was also remarkable for recording huge jumps in the American stock market, carried by sectors that thrived during the pandemic (notable technology).

As to the numerical data related to the stocks in question, 6 closing values were retained on 6 separate dates: One day prior to the stock split taking effect, the day immediately after, 7 days after, 30 days after, 90 days after, and finally 365 days after.

Using said data, average, median and standard deviation values are calculated to measure the significance of the effect (if any) of stock splits on the studied variables.

Taking into account markets' tendency to price the assets before the actual splits go into effect, the analysis was repeated using the price of the day of the announcement of the split as well, providing two separate data sets to measure how the stock prices reacted to the news of the stock splits in question as well.

Finally, a third data set that only includes large cap companies is also included to eliminate any possible distortion of the results from companies with small caps, that may have a larger influence on the result, given their tendencies to be less liquid and more volatile.

As such, this third and final data set only retains companies with a market cap of at least 10 billion USD.

In order to keep the analysis apples-to-apples as much as possible, all the prices used in the analysis were adjusted for the stock splits.

Some entries were cut from the analysis due to incomplete pricing information and to avoid introducing needless bias, also, because some of the splits were more recent, some observations have partially missing data.

As such, 54 observations were retained for the analysis, representing 54 companies that went through 54 stock splits during the relevant timeframe, of which 30 had a complete set of data.

Finally, the resultant returns were compared to the S&P 500 average return over the same timeframe, in order to highlight how the overall market performed compared to just the companies that had stock splits, for the sake of completeness.

This is by no means a perfect sample size, but one that is sufficient for statistical significance.

It is also worth mentioning that the analysis has been done using calendar days, not trading days. The availability of the data relative to the analysis presents no constraints to speak of: all of the information about publicly traded companies is freely accessible, and in the case of this analysis, the data was pulled from Fidelity.com's stock split calendar from January 31st 2020 to April 30th 2022.

The criteria held to measure the reaction of the studied variables to stock split events are the following:

- Average return: Calculated by the sum of the overall returns over the specific time frames divided by the overall number of observations.
- Median return: Simply put, a median value divides a data set into two equal ranks, with exactly 50% of the values above its value and the other 50% below it.
- Standard Deviation: Which measures by how much the return values of the data set deviate from the average (or the mean value), and is calculated as the square root of the sum of the difference of each observation minus the set's mean value all squared which is then divided by the overall number of observations.
- Maximums and Minimums: Which represent the extremes for each value at each given date, i.e the highest and lowest values observed.

The conclusion as to the reaction of the selected stock prices to stock splits over the studied time frame depends on the significance of the evolution of the studied variables after the splits' announcement taking effect contrasted against their previous values and the performance of the overall market represented by the S&P 500 index, according to the statistical criteria alluded to above.

4. Empirical analysis results:

The results of the empirical analysis conducted in this paper which cover 55 stock splitting firms between January 2020 and April 2022 (of which 29 feature full data while the rest have partially missing data) are split into three separate data sets in an effort to maximize its accuracy and relevance.

Thus, the results are presented for effective dates, announcement dates and large cap positions only (including two subsets of effective/announcement dates).

The full raw data of each observation used to perform this study can be found in the annex table at the end of this paper.

4.1. Results of the first data set: Returns after stock split effective date:

Table 1: Returns (Post Effective Stock Split Date)

Value	+1 Day	+7 Days	+30 Days	+90 Days	+365 Days
Average	1.9%	1.2%	2.6%	9.4%	12.7%
Median	0.2%	-0.4%	2.2%	6.5%	12.4%
Standard Deviation	9.3%	15.3%	14.5%	37.9%	40.7%

Source: Yahoo finance historical data charts, Google finance historical data charts, Fidelity.com US stock split calendar (January 1st 2020-April 30th 2022)

As shown in the table above, the analysis results that include all the companies that had stock splits over the studied timeframe show a substantially wide standard deviation, ranging from 9.3% to as much as 40.7%, indicating that results were practically all over the place, and as such it is highly questionable that there is a significant correlation between stock splits and excess returns.

The average results were, however, much more reasonable, with nearly 2% average return after one day and as much as 12.7% after one year, which is definitely a considerable rate of return.

The median values tell a similar story, closely following the +30, +90- and +365-days averages, albeit lagging behind them in the short term (+1 and +7 days).

While a 12.7% average return over a calendar year and nearly 2% over a single day is quite impressive, it pays to contrast the performance data obtained through the analysis with the average returns of the S&P 500 index, which tracks the returns of the 500 most valuable companies in the United States by market value, as the shown in the table below (table 2).

Table 2: Returns (Post Effective Stock Split Date) VS S&P 500 returns over the same period (Stock return - Index return)

Value	+1 Day	+7 Days	+30 Days	+90 Days	+365 Days
Average	1.9%	0.6%	0.9%	3.7%	-11.3%
Median	0.3%	-1%	1.1%	-1.1%	-10.9%
Standard Deviation	9.6%	16%	14.7%	37.3%	37.2%
Maximum	53%	103.8%	56.6%	166.9%	45.7%
Minimum	-7.2%	-25.2%	-38.4%	-75.8%	-92.5%

Source: Yahoo finance historical data charts, Google finance historical data charts, Fidelity.com US stock split calendar (January 1st 2020-April 30th 2022)

The results of this second analysis clearly show that the stocks in question ended up performing quite poorly compared to the index of reference.

While the short-term returns show a small edge, after a full calendar year the stocks are seen to be meaningfully underperforming the index.

The average returns are particularly noteworthy, where the index is seen almost doubling the performance of the stocks in question: a very weak performance, to say the least.

In conclusion, the stock returns that may seem impressive at first glance are rendered less so when put against the returns of the index.

While the data at hand is insufficient to conclusively link the poor performance (compared to the index) to the stock splits in a meaningful way, it is - however - safe to conclude that if they did not harm the returns, they did not boost them either, indicating that said returns may have been due to the overall market performance and less a matter of stock splits pushing up returns.

Nonetheless it is hard to ignore the gains recorded immediately after stock splits take effect, as they are consistently significant, and so it is worth further investigating any potential factors that may have influenced the average +1-day returns.

The picture becomes clearer when the main source behind that near +2% return after 1 day are revealed to be caused mostly by 2 outliers: 2 companies (namely Generex Biotechnology Corp and Tiziana Life Sciences Ltd.) single handedly contributed 1.7 percentage points of the 1.9 observed, and it also happens upon further investigation that said companies are both micro-cap positions (both less than 100 Million USD) that were highly volatile, and would go on to lose most of their peak stock value (as of the time of conduct of this analysis) in the following shortly after the stock split took place.

Curiously, one of the companies in question (Tiziana Life Sciences Ltd.) may have had its stock value increase significantly one day after the stock split took effect due to a reason outside increased liquidity and investor accessibility: Tiziana trades under the ticker TLISA, which is one typo away from Tesla's TSLA, and Tiziana's stock split also rather curiously took place exactly one month before Tesla's (July 31st VS August 31st), while it is unlikely that a large enough subset of investors mistook Tiziana's stock for Tesla's to drastically affect its stock price, the possibility given the aforementioned coincidence is nonetheless worth entertaining.

As a result, any argument in favor of stock splits directly and positively impacting stock prices quickly falls apart, as the long-term results underperformed the market (quite severely, in fact) and

the short-term results were also primarily due to 2 highly volatile micro-cap outliers that went on to lose most of their value in the following months.

In conclusion, stock splits - in and of themselves - do not seem to meaningfully impact performance through additional investor capital (i.e increased liquidity).

4.2 Results of the second data set: Returns after stock splits announcement date:

While the announcement of a forthcoming stock split has no effect on liquidity or investor accessibility before said split actually takes place, stock splits remain a positive signal, since it directly implies that management strongly believe that the stock price will go higher provided it is given a significant boost in liquidity, and such a some investors may opt to buy before the split takes place in order to capture any returns that may result in the price of the share going upwards after the stock becomes exposed to more liquidity, and as such those that buy in at or around the announcement date may add buying pressure that increases the stock price, a self-fulfilling prophecy, if you will.

The following are the results when taking into account the date of the announcement of stock splits to measure weather it has any meaningful impact on stock performance compared to the date splits actually take effect:

Table 3: Returns (Post Stock Split Announcement Date) VS S&P 500 returns over the same period (Stock return - Index return)

Value	+1 Day	+7 Days	+30 Days	+90 Days	+365 Days
Average	2.7%	4.5%	4.8%	6.2%	-2.3%
Median	1%	-1.1%	-1%	2.7%	-7.6%
Standard Deviation	10.1%	19.4%	18.7%	33.1%	44.8%
Maximum	45.8%	103.8%	72.2%	171.8%	129%
Minimum	-22.6%	-33%	-30.4%	-60.4%	-79.1%

Source: Yahoo finance historical data charts, Google finance historical data charts, Fidelity.com US stock split calendar (January 1st 2020-April 30th 2022)

Once more, the results are not promising: the one-year returns are quite underwhelming while the median results are considerably more moderate and less impressive than the average ones, further suggesting that some outliers are heavily swaying the results.

However, what remains consistent are the short-term returns, namely the +1-day results, in this case the +1 indicates one day after the announcement of a stock split rather than that of the later taking place: offering 2.7% average and 1% median returns when put against index returns, comparable to those shown in the previous data set.

While a conclusion might be drawn that stock splits have a positive impact on returns in the very short term, when put against the index the returns are not high enough to conclusively justify that. In addition, it is worth highlighting that even if one were to assume that a strong positive correlation exists between stock performance and stock split announcements, it would be very difficult to develop a reliable trading strategy based on such assumption, as one would have to

correctly guess which stocks to invest in that are likely to split before not just the split, but also its announcement.

4.3 Results of the third data set: Large cap result only:

So far, the analysis has been based on a relatively wide range of companies, large and small, and so an argument could be made against the inclusion of small cap positions in the analysis data if the ultimate goal is to measure how stock splits affect returns when it comes to the large actors in the industry, such as Amazon or Alphabet.

This argument becomes more valid given the significant volatility associated with micro-cap companies and their inferior liquidity compared to large cap companies.

For these reasons, the numbers were run again as part of this third data set which only retains companies with a market value superior to or equal to 10 billion USD.

As before, the returns taken into consideration are both at the announcement and effective dates of the stock splits in question.

Table 4 : Returns - Large Cap Only (Post Effective Stock Split Date) VS S&P 500 returns over the same period (Stock return - Index return)

Value	+1 Day	+7 Days	+30 Days	+90 Days	+365 Days
Average	1.8%	2.1%	4.2%	1.5%	-8.1%
Median	1.2%	0%	1.9%	1.4%	-10.7%
Standard Deviation	3.5%	7.7%	8.7%	10.4%	32.2%
Maximum	7.8%	27.6%	23.2%	25%	45.7%
Minimum	-5.6%	-7.8%	-9.9%	-16%	-54.6%

Source: Yahoo finance historical data charts, Google finance historical data charts, Fidelity.com US stock split calendar (January 1st 2020-April 30th 2022)

Taking into account the effective split date, the average and median results are more in-line with the previous data set, for better and for worse: the short-term returns remain consistently positive and within a reasonable margin of each other, indicating the smaller cap positions were not a significant factor in skewing the average and median results, however, the long-term returns have remained consistently sub-par, with the S&P 500 index seen to be considerably outperforming this virtual basket of stocks.

Of significant note are the maximum and minimum values, which have been reigned in quite substantially when small cap companies were eliminated from the calculations.

The large cap-only results show a more mixed picture (Table 5), with lower overall short-term returns (which were consistently higher in previous data sets), but better overall long-term returns, particularly the average +365 days returns which are seen to outperform the reference stock index by about 2.5 percentage points (+365 days returns in previous data sets were consistently and significantly negative).

However, the standard deviation values are still very high, making it very difficult to put weight on the data provided above for any sort of conclusive commentary, as this indicates that a few outliers are likely to be tilting results one way or another, making it very challenging to use this

data as part of a reliable trading strategy aimed at capturing returns in the wake of a stock split's announcement or effective dates.

Table 5 : Returns - Large Cap Only (Post Stock Split Announcement Date) VS S&P 500 returns over the same period (Stock return - Index return)

Value	+1 Day	+7 Days	+30 Days	+90 Days	+365 Days
Average	0.7%	-0.3%	4.4%	6.4%	2.6%
Median	0.4%	-2.7%	2.9%	4.2%	-4.2%
Standard Deviation	8.4%	12.8%	12.8%	16.4%	51.4%
Maximum	18.3%	33.6%	35.2%	44.6%	129%
Minimum	-22.6%	-24.3%	-12.8%	-19.8%	-48.6%

Source: Yahoo finance historical data charts, Google finance historical data charts, Fidelity.com US stock split calendar (January 1st 2020-April 30th 2022)

It is also worth noting that by this point, we are dealing with a very small sample size of just 21 observations, of which only 12 have sufficient historical data for a full set of information, rendering it more difficult to synthesize any strong conclusions as to whether stock splits positively affect returns over the studied time frame.

5. Discussion of analysis results:

The results of the analysis of the different data sets presented above according to the statistical criteria applied to measure the impact of stock splits on stock returns show pretty much across the board no significant positive correlation throughout the COVID-19 pandemic window studied in the analysis (2020-2022).

Given that stock splits may influence stock prices in a number of ways, each scenario was studied individually to produce data as comprehensive as possible.

The first data set of this analysis studied the evolution of the stock returns after their respective splits took effect, across 5 different time frames, and the results - which would remain consistent throughout the rest of the analysis's data sets - have shown that +1 day returns were very consistently positive, while the long-term returns, most notably the +365 day returns, were also very consistently negative, when compared to the performance of the S&P 500 index which was used to represent the overall market.

While that is by no means to say that stock splits - in and of themselves - can be linked with future poor returns, it is safe to conclude that they do not seem to have a significantly positive effect either, which contradicts what the concept of a stock splits entails and what the corporate action signals to the market.

The second data set covers the second way stock splits may potentially influence returns, which is the mere fact of their announcement, much like the first set, this factor does not seem to hold any significance when it comes to boosting returns over those of the market, quite the opposite in fact in the case of long-term returns, which lagged behind the index's returns over the same period by

a huge margin, while the short-term returns (namely the +1 day returns) have remained consistently positive, and are shown to have outperformed the returns of the first data set up to the +90 days mark, indicating that indeed splitting stocks tend to slightly but consistently outperform the market in the short term, according to the average and median values, but still fail rather terribly in the long run (+365 days).

The only viable conclusion that could be extracted from this second data set is that the announcement of stock splits tends to have a marginally higher positive effect on returns than the split actually taking effect, at least partially confirming one of the research hypotheses related to how stock splits may influence stock returns, namely the signaling hypothesis.

The third and final data set, which only keeps companies with market values worth at least 10 billion USD in an attempt to rid the set of any bias introduced by small cap, highly volatile and less liquid positions to measure how the large companies' stocks react to splits, shows some interesting results: first, and unlike the previous sets, the short-term results were lower, particularly those that concern the announcement day, indicating rather surprisingly that large cap positions are less affected by news of an upcoming split, although in fairness that could be attributed as well to the generally stable and liquid nature of those particular stocks.

On the flipside, the long-term returns of the third set seem to be consistently outperforming the first and second sets and, in the case of the announcement date table, even outperforming the index itself, although again, these returns may be interpreted as the natural result of those companies being large and successful, and as such would have performed well regardless.

The ultimate conclusion of the analysis is that there seems to be little to no significant positive correlation between stock splits, whether they are taking place or the mere event of their announcement, and returns over the short and long term, with the main takeaways being that the announcement of a stock split is more likely to influence returns (positively) than it actually taking place, and that the observed evolutions of returns (positive or negative) were either not sufficiently significant to produce a strong link, or can simply be explained by either small cap, highly volatile and less liquid stocks belonging to smaller companies upsetting the results, or in the case of the large-cap only analysis, that positive return evolution can be more a matter of the companies being large, successful and have good prospects more so than a matter of stock splits uplifting their returns.

In other words: between January 2020 and April 2022 (i.e the duration of the pandemic's crisis), stock splits by themselves have demonstrated no meaningful influence over stock returns, and while they do not seem to meaningfully harm said returns, they definitely do not seem to boost them either.

This conclusion contradicts the results of the research paper published in the *Journal of Financial and Quantitative Analysis*, Volume 31, Issue 3, September 1996, pp. 357 - 375 by David L. Ikenberry, Graem Rankine and Earl K. Kan, entitled "What do stock splits really signal?", which has concluded that stock splits have boosted returns of splitting companies by almost 8 percentage points over 1 year of the stock splits taking effect, and also rather curiously, another conclusion of that paper was that the market under-reacted to split announcements, showing only a 3.38% uplift to returns.

It is also worth noting that the paper above was published in 1996, under very different circumstances, and that its sample size was much larger: 1275 2-for-1 stock splits.

The results also do not align with the hypotheses detailed in section 2, notably the liquidity hypothesis and optimal trading range hypothesis, as they do not explain the seemingly random of splitting stocks during the period this paper covers.

6. Conclusion:

In financial markets, stock splits designate a corporate action taken by management and approved by shareholders to increase the float of the company's shares by dividing existing shares by the agreed upon factor, effectively making said shares available for the market at a lower denomination, which in turn increases the liquidity of the stock and the ease of which it can be accessed by investors in the market.

Although stock splits are generally assumed to affect the performance of stocks in a variety of ways related to the signals this particular corporate action broadcasts to the market and its participants, the analysis presented in this research paper indicates no meaningful link between stock splits and positive stock returns following said splits within the context of this paper which takes into account both the coronavirus pandemic as well as the buzz surrounding several stock splits, notably that of electric automobile manufacturer Tesla.

The analysis revealed a trivial but consistent link between stock splits and very short-term stock returns (notably the +1 day of announcement or effective dates) compared to the index of reference (S&P 500), and given how pre-split runup and post-split excess returns were inversely linked, this indicates that such excess returns were unlikely to be the simple result of market momentum.

However, these returns - which are not very significant to begin with (peaking at just under 2%) - are heavily influenced by a few outliers, representing a couple of small cap, highly volatile positions responsible for most of the observed returns.

Indeed, this becomes more apparent when analyzing the large cap positions in a vacuum: where short term results drop to below those of the market index, further suggesting that even the short-term positive returns observed in the first two data sets were not representative of the overall market.

Ultimately, no link could be established with a reasonable degree of confidence regarding stock splits and their impact on returns, as even the stocks that performed well in the wake of a split went on to underperform (some quite severely) in the following months, and while this drop in performance also cannot be linked the splits alone, it is nonetheless worth considering.

Furthermore, with the exception of the large cap-only set, all other data sets consistently underperformed the market index after a year, and the former likely showed better performance more due to the companies' prior success and solidity, and less a matter of the splits themselves.

The main takeaway thus, is that during the COVID-19 induced global sanitary crisis between 2020 and 2022, a period characterized by a very strong performance in the American stock market, stock splits do not have any meaningful, long-term impact on performance, whether positive or negative.

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Appendix: Raw analysis data related to the 55 companies and their respective stock price performance following their respective splits:

Ticker	Ratio	Sector	Eff. date	Ann. date	-1 Day Price (\$)	+1 Day Price (\$)	+7 Days Price (\$)	+30 Days Price (\$)	+90 Days Price (\$)	+365 Days Price (\$)
GNBT	7:5	Health	2020-2-24	2020-2-21	0.44	0.65	0.87	0.58	0.76	0.41
ODFL	3:2	Indust	2020-3-25	2020-2-24	125.25	140.60	122.33	141.63	163.34	231.76
EW	3:1	Health	2020-6-1	2020-5-7	74.91	74.83	76.95	69	85.84	95.12
TLSA	2.5:1	Health	2020-7-31	2020-7-16	4.95	6.99	5.18	3.68	3.82	2.13
MRTN	3:2	Indust	2020-8-14	2020-7-17	18.68	18.60	18.81	17.77	17.75	15.14
POWI	2:1	Info-tech	2020-8-19	2020-7-30	58.27	56.82	57.53	53.56	68.07	98.74
AAPL	4:1	Info-tech	2020-8-31	2020-7-30	124.81	134.18	120.96	115.81	119.05	51.83
TSLA	5:1	Consumer-disc	2020-8-31	2020-8-3	442.68	475.05	418.32	429.01	567.60	735.72
TREX	2:1	Indust	2020-9-15	2020-8-12	69.95	70.11	68.24	78.33	82.97	108.08
RUSH A	3:2	Indust	2020-10-13	2020-9-14	37.70	36.28	36.17	37.46	44.17	47.82
NEE	4:1	Utilities	2020-10-27	2020-9-15	75.66	74.46	76.02	75.97	85.23	85.01
DQ	5:1	Info-tech	2020-11-17	2020-9-29	43.68	39.87	42.53	57.14	120.22	68.15
TPX	4:1	Consumer-disc	2020-11-24	2020-10-27	25.65	25.50	25.11	28.06	33.78	43.87
MKC	2:1	Consumer-stap	2020-12-1	2020-10-27	93.49	91.42	93.44	95.60	84.90	86.55
ROL	3:2	Indust	2020-12-11	2020-10-27	36.10	36.67	40.60	40.80	33.04	31.91
BEPC	3:2	Utilities	2020-12-14	2020-10-29	46.96	51.06	53.45	59.57	46.27	33.80
BEP	3:2	Utilities	2020-12-01	2020-11-4	38.69	41.14	39.91	47.21	41.27	33.30
SF	3:2	Financ	2020-12-17	2020-11-11	51.52	51.96	51.20	52.15	66.68	68.04
LSI	3:2	Real.est	2021-1-28	2020-12-2	82.06	81.58	84.41	83.90	94.86	134.33
EXPI	2:1	Real.est	2021-2-16	2021-1-4	77.89	72.91	63.45	47.73	28.16	29.44
FIZZ	2:1	Consumer-stap	2021-2-22	2021-1-19	50.40	48.39	48.99	46.85	46.12	42.33

HWK N	2:1	Material s	2021-3-2	2021-1-27	31.97	32.20	34.60	33.90	34.60	45.93
CLWT	1.67:1	Indust	2021-3-3	2021-1-28	2.18	1.97	2.17	2.36	2.32	1.36
APH	2:1	Info-tech	2021-3-5	2021-2-3	60.05	61.56	64.09	67.05	69.16	76.23
VRNS	3:1	Info-tech	2021-3-15	2021-2-5	58.50	56.72	55.13	55.75	53.91	37.90
ENPC	2:1	-	2021-3-26	2021-2-8	9.78	9.77	9.74	9.75	9.74	9.87
SHW	3:1	Material s	2021-4-1	2021-2-12	246	249.75	253.48	273.87	275.34	255.21
HFBL	2:1	Financ	2021-4-1	2021-3-8	15.70	16.07	15.78	16.24	19	21
AVNW	2:1	Info-tech	2021-4-8	2021-3-10	41.69	40.64	32.12	32.26	31.31	29.06
AMOT	3:2	Indust	2021-5-3	2021-3-10	34.70	35.11	33.77	35.70	31.65	-
BRBS	3:2	Financ	2021-5-3	2021-3-16	15.87	16	16.75	16.97	17.13	-
BAFN	3:2	Financ	2021-5-12	2021-3-17	22	23.50	22.44	23.50	27	-
NEOG	2:1	Health	2021-6-7	2021-5-5	45.24	45.20	45.37	45.91	44.53	-
TTD	10:1	Info-tech	2021-6-17	2021-5-10	59.02	60.88	75.88	70.62	73.20	-
CSGP	10:1	Industr	2021-6-28	2021-5-12	88.27	83.29	82.58	86.95	87.63	-
CSX	3:1	Industr	2021-6-29	2021-5-21	31.77	32.08	32.40	32.09	30.50	-
FSBW	2:1	Financ	2021-7-15	2021-6-4	35.50	35.21	34.86	35.46	34.75	-
NVDA	4:1	Info-tech	2021-7-20	2021-6-7	187.80	194.10	192.08	197.98	222.90	-
SCVL	2:1	Consume r-disc	2021-7-20	2021-6-22	32.03	33.92	32.81	36.06	32.65	-
PTSI	2:1	Indust	2021-8-17	2021-7-17	16.95	16.30	16.7	19.49	39.56	-
FSFG	3:1	Financ	2021-9-16	2021-8-15	27.73	27.29	27.33	28.97	26.43	-
RJF	3:2	Financ	2021-9-22	2021-8-20	85.90	91.60	93.58	102.53	97.99	-
INMD	2:1	Health	2021-10-1	2021-9-1	79.73	78.85	70.56	94.74	70.58	-
ISRG	3:1	Health	2021-10-5	2021-9-1	323.50	334.94	324.45	363.32	354.63	-
MCHP	2:1	Info-tech	2021-10-13	2021-9-30	70.50	72.48	74.88	83.35	85.23	-
ANET	4:1	Info-tech	2021-11-18	2021-10-15	132.08	128.96	127.78	135.03	129.23	-
PLUS	2:1	Info-tech	2021-12-14	2021-11-10	54.02	54.19	51.59	50.83	52.91	-

NSSC	2:1	Info-tech	2022-1-5	2021-12-1	23.65	22.75	22.54	20.41	19.87	-
MTMT	5:1	Indust	2022-1-10	2021-12-10	9.60	9.53	9.91	6.27	1.78	-
MBIN	3:2	Financ	2022-1-18	2021-12-15	32.97	30.75	30.15	30.21	26.34	-
CLWT	3:2	Indust	2022-1-24	2021-12-20	1.60	1.69	1.56	1.30	-	-
SGH	2:1	Info-tech	2022-2-2	2022-1-1	28.53	27.12	28.72	26.91	-	-
WRB	3:2	Financ	2022-3-24	2022-2-20	65.30	65.98	66.59	-	-	-
ACMR	3:1	Info-tech	2022-3-24	2022-2-19	22.09	21.75	20.69	-	-	-
PTSI	2:1	Indust	2022-3-30	2022-2-28	34.22	34.75	26.74	-	-	-

Source: Yahoo finance historical data charts, Google finance historical data charts, Fidelity.com US stock split calendar (January 1st 2020-April 30th 2022)