Composite Seasonal Equity Trading Strategy

Radovan Vojtko, Matus Padysak

Abstract

The main focus of this paper is to show that calendar/seasonal anomalies are well-working even in the most recent periods and, additionally, to find a way how to combine them in a search for profit from the practitioner's point of view. This paper is a case study of possible usage of following anomalies: Turn of the Month in Equity Indexes, Federal Open Market Committee Meeting Effect in Stocks, Option-Expiration Week Effect and The Payday Effect. Firstly, it was found that each individual trading strategy is profitable and those strategies could or probably should be combined into one complex composite seasonal strategy. The analysis has also found that the strategy mentioned above could be enhanced by the addition of a trend factor. To be more precise, data suggest that it is worth to systematically trade only if the trend factor signals to do that. Such addition drastically reduces drawdowns and the resulting strategy simply does not enter into trading positions when the market situation is not favorable.

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Introduction

Despite the fact that the economic theory states that financial markets are efficient and investors are rational, a large amount of research is about anomalies, where the result is different from the theoretical expectation. At Quantpedia, we deal with anomalies in the financial markets, and we have identified more than 400 attractive trading systems together with hundreds of related academic papers.

This paper should be a case study of some strategies that are listed in our screener, with an aim to present a possible usage of strategies in our database. Moreover, we have extended the backtesting period, and we show that the strategies are still working and have not diminished. This paper also should serve as a case study on how to use Quantpedia's database itself; therefore the choice of strategies was not obviously random, and strategies were filtered by given criteria, however, every strategy is listed in the "free" section, and therefore no subscription is needed. Since our strategies are connected with the equities, the first filter in our screener is "Markets", where we have picked equities. Secondly, various characteristics of strategies could be simply found by searching with keywords, in this case, we would choose the market timing since every strategy aims to "time the market". Lastly, we would pick "Only Free" from the Free/Premium filter. Although the term anomalies in the financial markets might sound too complicated, we have picked simple, yet working seasonal anomalies. Each strategy works well alone, and at first, we examine them one by one, but we also show that those strategies could and probably should be considered as building blocks of one bigger strategy. Therefore, the paper is divided into two parts, where the first part is about the examination of the seasonal strategies found by the filtration - Turn of the Month in Equity Indexes, Federal Open Market Committee Meeting Effect in Stocks, Option-Expiration Week Effect and The Payday Effect. As the names are suggesting, the anomalies are seasonal. Another possibility is that we could consider them as calendar anomalies; therefore the analysis could be done simply, and in our opinion, these strategies are an ideal way how to dig into the world of anomalies in the financial markets.

As we have previously mentioned, the second part is about the composite strategy made of building blocks. This approach might be simple but also efficient and working. Although some complicated mathematical models may sound more fancy, combining simple strategies can lead to extraordinary results. Our goal is to show that if strategies picked by us are

combined, they are working just in that way. Additionally, for each strategy or the composite one, the investor only needs to invest in the S&P500 index, which can be easily made by ETFs (for example, SPY). Last but not least, our aim is to present the strategies from the practitioner's point of view, for the readers interested in the more theoretical depths, we would advise reading the original papers connected with the particular strategies.

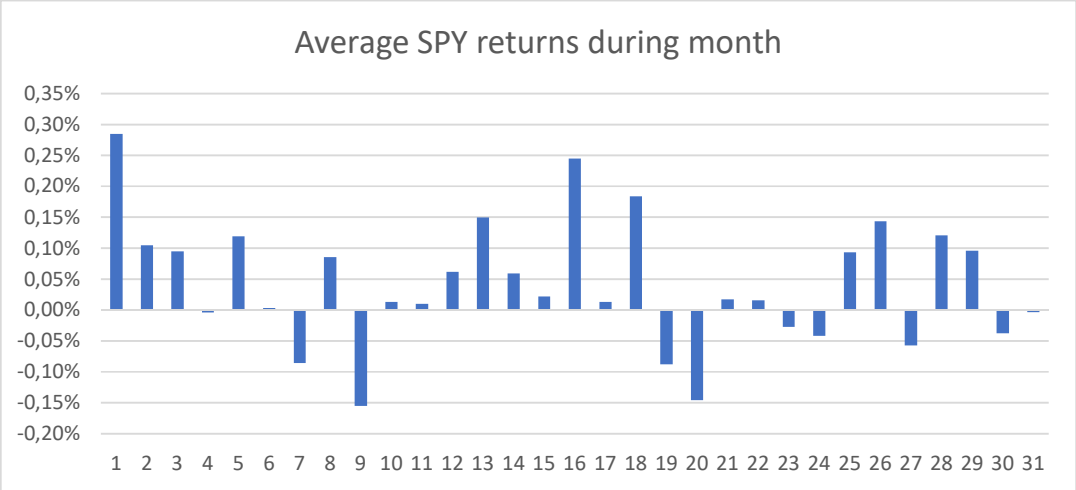
Related literature

This case study would not be possible without the original papers related to the anomalies since the aim of this paper is not to provide new theoretical findings but rather focus on the practitioner's point of view. Therefore, the academical papers and theory are key to building profitable trading strategies. The first paper is: Xu, McConnell: Equity Returns at the Turn of the Month, where authors have examined a turn-of-the-month effect in U.S. equity returns that were initially identified by Lakonishok and Smidt (1988) using the DJIA. However, Xu and McConnell used CRSP daily returns with a finding that the turn-of-the-month effect persists over a more recent interval of 1987-2005. Citing the authors: „over this 19-year period (and over the 109-year period of 1897-2005) all of the excess market return occurred during the four-day turn-of-the-month interval. Thus, during the other 16 trading days of the month, on average, investors received no reward for bearing market risk.“ The second paper is by Tori: Federal Open Market Committee meetings and stock market performance. The paper has examined a calendar effect, a relationship between contemporaneous stocks market returns and dates of Federal Open Market Committee (FOMC) meetings. By examination of the S&P 500 stock market returns between 1960 and 2000, the paper has found that there is a positive and also significant calendar effect during FOMC meeting dates. An interesting finding was that while FOMC meeting dates accounted only for 4.42% of the trading days, returns of those dates accounted for over 13% of the cumulative returns over the time period of Tori’s study. Option-expiration week strategy is based on the study of Stivers, Sun: Option Activity and Stock Returns During Option-Expiration Weeks. This research has found that large-cap stocks (therefore, it is possible to use SPY for trading) that have actively traded options tend to have significantly higher average weekly returns during option-expiration weeks (a month's third-Friday week). Additionally, this period is connected with only a little difference in weekly return volatility. The importance of this finding could be easily understood by the fact that over a pre-option-market sample period from 1948 to 1972, the average third-Friday weekly stock returns are not different than other weeks. Last but not

least, what is the most important, according to the research, this effect significantly affects prices of stocks: „Along with related recent literature, our collective findings suggest that intra-month weekly patterns in call-related activity contribute to patterns in weekly average stock returns, with hedge rebalancing by option market makers being a likely avenue.“ The last academic paper is: Ma, Aixin and Pratt, William Robert: Payday Anomaly. This research about the Payday effect is also linked with the Turn of the Month anomaly, because if abnormal returns have been found on days near the turn of the calendar months, which academic research has linked to month-end paychecks, similar effect should be present also in the middle of month, because a lot of firms adopt a semi-monthly pay schedule. A sizable proportion of paychecks goes into retirement accounts, and after that, this proportion is automatically invested in the market. Authors have successfully shown with their results, that the 16th day of the month statistically and economically outperforms all other calendar days except the first and second day in the month (Turn of the Month days).

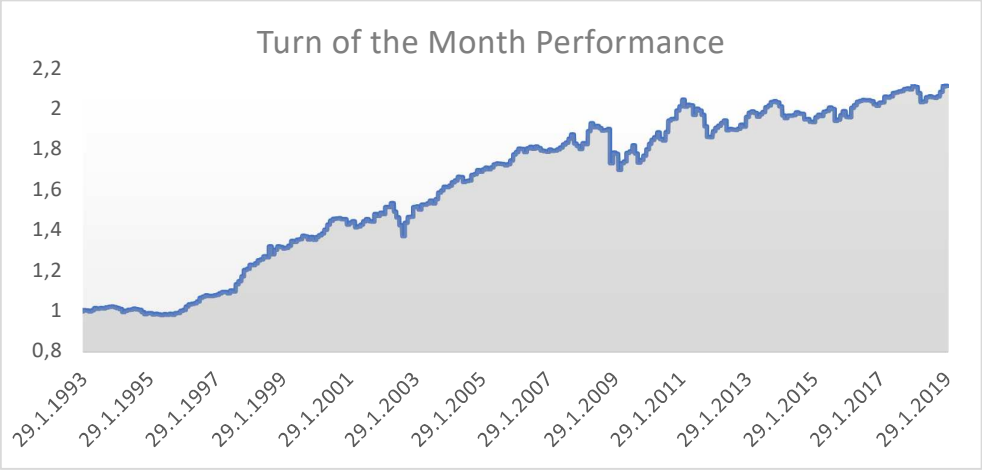
Turn of the Month

The turn of the month is a well-known effect on stock indexes, with a simple idea that stock prices usually increase during the last four days and the first three days of each month. Such a pattern was identified by various distinct researches for various time periods both in the Dow Jones Industrial Average and also in the S&P500 index. Apart from the expanded backtesting period and proving that such simple strategy with an easy execution still works in the present, we think that this strategy can be even more simplified by buying the SPY ETF on close at the end of the month, and selling it on close of the first day in the following month.



The proposed rule of buying at the end of the month and selling it on the first day can be easily understood by looking at average SPY returns during days in the month. Clearly, the first day of the month is, on average, the best performing day. Moreover, the plot of the returns also explains why the index could also be held for the first three days as past research suggests since the performance during all these days is positive. However, for the sake of simplicity, we would rebalance the Turn of the Month strategy on the first day in the month, but holding the index during more days at the beginning of the month would also be a valid option.

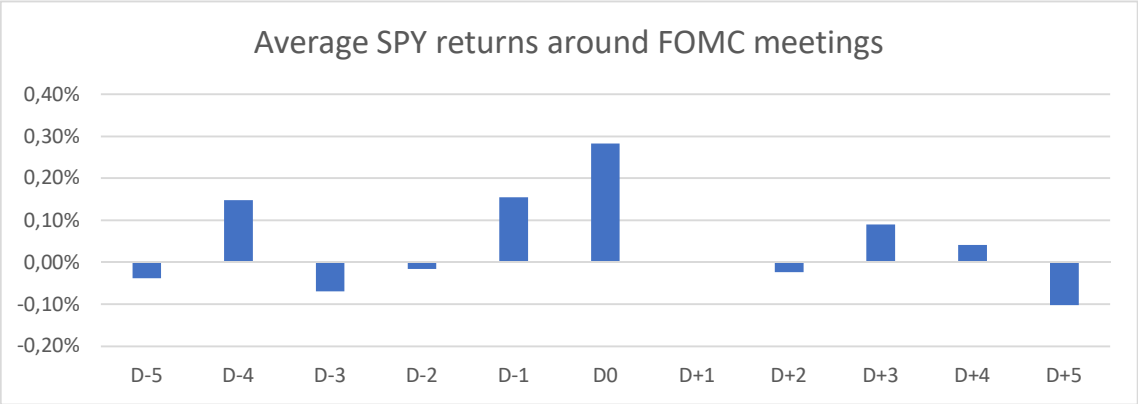
Despite the simplicity of this anomaly, it is a puzzle for the academic world. The Turn of the Month strategy is a big challenge for the academic world that tries to explain the potential reasons for the functionality. The reason for the functionality is not a risk-based since higher risk does not appear to explain the turn-of-the-month effect. However, according to the other branch of the literature, the effect may be simply explained by the regularity in payment dates in the United States, because investors receive a preponderance of compensation from employment, dividends, and interest at month-ends. Consequently, as investors seek to invest these funds, equity prices are pushed up.



As the graph of the strategy for the years 1993-2019 shows, the Turn of the Month is profitable, and this pattern is still alive even in the present. One dollar invested in 1993 would be more than doubled to 2,11 dollars in the year 2019, with a yearly performance of 3,01%. Such a strategy has a maximal drawdown of 11,97%, which results in the return to a drawdown ratio of 0,25.

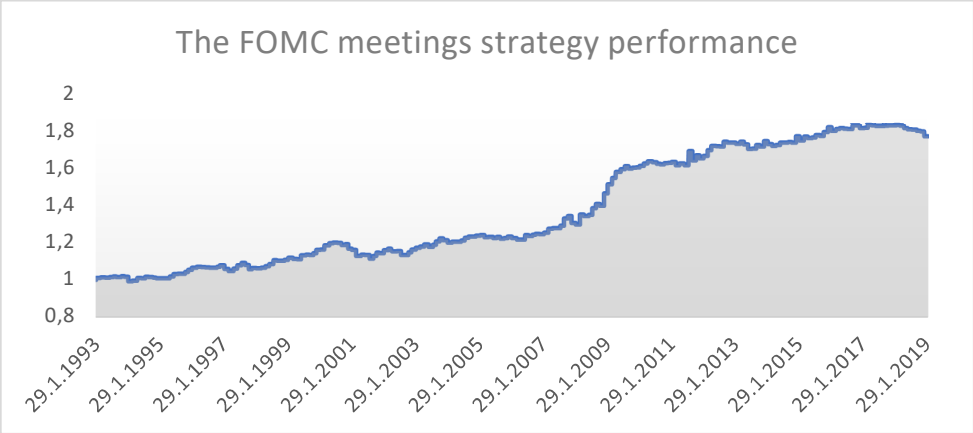
Federal Open Market Committee Meeting Effect in Stocks

According to the past research, the S&P 500 index average daily returns during Federal Open Market Committee (FOMC) meetings since 1980 (or the year since FED started to be less secretive and more open about its future plans and actions) are outstanding - more than 5 times greater than returns during other average days on market. Since the dates of FED meetings are publicly known and available, such an effect could be easily utilized in the seasonal strategy that would go long the S&P 500 index during these FED meetings. As we have previously mentioned, the simple execution of this strategy could be made by buying SPY ETF on a close day before the meeting and selling it on close after the meeting.



The aforementioned trading rule can be instantly understood, if one looks on the returns of the index during the days around the Federal Open Market Committee meetings (the D0 represents the FOMC day). The average performance at the FOMC day is significantly larger than other days around. Moreover, also the day before tends to be profitable, which could be an interesting modification of the FOMC strategy.

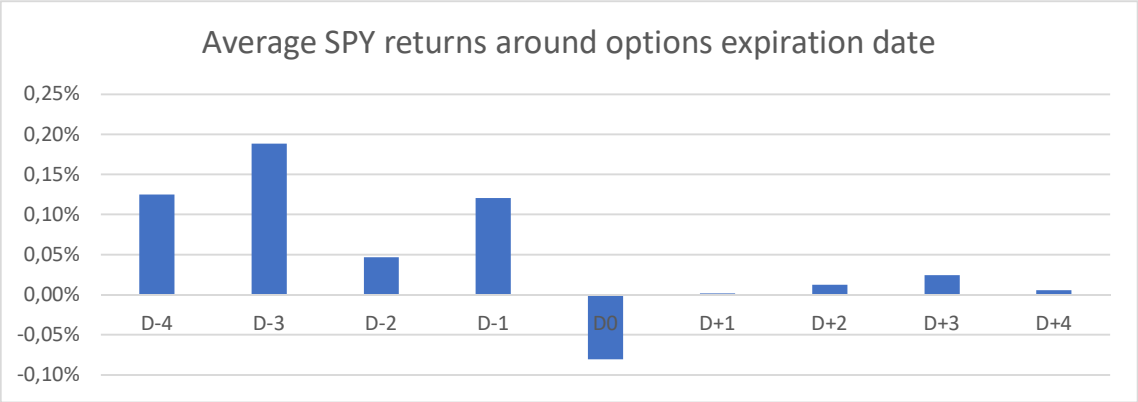
A simple explanation could be connected with the one market wisdom that says: „Don't fight the FED". Since the FED's main aims are to address banking panics, maintain the stability of the financial system, contain systemic risk in financial markets, and strengthen economic growth, it is highly unlikely that FOMC meetings' conclusions would be highly negative for stocks. Moreover, in reality, the actions of FED are the opposite, and in average those actions are positive for the stocks, what is the main cause for a positive drift.



The graph shows that also this anomaly is alive and working in the present. A dollar invested in 1993 would have resulted in the 1,77 dollars in 2019, with a yearly performance of 2,30%. Although the performance might not seem to be impressive, it is important to bear in the mind that the strategy is invested only a few days during the year and the strategy is able to perform in this way with a relatively small maximal drawdown of 7,17%, what results in the return to drawdown ratio of 0,32.

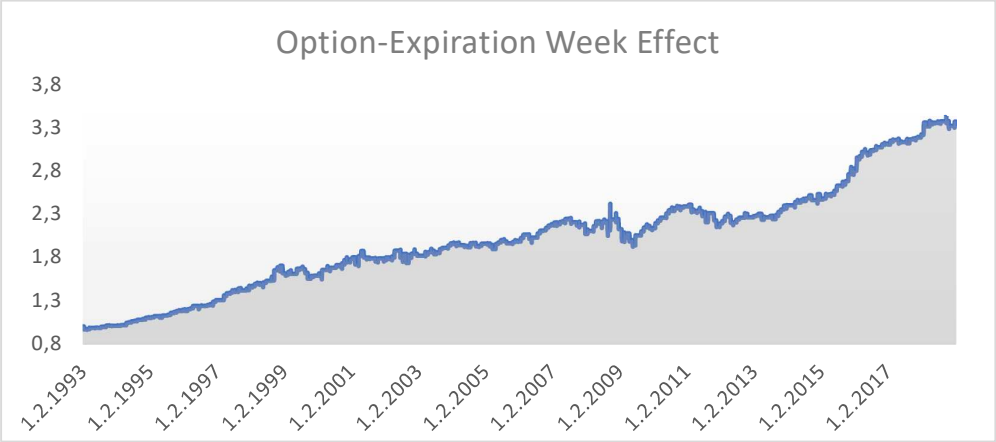
Option-Expiration Week Effect

As the name Option-Expiration week effect suggests, this effect is another calendar anomaly. This one is connected with the Option-expiration week - a week before options expiration (Friday before each 3rd Saturday in each month). The research suggests that stocks with large market capitalization, that have actively traded options, tend to have substantially higher average weekly returns during these weeks. This leads to a construction of a simple market timing strategy, where the investor buys the SPY ETF on close each Friday before 3rd Saturday in the month and sells it on close again in the next week's Thursday.



If we look at the average SPY returns around the day when the options expire, we will see three patterns. Firstly, the actual day of expiration (D0) is connected with a negative performance of SPY. This makes it clear why we would rebalance the strategy day before and why we would not hold it during this day. On the other hand, the days before or in other words, the days when our aim is to hold the SPY are the days with significantly positive performance compared to the days after expiration. Lastly, these days after the expiration highlight the benefits of holding the index week before the options expiration.

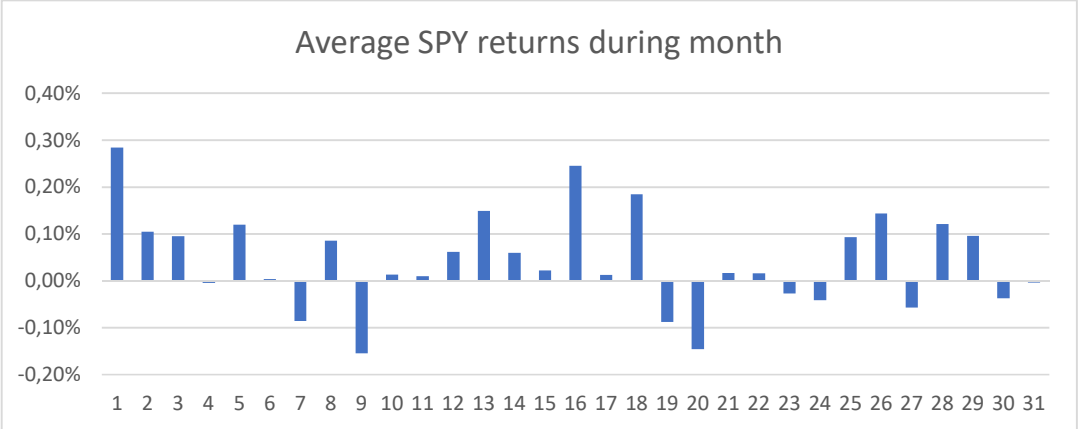
According to the research, intra-month weekly patterns in call-related activity contribute to patterns in weekly average equity returns, and this should be the main driver of the performance. Simplified, hedge rebalancing of option market makers trading the largest stocks that have the most actively traded options should be the main reason for the abnormal returns of these largest stocks. Additionally, during option-expiration weeks, a sizable reduction occurs in open option interest because the near-term options approach expiration, and after that, they simply expire. This reduction in open call interest should be associated with a reduction in the net long call position of market makers, which implies a decrease in the short-stock positions being held by market makers to delta hedge their long call holdings.



Out of our seasonal strategies, the Option-Expiration Week Effect has the highest performance, the dollar invested in 1993 would result in 3,36 dollars in the year 2019. Therefore, the strategy has an annual performance of 4,93%. The maximal drawdown of the strategy is 20,39%, which results in a return to a drawdown ratio of 0,24. Unfortunately, the high performance is also connected with a greater risk represented by the maximal drawdown, but this could, and we would show later that should be enhanced.

The Payday Effect

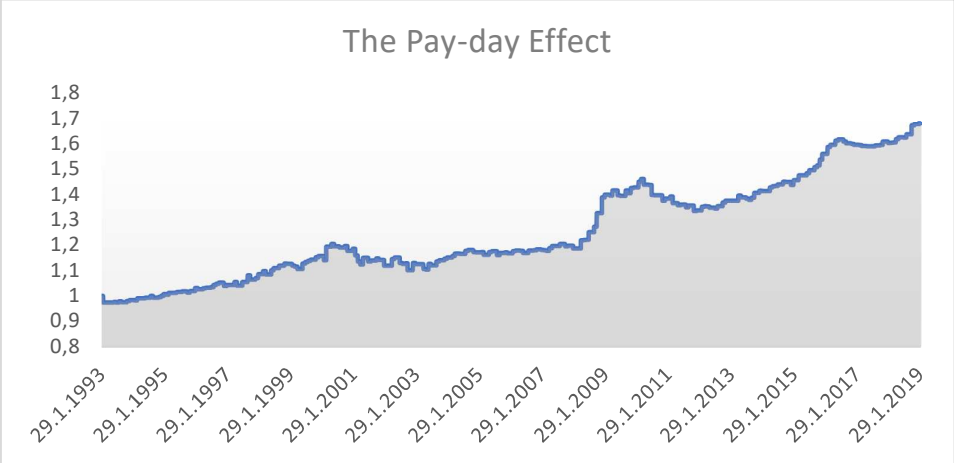
The Payday effect is similar to the Turn of-the Month (ToM) anomaly. For the ToM, the research has linked the abnormal return with pay-days. After pay-days, investors seek to invest these funds, what causes pushed up equity prices. However, many companies pay their employees twice a month, on the 15th day and at the end of the month, therefore it is natural that on the condition that the pay-day effect holds true for the turn-of-the-month days, there should be a recognizable pattern in the middle of the month as well.



Research confirms the hypothesis mentioned above, and abnormal returns truly exist in the middle of the month. Therefore, the simple strategy that utilizes this effect consists of buying the SPY ETF on close on the 15th day each month and selling it on close the next day.

The same graph we have used to demonstrate why is it worth to trade during the first day in the month could also be used to demonstrate the simplicity and profitability of the Pay-day effect. The 16th day in the month is after the first one the most profitable in the sample; therefore, it is expected that buying the index day before and selling it on the close day after should be profitable.

The reason for the functionality is probably deeply connected with paychecks. Many companies pay their employees twice a month, on the 15th day and at the end of the month, therefore building on that the Pay-day effect holds true for the turn-of-the-month days, there should be a clear pattern in the middle of the month as well as at the end of the month. If employees get paid, many of them either automatically invest a portion of their paycheck in the market through retirement contributions or are encouraged to do so by having a surplus of funds with the new paycheck. This causes a temporarily pushed prices of stocks up. Moreover, it is rational to utilize that temporary situation by investing in S&P500 since these stocks should move up at most. Last but not least, according to the past research, the 16th of the month is the 3rd best day in the month overall (moreover, in our sample the 16th is the second-best day in the month), therefore it makes a great addition to our pool of strategies and different calendar days.



Consistent with the research that has been made, the Pay-day Effect strategy is obviously profitable, and this still holds true even in the present. The dollar invested in 1993 would result in approximately 1,68 dollars in 2019. The strategy has an annual performance of 2,08% and is able to perform in this way with a maximal drawdown of 8,62%. This results in a return to a drawdown ratio of 0,24.

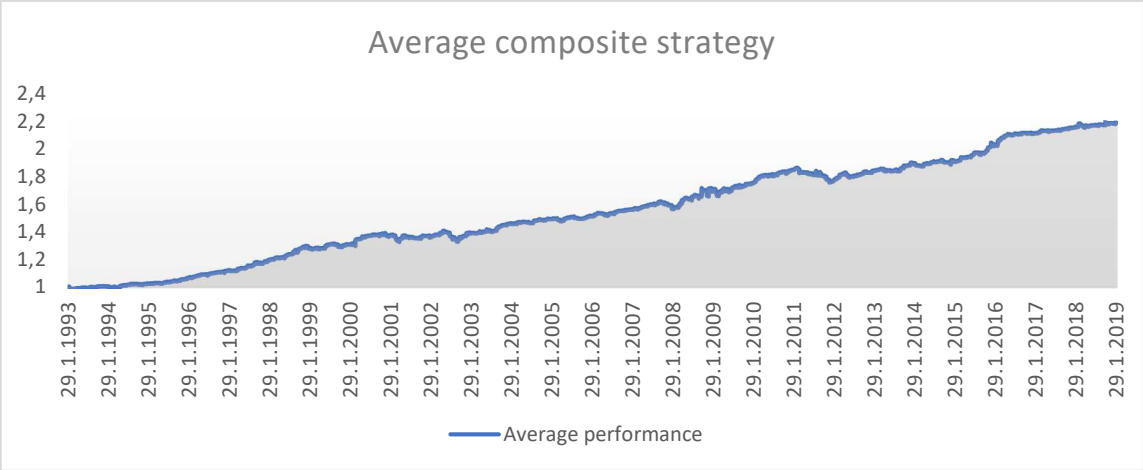
Alternative strategies

As we have previously mentioned, the performance of simple strategies could be enhanced by the addition of some trend factor. An easy way how to do it is to trade only if the price of SPY is higher than it's 200-day average. In this part, we present a simple table consisting of some characteristics of both enhanced strategies with trend factor and simple strategies without the trend factor. In general, we assume that the performance slightly decreases, but on the other hand, the drawdowns should be drastically lower, which would result in a higher return to drawdown ratios.

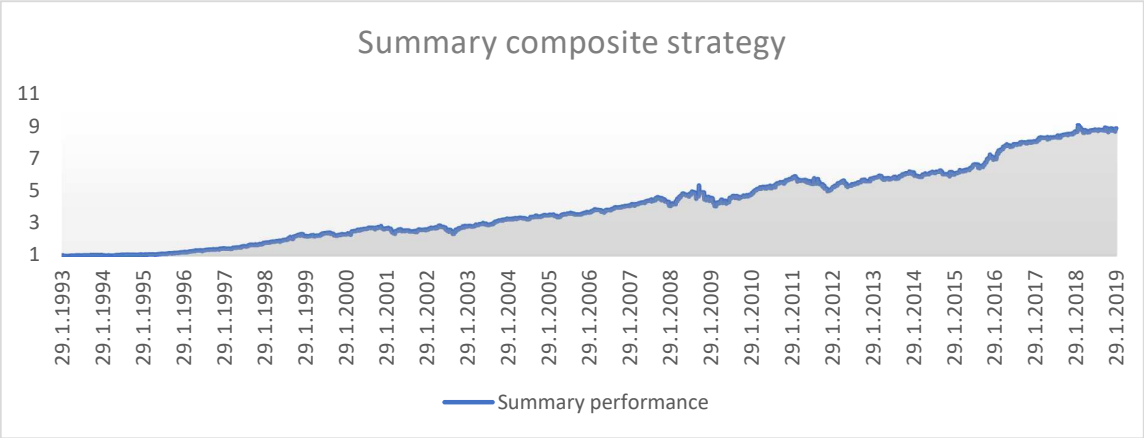
	Turn of the Month with trend factor	Turn of the Month without trend factor	**Option-Expiration Week with trend factor**	Option-Expiration Week without trend factor
Performance	3,10%	3,01%	3,67%	4,93%
Maximal drawdown	5,04%	11,97%	9,34%	20,39%
Return to drawdown ratio	0,62	0,25	0,39	0,24
	The Payday effect with trend factor	The Payday effect without trend factor	**FOMC meeting effect with trend factor**	FOMC meeting effect without trend factor
Performance	1,50%	2,08%	1,34%	2,30%
Maximal drawdown	4,43%	8,62%	3,09%	7,18%
Return to drawdown ratio	0,34	0,24	0,43	0,32

The composite strategies

Naturally, we would like to form one bigger strategy out of these smaller ones that would represent building blocks. Although there are many options on how to form such a strategy, the approach of investing the whole portfolio into SPY during “anomaly“ days sounds simple, and it is also logical. If some days are overlapping, we do not leverage our portfolio. We would call such a strategy as the Summary strategy. Another possibility is to trade only a part of the portfolio and have an “average“ trading signal; hence, we would call such a strategy as the Average strategy. Such a strategy would trade only a quarter of portfolio if one strategy signals to trade, but the signals may overlap, what would cause investing one half or three quarters, or even the whole portfolio.



Since all of the building blocks' strategies have positive performance, it is natural that also Average composite strategy would be profitable. However, with an annual performance of 3,16%, the strategy is comparable with the simple strategies. The added value is in a lower maximal drawdown of 5,65% and the resulting return to drawdown ratio of 0,56, which higher than every simple strategy.



No surprise, trading just a part of the portfolio each time when some strategy signals cannot be as profitable as always trading "everything". Given the nature of our building blocks, such an approach should be much more profitable, and the numbers prove that. The annual performance of 9,06% is much higher than the performance of the Average strategy. However, this is also accompanied by the large maximal drawdown of 24,02%, which results in a return to a drawdown ratio of 0,38. Such a high drawdown is something that we would like to reduce.

The relationship of composite strategy and market

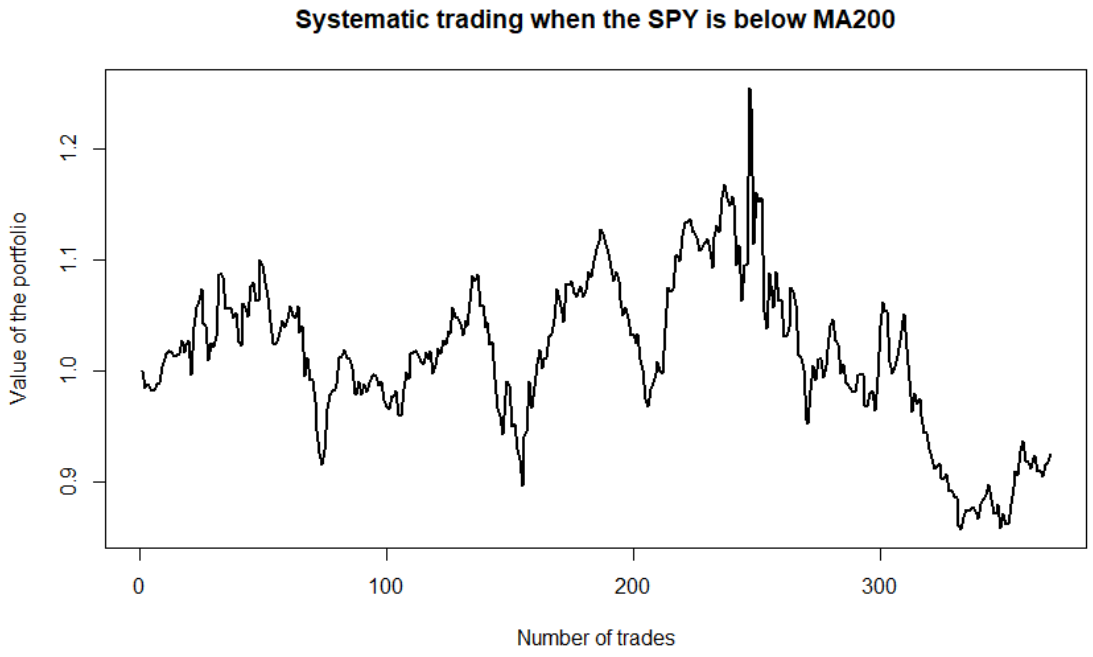
The equity market is usually very attractive for practitioners since it is connected with large returns. However, during bear markets, equity strategies become extremely unattractive, and investors are looking for strategies that are not correlated with the equity market or even better, strategies that are negatively correlated with the equity market. Since this strategy trades equity index that is often taken as a proxy for a market as a whole, common sense suggests that the strategy would be correlated with the equity market. On the other hand, the strategy is invested in the equities only a few times during the year; therefore, there could be a chance that the strategy would not be correlated with the market. Therefore, we have examined the correlations between the returns of the strategy and the SPY and also between two moving averages of SPY. The first one was the short 20 days moving average and second was the long 200 days moving average.

Table of correlations		
	Summary strategy	**Average strategy**
SPY	-0.006 (0.6733)	-0.004 (0.5833)
MA20	-0.02 (0.1988)	-0.016 (0.1615)
MA200	-0.023 (0.1105)	-0.016 (0.08508)

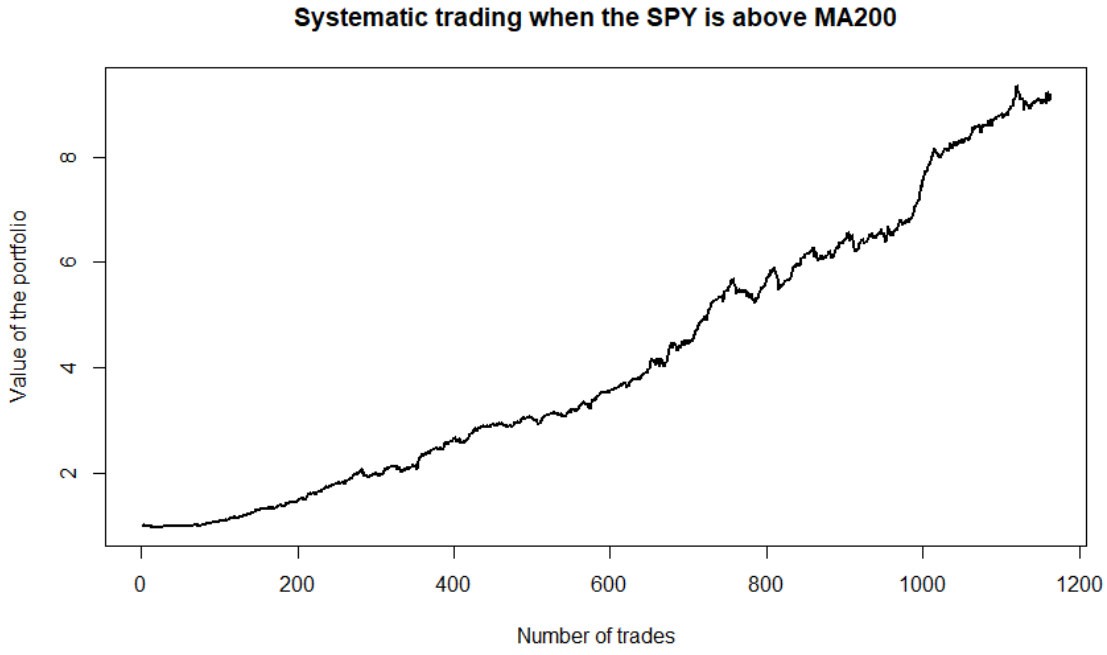
The table consists of Pearson´s correlation coefficients, but the p-values in parentheses are from the Kendall rank tests since the data are not normally distributed. Although the correlations are slightly negative, all of them are statistically insignificant. However, this result suggests that we could consider both strategies as uncorrelated to the equity market. Therefore this strategy could be applicable even during bear markets.

Although the strategies are uncorrelated to the market, in such a long backtesting period that includes two major financial crises, there naturally would be some drawdowns. We have previously used the rule to trade the simple strategies only if the SPY is above its own 200 days moving average (MA200). In this section, we would like to dive deeper into the usage of the MA200 and show why and how does this simple addition work.

In the following part, we consider the Summary composite strategy. We started our analysis by looking at returns of strategy when the SPY is above and below the MA200. Considering only returns when the SPY is above, the mean return is 0.195% (per trade). On the other hand, when the SPY is below, the mean return of the strategy per trade is -0,003%. Although such a return is negative, it seems that it is not much different from zero. If the SPY is below the MA200, there are 182 trades with negative returns and 186 trades with positive returns. The aforementioned numbers of positive and negative trades accompanied by the mean return of strategy during times when the SPY is bellow MA200 could cause the impression that trading during times when the SPY is below should not be such a problem. However, if we would systematically trade only during those times, the performance is simply not desirable.

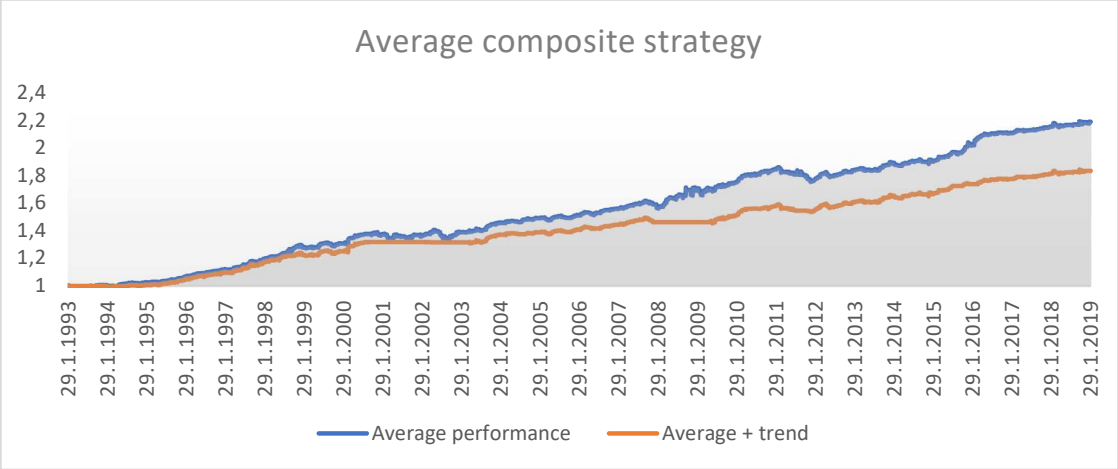


There are 182 trades with negative returns and 186 with positive returns, yet the strategy produces large drawdowns and produces losses. Simply said, the mean does not say everything and compounded "sub-strategy" tells us much more.

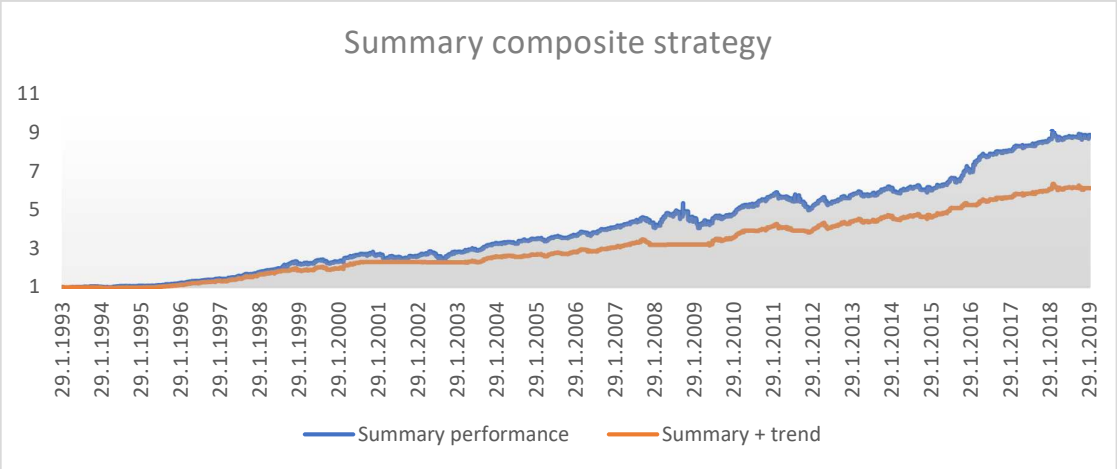


When the SPY is above, there are 461 trades with negative returns and 696 trades with positive returns. Although the number of positive trades is not that much higher, the performance of such a strategy is much more appealing, and that is why we strongly believe in the addition of the trend factor represented by the MA200. Considering our composite strategies, one has to think also about the risk of the strategy and not only the returns. Although most of the simple strategies do not have drastically high maximal drawdowns, there is an option on how to lower even these maximal drawdowns, and this can be simply done by the addition of MA200. For example, such addition to the Summary strategy would reduce the maximal drawdown from 24,02% to 10,14%.

Enhanced composite strategies



No surprise, considering only the performance, a pure Average strategy (annual performance of 3,16%) outperforms the Average strategy with added trend signal (annual performance 2,44%). However, the added value of the trend factor is in minimizing drawdowns since the strategy trades only if the SPY is performing better than it's own long-term average. Therefore such addition would lower maximal drawdown from 5,65% to 3,44%, which would also cause that the return to drawdown ratio would rise from 0,56 to 0,71.



Clearly, the composite strategy without the trend having an annual performance of 9,06% is the most profitable one. But one question arises, is it worth it? What about the ratio of return to risk? The strategy with the added trend has an annual performance of 7,47%, but with the reduced maximal drawdown, the return to drawdown ratio is 0,74. The return to drawdown ratio of the simple summary strategy without the trend is only 0,38.

To sum it up, we include a summary table of all composite strategies for comparison.

	Summary composite strategy with trend factor	Summary composite strategy without trend factor	**Average composite strategy with trend factor**	Average composite strategy without trend factor
Performance	7,47%	9,06%	2,44%	3,16%
Maximal drawdown	10,14%	24,02%	3,44%	5,65%
Return to drawdown ratio	0,74	0,38	0,71	0,56

Conclusion

We believe that we have successfully shown that the calendar anomalies and corresponding trading strategies are alive and significantly profitable, even in the most recent period, and by their nature, it is probably the best to trade them all at once. Naturally, the best approach seems to be a “summary“ approach of trading the whole portfolio during days when the strategies signals to trade and do not split the investment budget into partial strategies and trading just the part of the portfolio during days when some strategy signals to trade (“average“ strategy). Therefore, as a final strategy, we would propose the composite Summary strategy. Despite the negative correlation to the market, composite Summary strategy (the simple one, without the trend factor) would suffer major losses during the recent global financial crisis. On the other hand, the composite Summary strategy with the added trend factor that is notoriously used to lower drawdowns would remain perfectly flat during the crisis and would protect the portfolio. Therefore, we strongly believe in the addition of the trend factor. In the post-crisis period, the annualized return of the composite Summary strategy is 8,47%, comparing it to the composite Summary strategy with the added trend factor, which has an annualized return of 7,01%, the return is larger. However, the maximal drawdown of the strategy without the trend factor is 4,44%, while the maximal drawdown of the strategy with the trend factor is 2,84%. To sum it up, this result also highlights that the calendar anomalies are still alive and are not traded away.