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A view on recent corporate spin-offs in advanced economies

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A VIEW ON RECENT CORPORATE SPIN-OFFS IN ADVANCED ECONOMIES

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A view on recent corporate spin-offs in advanced economies: does the market reward shareholders for improved focus?

1. Literature review

Plenty of evidence exists regarding divestitures, and spin-offs in particular. Academics have analysed the performance of the parent company around the announcement date, that of the divested business once the separation has been executed, the combined performance of the parent and the new entity both in the short and in the long run and all of them have been compared with the average performance in the relevant industry to try to assess whether an overperformance has historically been achieved through divestitures. Since spin-offs are by far the preferred divestiture alternative by companies, it is not difficult to guess that most of the existing academic literature discussing divestitures is specifically focused on them.

Among the investigations listed above, event studies focusing on the consequences of spin-off announcements in terms of cumulative abnormal returns for the parent company are by far the most employed. Over the years, plenty of evidence has been produced, different intervals of time have been considered and cumulative abnormal returns have been computed, relying both on the constant mean model and the market model, or even comparing returns with industry average [11; 12; 18; 28; 30; 35; 39; 47; 48; 50].

The results obtained (**table 1**) clearly show that, whatever the specific features of the event study, in the days immediately preceding and following the announcement of a spin-off statistically significant abnormal returns have been observed for analysed securities.

In terms of short-term share price performance, on the other hand, plenty of studies exist suggesting that the initial reaction of the market to the first public trading of the subsidiary is negative. Some authors suggest that the temporary share price decline might be a consequence of a downward pressure imposed by institutional holders reducing substantially their holdings in spun-off subsidiaries after a divestiture transaction is performed (Brown and Brooke, 1993 [14]; Abarbanell, Bushee and Raedy, 2003 [1]).

As for what concerns the medium-long term, scientific literature came up with contrasting conclusions. Researchers have alternatively found that spun-off units show statistically significant improvements in operating performance (Boreiko and Murgia, 2010 [11]; Emerick, Khorana, Shivdasani and Ventouras, 2017 [20]), that their performance is not affected by the divestiture (Woo,

Willard and Daellenbach, 1992 [53]), that only a certain subtype of spin-off transaction results in a significantly better operating performance (Daley, Mehrotra and Sivakumar, 1997 [17]; Desai and Jain, 1999 [18]).

Whatever the specific conclusion formulated, researchers typically agree that most of the benefit stays within the new separated entity, since it is likely that the most constrained parts in a diversified company are the small subsidiaries that are forced to bear the rules imposed by the central firm management, which might be operating in the best interest of the overall company but to the detriment of some of the businesses in its portfolio.

Drivers of spin-off decisions have attracted the interest of many researchers as well. Therefore, it is quite difficult to try and get out of the huge amount of academic contributions that have been threw together about this specific topic. One of the most comprehensive study on the topic is Kolev, 2016 [33], which, moving from the contributions of many authors (Brauer, 2006 [13]; Johnson, 1996 [29]; Ocasio, 1997 [42]; Koh, 2007 [32]) involves a meta-analysis of the existing academic literature about divestitures and suggests four broad categories of reasons that motivate divestitures, namely: corporate governance, firm strategy and performance determinants (internal factors) and industry environment determinants (external factors).

Several studies exist suggesting that both the quality and the quantity of research produced by analysts significantly improve as a result of a spin-off transaction (Gilson, Healy, Noe and Palepu, 2001 [25]; Feldman, Gilson and Villalonga, 2014 [24]) and, in general, that analysts' composition is affected by such transactions (E. R. Feldman, 2016 [22]). As analyst are able to influence investors (Benner, 2007 [7]; Beunza and Garud, 2005 [9]; Nocera, 1997 [40]; Womack, 1996 [52]), this increase in coverage results in an increased transparency and, consequentially, in a reduction of information asymmetry for stock market participants.

As diversification is a natural step in the growth process of companies, almost all of them, at a certain point of their development and to variable extent, pursue such a strategy. Some authors (Henderson, 1970 [27]; Williamson, 1975 [51]; Myers and Majluf, 1984 [40]; Shin and Stultz, 1998 [49]) argued that diversification is motivated by the possibility of creating an internal capital market able to provide cheaper cash to fast-growing businesses. Still, sometimes it might be the case, as suggested by agency theory, that the decision to diversify is driven by personal goals of the management rather than by strategic motivations aimed at ensuring a healthy growth for the company (Roll, 1986 [476; Ahn, 2011 [3]). As a consequence, it is often the case that this internal capital market within conglomerates is actually quite far from being efficient.

In this regard, it should be noted that most of the academic literature (Berger and Ofek, 1995 [8]; Lang and Stulz, 1994 [36]; Maksimovic and Phillips, 2002 [38]; Ahn and Denis, 2003 [4]; Burch and Nanda, 2003 [16]; Ahn, 2009 [2]), weighing together benefits and costs associated with diversification, agrees on the point that its overall effect is, in fact, detrimental to companies' value, so that a conglomerate discount exists. It should be noted, however, that such theory posits that the value that the market does not recognize to the firm is not lost, but just hidden within its boundaries, with the consequence that the firm might recoup it by separating one or more of its divisions through a divestiture.

In addition, researchers have argued that divestitures and M&A activity can be intuitively considered as two sides of the same coin. Not surprisingly, most of them agreed on the fact that they cannot be considered as two separate strategic decisions, as evidence shows that they are not only strongly interrelated, but also that divestitures tend to stimulate M&A activity and vice versa (Porter, 1987 [43]; Ravenscraft and Scherer, 1987 [45]; Kaplan and Weisbach, 1992 [31]; Allen, Lummer, McConnell and Reed, 1995 [5]; Ma and Wang, 2017 [37]).

As just shown, several academics have investigated spin-offs and their relationship with conglomerate discount over the years, proving that such a topic is of paramount importance for the economic scientific literature. The analysis developed in the following sections is meant to logically follow the same direction, in the attempt to build on past experiences to offer an updated point of view on the subject.

2. Data and methodology

For the purpose of this analysis, a sample of 65 spin-off deals, for the period ranging from 2010 to 2017, has been considered. All the deals in the sample occurred in Northern America and Western Europe, advanced economies in which spin-offs have already a long history and are well-known and well-accepted.

The sample was constructed starting from the spin-off deal list provided by Bloomberg M&A for the period and the geographies under review. Every single transaction was then analysed, looking at press releases and official documents published by the involved companies to check the specific features of the deal, the announcement date and the closing date. Finally, a number of screens aimed at ensuring a sufficient degree of homogeneity were implemented, resulting in the actual sample size.

In the first place, only divestitures configurated as proper spin-offs were kept (*i.e.* deals in which the shares of the subsidiary were freely distributed *pro quota* to the shareholders of the parent company, resulting in the concurrent listing of the spun-off company on a stock exchange and the start of its

trading as a totally independent company). Logically and consequentially, deals in which one of the involved parties was not listed were excluded. Only cases in which the distribution of shares involved a full-controlled subsidiary (with parent's ownership amounting to at least 50% of total outstanding shares) of the diversified parent company were considered.

In the second place, in accordance with prevailing academic literature on the topic, companies that can be categorized as Financial Institutions and Group (banks, insurance companies and other intermediaries) were kept out of the sample, with the aim of ensuring an analysis as homogenous and meaningful as possible. Indeed, FIGs are subject to very different rules with respect to companies operating in other industries (especially in terms of capital and tax requirements, which tend to be the main reason for the realization of spin-offs for such institutions) and considering them in the sample would likely provide altered results (Woo, Willard and Daellenbach, 1992) [53].

In the third, and final, place, deals in which one of the two parties has been involved in a M&A transaction in the 12 months following the announcement date are excluded, because, in such situations, it would be very hard to ascertain whether and to what extent the stock performance is influenced by the spin-off itself.

The statistical methodology that will be employed in the analysis is the event study, where the relevant event to be investigated is the spin-off announcement date, as reported by Bloomberg. A second-check is then performed with respect to the reported date, taking into consideration official press releases by the involved companies.

The event study methodology has been by far the one most employed by researchers in this field, due to its simplicity and its explanatory power with regard to abnormal returns to be associated with financial events. The application of such methodology to financial research has been introduced to a large audience for the first time by Ball and Brown in 1968 [6] and by Fama, Fisher, Jensen and Roll in 1969 [21]. Nevertheless, it needs to be clarified that many other academics had already employed such methodology in their papers before these milestone studies (see, among the others, Dolley, 1933 [19]).

Since their inception in the academic financial literature, uncountable event studies have been published. In order to try and get a grip over the magnitude of such practice, it should be cited the investigation performed by Kothari and Warner in 2006 [34], which reports that in the period 1974-2000 alone, taking into consideration exclusively five of the most relevant financial journals, the articles containing analysis based on event studies have been as high as 565. It is easy to understand

that extending the investigation to all finance journals and to a longer period of time would result in an outstanding number.

Daily stock returns will be analysed, and, for this purpose, the mean adjusted return (also known as constant mean return) methodology will be employed. Such methodology, in fact, performs as well as more complex methodologies (e.g. market model) in detecting the presence of abnormal return" (Brown and Warner, 1985 [15]; Hearth and Zaima, 1986 [26]).

The first step of such an analysis will naturally be to gather data for daily returns for the sample of stocks. Data will be extracted from Bloomberg terminal and will refer to total shareholder return (*i.e.* should be adjusted for possible dividends paid or other relevant corporate actions completed in the considered period). Starting from these data series, the presence of any excess abnormal return will be assessed.

Abnormal return for a given stock *i* in the day *t* ($AR_{i,t}$) is defined as the difference between the return realized in the day *t* by that stock ($r_{i,t}$) and the expected return for the same date according to a chosen reference model ($E[r_{i,t}]$):

$$AR_{i,t} = r_{i,t} - E[r_{i,t}]$$

When employing the constant mean return model, the *ex-ante* expected return is the sample mean of the returns calculated in a pre-specified estimation window: expected return, therefore, stays constant for every date to be investigated. In this case the estimation window will go from 120 trading days to 21 trading days before the announcement of the spin-off. The event is outside this window in order not to influence the estimation:

$$E[r_{i,t}] = \frac{1}{100} \sum_{t=-120}^{-21} r_{i,t}$$

Abnormal returns will be computed in the so-called event window. The period under review will be ranging from 20 trading days before to 20 trading days after the announcement of the spin-off (which will take place in day 0). Indeed, the daily stock returns refer to the parent company, due to the fact that the spun-off entity will not be traded until closure of the transaction. In light of these assumptions, we can divide the analysed time period into two parts:

a) Estimation window: day -120a (T0) to day -21a (T1 - 1)
b) Event window: day -*20a* (T_1) to day +*20a* (T_2)

The event study will be a short-horizon one. Thus, it will not present the controversies about methodology and statistical properties typical of long-horizon event studies.

Once abnormal returns are computed for stock *i* for all the dates in the event window, they should then be aggregated across time to get to a Cumulative Abnormal Return for the stock in question ($CAR_i (T_1, T_2)$):

$$CAR_i (T_1, T_2) = \sum_{t=-20}^{+20} AR_{i,t}$$

The following step to implement would be to replicate the analysis just described for every stock in the sample, and then aggregating again abnormal returns, this time across securities, to get to Average Abnormal Return (AAR_t) for the different days in the event window:

$$AAR_t = \frac{1}{65} \sum_{i=1}^{65} AR_{i,t} (T_1, T_2)$$

Later, the Cumulative Average Abnormal Return (CAAR) for the whole event window and the entire sample of stocks will be computed:

$$CAAR (T_1, T_2) = \frac{1}{65} \sum_{i=1}^{65} CAR_i (T_1, T_2)$$

On the basis of these calculations, conclusions about abnormal returns in response to corporate spin-off announcements will be formulated.

Obviously, a statistical test like this has also implications in terms of market efficiency. If we assume that the market values correctly the diversified parent company before the spin-off, then the announcement would not result in any statistically relevant cumulative average abnormal return. Therefore, the null hypothesis (H_0) for this statistical investigation will be the following:

$$H_0: E [CAAR (T_1, T_2)] = 0$$

Consequently, the alternative hypothesis (H_1) will be:

$$H_1: E [CAAR (T_1, T_2)] <> 0$$

The aim of this event study is to test whether the null hypothesis should be rejected or not. To test the significance of CAAR, a parametric test will be employed (a test based on the assumption that the population of the sample is normally distributed), in order to ascertain if there are abnormal price movements in the period around the announcement of a spin-off.

To calculate the t-statistic necessary for executing the significance test for CAAR, the first step will be to compute CAAR's sample standard deviation ($SD_{CAAR (T1, T2)}$):

$$SD_{CAAR} (T_1, T_2) = \sqrt{\frac{1}{64} \sum_{i=1}^{65} \left(CAR_i (T_1, T_2) - CAAR (T_1, T_2) \right)^2}$$

Then the so called "cross sectional standard deviation test" (CSS) (Brown and Brown, 1985 []; Rani, Yadav and Jain, 2016 []), is executed, calculating the proper statistic:

$$t_{CAAR}(T_1, T_2) = \sqrt{N}\ \frac{CAAR(T_1,T_2)}{SD_{CAAR}(T_1,T_2)}$$

Under the null hypothesis, for a sample size big enough, the test-statistic t_{CAAR} (T_1, T_2) is asymptotically distributed as a standardized normal, making possible a test of significance, in light of which deciding to reject or not H_0:

$$t_{CAAR}(T_1, T_2) \sim N(0, 1)$$

Other relevant dates in the event period can be defined (τ_1, τ_2), so that $T_1 \leq \tau_1 \leq 0 \leq \tau_2 \leq T_2$, and the null hypothesis (H_0: E [CAAR (τ_1, τ_2)] = 0) should be tested again for these subperiods, following the procedure discussed above, in order to analyse abnormal returns dynamics in a deeper and more insightful way. This obviously implies that the statistics CAR_i (τ_1, τ_2), CAAR (τ_1, τ_2), SD_{CAAR} (τ_1, τ_2) and t_{CAAR} (τ_1, τ_2) should be defined.

Analogous tests can be obviously run again to assess whether positive AARs are present for certain specific days and whether they significantly differ from 0. In this sense, the statistics SD_{AAR} (T_1, T_2) and t_{AAR} (T_1, T_2) should be defined and computed for the days in the event window.

In this case the null hypothesis to be tested would be the following:

$$H_0: E[CAAR(T_1, T_2)] = 0$$

Finally, results should be understood and discussed. It is logical that, if a diversified company could increase its value as a pure consequence of the announcement of the separation of a captive subsidiary, then it can be concluded that a conglomerate discount exists and that the market is not able to fully recognize information in the company's value.

3. Results obtained

Since the statistical methodology employed for the purpose of this analysis (event study) and the cross-sectional testing procedure both move from the assumption that, thanks to Central Limit Theorem in conjunction with a sufficiently large sample size, the computed Cumulative Abnormal Returns for the stocks considered are normally distributed, it is necessary to first assess whether the distribution presents the features of a normal distribution or not. In this sense, it is useful to

preliminary sum up with the visual help of a table (**table 2**) the main features of the CARs distribution over the event window.

In the first place, the distribution presents a slightly negative skewness, but this is due to the presence of a single very negative outlier, more than to a proper fat left tail (**figure 1**). From statistical literature, values for skewness in the range ±1 are considered acceptable for a normally distributed sample, so that the normality hypothesis is still valid. In the second place, as for what concerns the kurtosis, the small positive value suggests that the distribution is slightly leptokurtic. But the value computed for the sample kurtosis is well inside the ±3 range suggested by statistical theory as the maximum and minimum values acceptable for a normal distribution. In light of these results, it can be concluded that the normal distribution assumption for the considered sample is a reliable one. The immediately following consequence is that the test run to assess the statistical significance of the results obtained is well-specified and therefore meaningful.

Now that the normality assumption has been verified and the testing statistical methodology has been found to be sound, it is possible to proceed with the discussion of the results obtained.

The first, striking result deriving from the carried-out investigation is that it appears clear that over the whole event window (from 20 days before the announcement up to 20 days after) there is no evidence of any abnormal return following spin-off announcements by companies.

Actually, the Cumulative Average Abnormal Return computed over this period for all the companies in the database amounts at a slightly negative -0.91%. Anyway, the test statistic $t_{CAAR}(T_1, T_2)$ has a value of around -0.3922, a value very close to 0 that is *de facto* supportive of the null hypothesis H_0, that cannot therefore be rejected with any statistical confidence.

A more insightful way to analyse the overall results of the investigation is to look at Average Abnormal Returns and Cumulative Average Abnormal Returns for every single day in the event window (**table 3**).

As a rule of thumb, it is convenient to consider a test-statistic with an absolute value larger than 1 as a significant departure from the null hypothesis. A glance is more than enough to see that the value of the test-statistic for Cumulative Average Abnormal Returns converges to 0 as the days in the event window pass by. This implies that the distance of the final CAAR from 0 is not big enough to justify a rejection of the null hypothesis H_0.

The following logical step is to try to ascertain whether in this 41-days period some specific peculiar patterns with any statistical significance are observable. In this sense, the first move that should be

performed is to look at the evolution of the CAAR over the event window, in order to gather some additional insights (**figure 2**).

As we can infer, even if the final value is very close to 0 (in fact, it is slightly negative) and statistically not different from it, the dynamics of the Cumulative Average Abnormal Return are quite peculiar and seem to suggest a specific path for the CAAR evolution following the announcement of a spin-off transaction.

In particular, at a first glance, it is intuitive to note that 2 subperiods with specular features can be identified:

- from day -1a to day +6a (in the week immediately following the event day), the curve in the chart is visibly upward sloping;
- from day +7a to day +18a, the curve has a visibly downward trend, that completely offsets the gains in terms of CAAR registered in the previous week.

In order to get a better grip on these dynamics, the first subperiod of the two just identified will be analysed on its own. Selecting day -1a as τ_1 and day +6a as τ_2, it is then possible to define CAAR (τ_1, τ_2) and t_{CAAR} (τ_1, τ_2) and test again the null hypothesis implying the absence of abnormal returns for the subperiod τ_1 - τ_2.

With respect to the results for the event window as a whole, it is clear that the ones obtained for the subperiod under investigation (**table 4**) present some interesting and partially conflicting evidence.

In the first place, CAAR is now positive, reaching a value of 2.28%, which is extremely high for a weekly interval. In the second place, in consideration of the value of the test-statistic being more than 2 standard deviations from zero, the null hypothesis that abnormal returns are not achieved by the parent company in a spin-off announcement is likely to be rejected.

Quite interestingly, these results show a good degree of homogeneity with those prevailing in academic literature with regard to impact of spin-off announcements on parent company's share price. In fact, it is possible to identify many different subperiods, within the employed event window, for which a statistically significant and positive CAR exists and therefore the null hypothesis should be rejected.

The next step in analysing the results is to assess the magnitude of AARs as measured in every single day of the interval, together with their statistical significance (**figure 3**). A graphical analysis is sufficient to support the conclusion that the more relevant AAR as for what concerns magnitude is the one registered in the event day (day 0), a fact that seems to support the conclusion that the

announcement indeed conveys some financial information, that is reflected in an anomalous increase in price.

The Average Abnormal Return computed in day 0, in fact, amounts at +1.28%, with a test-statistic of 2.3466, again more than 2 standard deviations from 0 (check table 2 above for the entire spectrum of data for AARs over the event window and related test-statistics). In this case too, the null hypothesis is to be rejected with a significative degree of confidence.

4. Conclusions

The developed analysis is aimed at determining whether the market believes that spin-offs have, on average and therefore regardless of the specific situations in which they might take place, a positive impact on the valuation of conglomerate firms. This investigation naturally consists also in an assessment of the existence or inexistence of a statistically significant conglomerate discount in advanced economies (Western Europe and Northern America) in recent years (2010-2017).

Most researchers agree on the conclusion that, in the very short-term, spin-off announcements result in significant Cumulative Abnormal Returns for the parent firms involved. The results computed for the interval of days -1a to +6a, showing evidence of a Cumulative Abnormal Return with a positive value of +2.28% and a test-statistic with a value of 2.41 (more than 2 standard deviations away from 0), confirm the conclusions of such studies. In this case, in fact, the null hypothesis stating that Cumulative Average Abnormal Returns are not statistically different from 0 should be rejected.

Looking at this evidence on its own, few doubts survive with regard to the above-mentioned investigation. Still, it should be noted that, by enlarging the event window to the longer interval -20a to +20a, the interpretation of the results obtained ends up being a lot more controversial. Employing such event window, in fact, the computed Cumulative Average Abnormal Returns do not statistically differ from 0 and, as a consequence, it is not possible to reject the null hypothesis.

These findings spread a new light on the results of the developed analysis. On one side, they show indeed that, for the days closely surrounding the announcement date, a conglomerate discount not only exists, but that it is also of a relevant magnitude and that it might even be exploited by an investor looking to capture the profits associated with abnormal returns, since the phenomenon mainly takes place from the announcement onwards (the largest Average Abnormal Return is in fact registered in day 0).

Still, on the other side, this increase in value appears to have an intrinsically temporary nature, since it ends up being reabsorbed in the following days. This might suggest that, overall, spin-off announcements do not convey value on their own and that, as a consequence, it might be necessary

to analyse in detail the performance of the separated subsidiary once it is listed on a stock exchange as well, to better assess the magnitude and even the existence of the previously discussed conglomerate discount. It appears, in fact, that the positive signalling effect associated by academic researchers with such transactions rapidly fades away if the event window is slightly widened.

Indeed, the obtained results strongly suggest that a temporary effect on the dynamics of share prices exists and that it stays unjustified by the model chosen to explain these dynamics. This evidence, therefore, shows that there is a market inefficiency with regard to the adjustments of the prices to new publicly available information (specifically, spin-off announcements) and that a smart investor might enjoy a "freeride" by investing its money in every transaction of this type on the day it is announced. Anyway, this imperfection is exploitable only for a very short window of time and its magnitude is not large, since the most of it takes place in day 0 and it might well be the case that investor is not able to immediately execute its strategy at announcement, so that the major part of its profit has already been captured.

In light of these findings and to sum up the reasonings developed in the previous sections, it is possible to state that the true, comprehensive impact of spin-offs depends on the effective ability of the spun-off subsidiary to perform well after the execution of the transaction and that the value created in the short-term for the parent, as well as the increase in its shareholders' wealth, might not survive in the medium/long-term. This implies that the spin-off decision (which, it is highlighted again, constitutes a crucial moment in the development of a firm's corporate strategy) should be taken cautiously by managers and only in the cases where the specific situation suggests that it is the best choice available to maximize the growth prospects of the company.

To conclude, spin-offs have the potential to be extremely advantageous for companies undertaking them and to generate large wealth gains for their shareholders, both in the short and the long-term, but they should not be regarded as a universal *panacea* for all the problems and issues that might arise in the management of a company's operations and might prevent it from growing. The particularly high standard deviation computed for the returns of the companies in the sample (18.81%), that might properly be considered as a proxy for the risk that companies have to face when choosing to perform transactions of this type, strongly supports the aforementioned conclusions.

The developed analysis is exclusively focused on the days immediately surrounding the announcement dates of spin-off transactions and the subsequent share price movements at a parent level. It is therefore, by definition, limited and these limitations should be taken into consideration when looking at the results that have been obtained.

Indeed, it should be considered that the possible analysis and investigations that could technically be performed with regard to spin-offs, or divestitures in general, are potentially countless. However, the gathered evidence drives towards a specific direction to be followed in developing future studies on the topic. In particular, the developed investigation and the formulated conclusions suggest that it would be useful to perform an analysis on the share price performance of the spun-off subsidiary once it has started trading on its own and that the results obtained should be aggregated with those computed for the parent company, so that it is possible to assess in more detail whether a conglomerate discount actually exists and if it has on its own the power to drive spin-off decisions.

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Table 1: Results for CARs around announcement date from previous spin-off studies

Authors	Date	Sample Size	CAR around announcement day
D. Boreiko and M. Murgia	2010	97	+4.8%
C. Veld and Y. V. Veld-Merkoulova	2002	156	+2.62%
S. Krishnaswami and V. Subramaniam	1999	118	+3.2%
H. Desai and P. Jain	1999	144	+3.84%
S. A. Johnson, D. P. Klein and V. L. Thibodeaux	1996	104	+3.96%
J. D. Rosenfeld	1984	35	+5.56%
G. Hite and J. Owers	1983	123	+3.30%
K. Schipper and A. Smith	1983	93	+2.84%
J. A. Miles and J. D. Rosenfeld	1983	55	+3.4%
K. J. Boudreaux	1975	31	-2.5%

Table 2: CARs distribution features

CAAR (T_1, T_2)	-0.91%
t_{CAAR} (T_1, T_2)	-0.392183322
Standard Deviation	18.81%
Skewness	-0.78241

Kurtosis	1.359278
Normally distributed?	Yes

Table 3: AARs, CAARs and relative test-statistics over the event window

t	AAR	t-cross-AAR	CAAR	t-cross-CAAR
-20	-0.72%	-3.008244096	-0.72%	-3.008244096
-19	-0.14%	-0.489674467	-0.86%	-2.140779643
-18	-0.35%	-1.46294548	-1.21%	-2.601678177
-17	-0.09%	-0.245260868	-1.31%	-2.216054291
-16	0.55%	1.436431809	-0.76%	-1.327237906
-15	-0.50%	-1.857794933	-1.26%	-1.926214735
-14	-0.24%	-0.796299819	-1.49%	-2.411567824
-13	-0.08%	-0.377988863	-1.57%	-2.345030584
-12	0.81%	2.135977013	-0.76%	-1.13296498
-11	-0.23%	-0.893398675	-1.00%	-1.401418463
-10	0.21%	0.738481158	-0.78%	-1.007373171
-9	-0.22%	-0.678149893	-1.00%	-1.202296099
-8	0.28%	1.130655618	-0.72%	-0.793355568
-7	-0.14%	-0.349342357	-0.86%	-0.894817471
-6	-0.12%	-0.436206709	-0.99%	-0.938284512
-5	-0.08%	-0.335459589	-1.07%	-0.923338042
-4	-0.44%	-1.70106511	-1.51%	-1.276399745
-3	0.35%	0.89883776	-1.16%	-0.975492107
-2	-0.53%	-2.006219019	-1.69%	-1.361175735
-1	0.22%	0.722462189	-1.47%	-1.115736084
0	1.28%	2.346554964	-0.18%	-0.126372755
1	0.33%	0.703231589	0.15%	0.096958956
2	0.06%	0.23562773	0.21%	0.139040927
3	-0.18%	-0.70806619	0.03%	0.020551106
4	0.03%	0.091676375	0.06%	0.037119361
5	0.12%	0.50291052	0.17%	0.108217352
6	0.41%	1.414459966	0.59%	0.359162533
7	-0.43%	-1.497256758	0.16%	0.098049256
8	-0.53%	-1.891140308	-0.37%	-0.214868086
9	-0.42%	-1.592603919	-0.79%	-0.451376215
10	0.21%	0.593552048	-0.58%	-0.316551872
11	-0.56%	-1.753739968	-1.14%	-0.596945549
12	0.18%	0.668713767	-0.97%	-0.495423994
13	0.36%	1.192751088	-0.61%	-0.308545495
14	-0.10%	-0.292762906	-0.71%	-0.345336938
15	0.21%	0.635696301	-0.50%	-0.235295455
16	-0.73%	-1.971677595	-1.23%	-0.565995668
17	-0.55%	-1.769035727	-1.78%	-0.782121749
18	-0.17%	-0.536171673	-1.95%	-0.862490339
19	0.68%	2.146742747	-1.27%	-0.55891955
20	0.36%	1.06828131	-0.91%	-0.392183322

Table 4: CAAR and relative test-statistic for the period ranging from -1a to +6a

CAAR (τ_1, τ_2)	2.28%

$t_{CAAR}(\tau_1, \tau_2)$	2.405583251
Standard Deviation	7.70%

Figure 1: CARs distribution

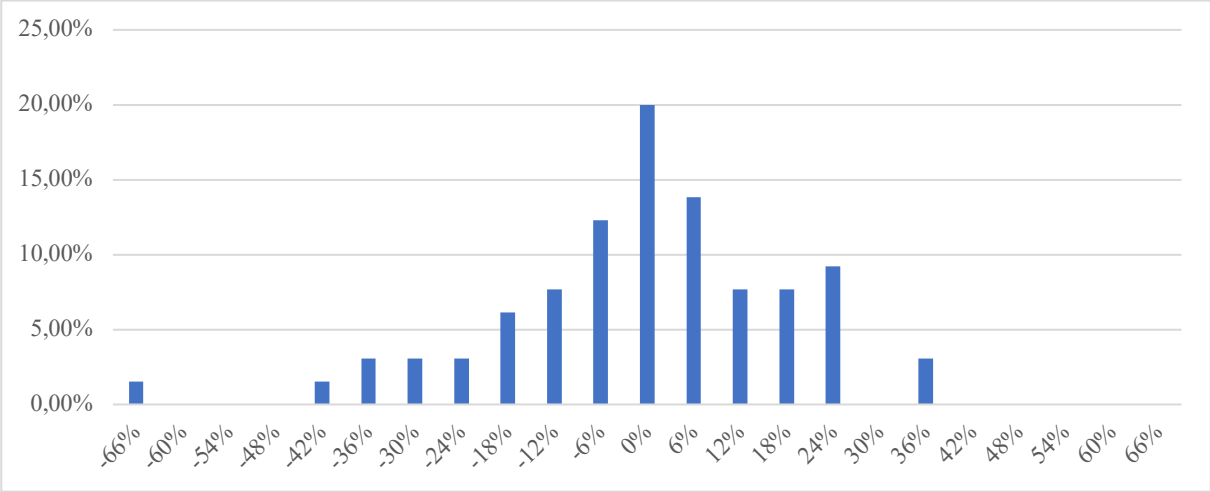


Figure 2: CAAR evolution over the event window

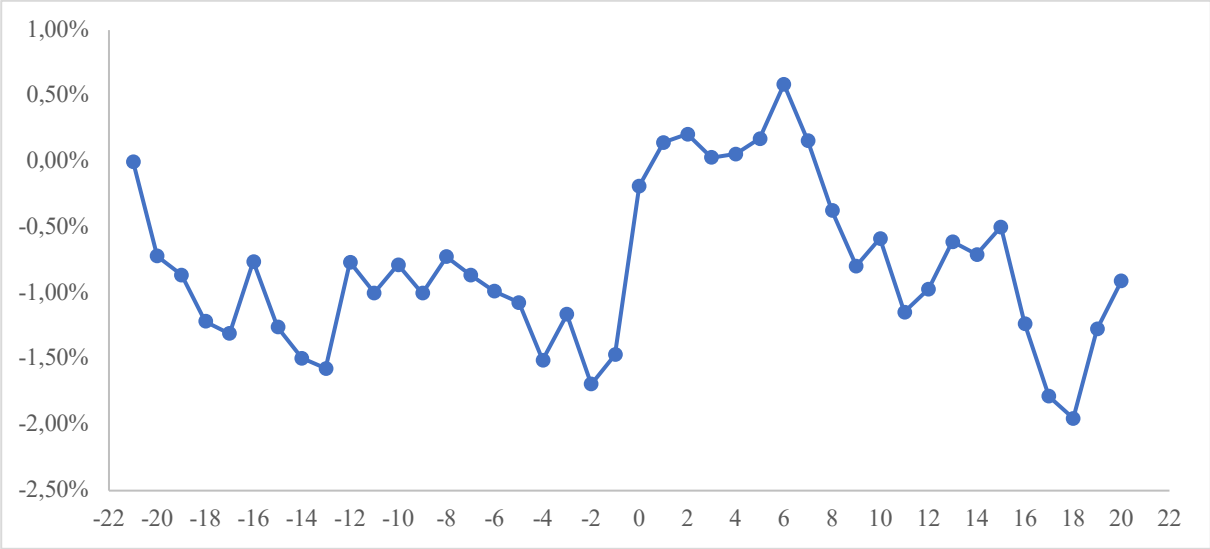


Figure 3: AARs in the event window

