Analysis of Spin-off Long-term Performance and Effects of Dual Directorship

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Abstract

This paper analyses the post spin-off stock performance of 198 European companies from 15 different countries. We calculate monthly abnormal returns over 36 months following the completion of spin-offs over the sample period from 2002 to 2014. We also analyze whether there is a significant effect on the abnormal returns when spin-off parent and target company continue to share board and management members after the completion of spin-off (dual directorship). We find that both spin-off parent and target companies continue to generate long-term abnormal returns after the spin-off while target companies tend to outperform parent companies. We also find that having continued dual directors has a positive effect on the performance of parent companies while the effect on the performance of target companies cannot be determined.

Keywords: Spin-offs, long-term performance, abnormal returns, dual directorship

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List of Abbreviations

Table of Abbreviations	
AR	Reads as Abnormal Return
CAR	Reads as Cumulative Abnormal Return
CAAR	Reads as Cumulative Average Abnormal Return
BHAR	Reads as Buy-and-Hold Abnormal Return
ABHAR	Reads as Average Buy-and-Hold Abnormal Return
IAS	Reads as International Accounting Standard
IFRS	Reads as International Financial Reporting Standard
SEC	Reads as Securities and Exchange Commission
IPO	Reads as Initial Public Offering
BvD	Reads as Bureau van Dijk
ICB	Reads as Industry Classification Benchmark
ISIN	Reads as International Securities Identification Number
MSCI	Reads as Morgan Stanley Capital International
SDC	Reads as Securities Data Company

1. Introduction

Spin-off is a special case of divestiture in which a publicly listed company distributes shares of its division or a business unit to the existing shareholders. After the implementation of this transaction the spun-off unit, therefore, becomes a separate publicly traded company. What is interesting about this type of divestiture is that spin-off is a cashless transaction since the parent entity and the divested unit do not receive any cash.

A company's managers may be motivated to implement a restructuring activity in order to improve efficiency, transparency, and strengthen their position within the firm (Bergh, 2017). Indeed, it may be argued that by separating and simplifying companies, managers achieve efficiency improvements and allow separated and more flexible firms to pursue growth strategies. In general, there exists a relatively small body of research focused on restructuring activities that may be classified as divestitures compared to the number of studies investigating other kinds of corporate actions such as, for example, mergers, acquisitions, joint ventures (Lee and Madhavan, 2010). Therefore, a spin-off transaction, as a type of divestiture, remains a relatively unexplored area of research.

Our motivation to research this topic comes from the fact that clear majority of research on spin-off performance has been done based on US data while empirical research on European spin-offs is hard to find. Therefore, we were interested whether there is sufficient data available for European spin-offs to conduct an empirical analysis of the spin-off company performance and if so, whether the result found in US based research would also reflect in Europe. Additionally, we found evidence in previous studies that both spin-off parent and target company performance is influenced by the continued dependencies between two companies. One of the papers (Feldman, 2016) offered a way to measure this kind of dependencies by looking at shared board and management members.

Our paper contributes to existing academic literature on spin-offs in several ways. First, we conduct our analysis using a set of European spin-off transactions. Second, unlike other studies that scrutinize spin-off effects on either the parent or divested entities, we examine the post divestiture stock performance of both parent and target entities as two separate units and as a combined entity. Third, we extend our analysis by using a non-commonly used firm characteristic that is designed to measure post spin-off interrelatedness between parent and target companies

captured by the dual directorship variable explained further in the methodology part. This measure allowed us to explore the relationship of having dual directors on the boards of parent and spun-off companies and their subsequent stock performance.

As key variables of performance for the analysis part we calculated CAR and BHAR measures for various time intervals. That allowed us to investigate both short and long-term performance of companies. The analysis implemented in this research may be divided into two parts. First, we simply examined whether target and parent companies produced any abnormal returns following the completion of spin-off process. In this part of the analysis, we evidenced that in the long term both parent and target entities experienced economically significant abnormal returns after the spin-off completion. Further examination revealed that target companies significantly outperform parent firms over the three-year period after the spin-off date when comparing the performance using CAAR and ABHAR measures. In the other part of our analysis, we focused on estimating the effect of dual directorship on post divestiture performance. Using different regression specifications, we found that dual directorship is positively related to the post-spin-off stock performance of combined parent-target pairs, and the effect is statistically significant in the long term. Similar results were obtained from the separate regressions using a set of parent companies. Finally, the regression analysis of target firms showed the same positive relationship, however, the obtained coefficients were mostly not statistically significant for this collection of regressions. The obtained results are robust to changes in the market indices used to calculate abnormal returns and other proxy variables.

The remaining part of this paper is structured in the following manner. In section 2, we review related literature on the post spin-off stock performance. In section 3, we define our research questions and provide motivation for this study. In section 4, we describe the data collection and cleansing steps, and provide an overview of our sample characteristics. In section 5, we describe the methodology used in this paper. In section 6, we summarize main results. In section 7, we discuss obtained results. Finally, section 8 concludes this thesis.

2. Literature Review

Spin-offs are undertaken by companies for several different reasons, such as reallocating resources, focusing managerial attention, simplifying the company structure and removing underperforming business units. All those reasons are likely to be economically rational, meaning that parent company believes the value of combined companies is lower than the sum of two separate companies. However, in case of spin-offs, the increase in value might not be immediately evident as there is no additional cash inflow into the company at the completion of the divestiture. Nevertheless, on average, stock markets will react positively to the announcements and completions of spin-offs. This section reviews the previous research conducted on the stock market performance of companies involved in the spin-off process, effects of continued co-dependence of two companies on spin-off performance and summarizes the most important findings.

2.1. Previous Research on Spin-off Performance

There have been several papers published in the past to investigate the stock performance of the companies involved in the spin-off process. The research can largely be divided into two major directions: those focusing on stock market effects of spin-off announcements (e.g. Hite and Owers (1983), Miles and Rosenfeld (1983)) and those focusing on stock performance during a defined period after the spin-off (e.g. Dallenbach, Willard and Woo (1992) and Cusatis, Miles and Woolridge (1993)).

The studies focusing on researching the announcement effects have found that there is a significant positive announcement day effect to the stock returns of the combined company. The first notable empirical paper published on this topic was by Miles and Rosenfeld (1983) analyzing the stock performance of 92 American companies that undertook spin-offs between 1963 and 1980. They found a cumulative average abnormal return of 22% between 120 trading days prior the announcement and 60 days after the completion date. Similarly, Hite and Owens (1983) analyzed 123 American companies that undertook spin-offs between 1962 and 1981 and found a statistically significant positive cumulative abnormal return of 7% between 50 days prior to the announcement date and spin-off completion date. There are several explanations that have been proposed as an explanation of this effect, such as stock market players expecting spin-off to bring along

organizational, capital market and governance improvements, reduced information asymmetry and bondholder expropriation (Maxwell and Rao, 2003).

However, our study does not focus on announcement effects but rather the ex-post effects of spin-offs. According to efficient market hypothesis (Fama, 1970), in a semi-strong form of efficient market, stock prices should include all the available public information. For spin-off stock performance this would mean that after the initial announcement and before the completion of spin-off, the stock price of combined company should already include all the expected positive operational effects brought along by the spin-off. Therefore, the completion of spin-off and later performance should not, on average, bring along significant abnormal returns. However, the empirical evidence does not confirm that.

Study conducted by Cusatis, Miles and Woolridge (1993) focused on ex-post spin-off effects and analyzed the long-term stock performance of 146 American listed companies that undertook spin-offs between 1965-1988. They found that even after the stock market players have adjusted the valuation of companies on announcement, the stock returns of both previous parent company and the spin-off company significantly outperform the stock returns of matched sample companies over a longer period. This indicates, that efficient market hypothesis proposed by Fama (1970) might not hold for spin-offs.

In their paper, Krishnaswami and Subramaniam (1999) provide two possible explanations for that kind of effect. It may arise from the long-term elimination of negative synergies between parent and the spin-off company, simultaneously rising the value of both companies. The elimination of those synergies would have to be, however, unexpected by stock market players at the spin-off announcement or it would be already immediately included in the stock price valuation. Or alternatively, if the two companies involved in the spin-off are considerably diverse (e.g. operate in unrelated industries), the valuation of a combined company would be more complicated due to information asymmetry. The value of different divisions would not be easy to communicate. Separation of two diverse companies enables better and more accurate overview of operational efficiency and the negative effects, created by information asymmetry, are mitigated. The second explanation does not violate the efficient market hypothesis since all the information regarding the company is not public.

Empirical evidence suggests that, on average, stock market expectations at spin-off announcement tend to undervalue the long-term positive operational effects of spin-offs, resulting in positive abnormal stock returns for both parent and target companies.

2.2. Previous Research on Continued Dependencies

Most of the previous research over the stock performance of spin-off related companies has treated the parent and spin-off companies as fully independent separate companies after the spin-off completion date. However, this type of treatment might not be completely accurate as the two companies will have developed multiple dependencies to each other (e.g. existing service and sales contracts or sharing board, management and other workers) while operating as one company. Given that during spin-off the spun-off company ownership is distributed between shareholders and not directly transferred to another owner, it is reasonable to assume that some of these dependencies will not be immediately terminated and will continue to influence the performance of the companies for some time (Cannella and Semadeni, 2011). For example, it is not uncommon that the two companies will continue to share members of boards of directors and management.

Various research has been conducted to find out the effects of having different kind of continued dependencies. Canella and Semadeni (2011) found that parent company having continued substantial ownership stake has negative effect on the stock market performance of the spun-off company. They argue, that "It appears that continued substantial ownership by the parent firm acts to constrain the child, preventing it from adapting and establishing itself as an independent entity."

Another empirical study of 228 spin-offs undertaken by American companies between 1995 and 2010 (Feldman, 2016) focuses on the stock market effects of shared management and board members. In her study Feldman finds that there is a statistically significant (at 5% confidence level) positive effect on combined performance of the companies from having dual directors. She finds that the value weighted returns of spin-off company pairs that share directors on their boards after the spin-off completion date exceeds the value weighted returns of those pairs that do not by 32 basis points. Additionally, parent companies that have dual directorships outperform those that do not by 47 basis points while spun-off companies with dual directors underperform their peer group by 42 basis points. Those findings together indicate that while having continued dependencies

between parent and spin-off company benefits the shareholders of both companies, the shareholders of parent company will benefit at the expense of the shareholders of spun-off company.

The reasons to appoint dual directors to the board and management of spun-off companies are, however, not only in the interest of parent company. The directors of spun-off company are a key resource of information, knowledge, capabilities and expertise (Feldman, 2016). These competences are likely to be amplified in the case of dual directors due to their previous experience with the spun-off company (Cannella and Semadeni, 2011).

The continuation of dependencies after the completion of spin-off seems to be beneficial when the performance of the two companies is evaluated as one. However, the empirical evidence based on the ex-post performance of the American companies indicates that majority of the benefits will flow to the shareholders of the parent company at the expense of the shareholders of spun-off company.

3. Motivation and Research Questions

3.1. Motivation

The research and the results summarized in previous chapter are exclusively based on data from US listed companies. There are several reasons for that. First, the spin-off market in US has been one of the most active for a long period of time, making it easier to obtain sufficiently large sample sizes over reasonable period. Second, the SEC requires every company to report significantly more detailed information (when compared to IFRS requirements) of their activities in standardized form, making it easier to collect specific data on spin-offs. However, the evidence, that stock performance of companies involved generate positive abnormal returns and that the continued dependencies between the companies influences the stock performance, seems to be strong. Therefore, it can be expected that similar evidence could be found from European stock markets, given that enough data is available.

This analysis sets out to find evidence of those two tendencies from the European spin-offs and stock markets.

3.2. Research Questions

Research Question 1: Do European companies involved in a spin-off generate on average positive abnormal return after the completion of spin-off?

According to the efficient market hypothesis, there should be no significant long-term stock market effect. However, based on the evidence found from the spin-offs undertaken by US listed companies, we expect both the European parent and the spin-off companies to generate positive ex-post abnormal stock returns.

Research Question 2: Does the average stock performance of a parent-target firm pair that shares one or more dual directors exceed the average stock performance of a parent-target firm pair that shares no dual directors?

The second research question aims to analyze whether the presence of dual directors has any significant effect on the stock performance of parent-target firm pair as a whole. Similarly to the effects found in US data, the effect is expected to be positive.

Research Question 3: Does the average stock performance of a parent firm that shares one or more dual directors exceed the average stock performance of a parent firm that shares no dual directors?
Research Question 4: Does the average stock performance of a target firm that shares one or more dual directors exceed the average stock performance of a target firm that shares no dual directors?
The third and fourth research questions aim to analyze whether the presence of dual directors has any significant effect on the stock performances of parent and target firms as separate units. Given the evidence found in US data, the effects are expected to be positive for parent companies and negative for spin-off target companies.

4. Data

4.1. Collecting Spin-off Data

The final dataset used in this analysis is collected from multiple sources and consists of 104 spin-offs undertaken in Europe between 2002 and 2014. Initially, the SDC Platinum International Mergers Database (Thomson Reuters) was used to compile a list of all the completed spin-offs within this timeframe, where both the parent and the target company were European, and the parent company had a known ticker symbol. Due to data availability issues, deals from Eastern-European countries were excluded. Following that, various news resources were used to identify and include only actual spin-offs. Deals were eliminated from the SDC dataset if they met at least one of the following conditions:

- Being duplicate entries to SDC;
- Could not be identified as an actual spin-off (e.g. IPO's or direct sale of target company to other company);
- Target company was never publicly listed;
- No additional information found on the deal from news resources.

During this stage, additional spin-offs were identified from other previous research done on European spin-offs (Vollmar, 2014) that met the criteria but were not included in the initial SDC dataset. The Table 1, presented below, provides exact number of deals gathered and eliminated at each step.

Table 1: Cleaning steps for spin-off sample data

The table presents the cleaning process of the spin-off data from the period of 2002-2014. For each of the two datasets, SDC and previous research (Vollmar, 2014), the total raw number of spin-offs is presented followed by number of spin-offs eliminated in each cleaning step. The two datasets were joined manually by verifying the nature of each deal.

Cleaning steps for spin-off sample data (2002-2014)	
Number of completed spin-offs collected from SDC:	*260*
No target ultimate parent ticker symbol:	-81
Target nation Eastern-European:	-24
Duplicate entry to SDC:	-3
Not an actual spin-off:	-36
Target company not publicly listed:	-4
Inadequate information available to verify deal:	-15
Total SDC:	**97**
Number of spin-offs from previous research:	*83*
Already included in SDC dataset	-49
Inadequate information available to verify deal	-7
Total previous research:	**27**
Joined cleaned dataset:	**124**

4.2. Collecting Management and Board Data

Having cleaned the dataset from spin-offs that did not meet the set criteria, management and board information was collected using BvD Amadeus database. For each company still left in the sample, list of current and previous members of the board of directors and senior management was

collected. To reliably match companies from our spin-off dataset to companies in Amadeus database, ISIN – International Securities Identification Numbers from Thompson Reuters Eikon database were used. Still, for some companies, board and management data was not available (company not found in Amadeus database). If either parent or target company management and board information was not obtained, then both companies were excluded from our dataset. In total 20 additional spin-offs were removed from analysis sample resulting in a final sample size of 104 spin-offs and 198 unique companies (some companies undertook more than 1 spin-off during the period). List of spin-offs in final sample is presented in Appendix A.

Based on collected board and management data, a variable for each spin-off was created. If the parent and the target company involved in the spin-off shared at least one board or management member for at least 6 months during the 5 years following the spin-off completion date, then the variable was obtained the value of total number of different shared directors over that 5-year period.

4.3. Collecting Firm Fundamentals and Return Data

Thompson Reuters Eikon database was used to collect various stock market and financial data. For each company, daily series of adjusted stock prices was collected. If the price on the exact specified date was not available, the earliest available price after the specified date was used. Additionally, daily series of European markets benchmark values (MSCI Europe, STOXX Europe 600, Euronext 100 and country specific indices) were collected in the same manner. Full list of country specific benchmark indices can be found in Appendix B. The collected data series were used to estimate the abnormal monthly stock returns up to 36 months after the spin-off completion dates.

Eikon database was also used to collect firm fundamentals data (e.g. total assets, market capitalization, industry classification) and daily foreign currency exchange rates to convert variables to euros when necessary.

4.4. Sample Characteristics

4.4.1. Industry

To account for the differential nature of firms' economic activities we collected Industry Classification Benchmark (ICB) codes and names for companies analyzed in this paper. The

detailed distribution of companies by industry classification is shown in the Table 2. It is worth mentioning that 25 percent of companies in our sample fall under the Industrials category. Other largest sets of companies in our final sample are Consumer Services and Basic Materials with 15 and 14 respectively. Other industries presented in the Table 2 contain smaller percentage of sample companies varying from 3 to 10 percent. It is possible to segregate companies further using less broad industry classifications, however, given the limited number of spin-off observations in the sample, the broader definition was deemed appropriate.

Table 2: Industry distribution of companies in the final sample

The table presents the industry distribution (number and percentage of total sample size) of 198 companies that were involved in the final sample of 104 spin-offs completed from 2002-2014.

Distribution by industry			
Industry Code	Industry Name	Number of Companies	% of Total
2000	Industrials	50	25.25%
5000	Consumer Services	30	15.15%
1000	Basic Materials	27	13.64%
3000	Consumer Goods	20	10.10%
8000	Financials	19	9.60%
4000	Health Care	13	6.57%
0001	Oil & Gas	13	6.57%
9000	Technology	12	6.06%
7000	Utilities	7	3.54%
6000	Telecommunications	6	3.03%
	Unclassified	1	0.51%
	Total	**198**	**100%**

4.4.2. Country

By analyzing a single European country, one might encounter that there are not enough spin-off observations available to conduct a statistical analysis. Furthermore, it might not be possible to generalize findings of a single-country study. From the other side, by using a sample of too diverse countries it might be hard to produce reliable generic results. In our analysis we intend to produce findings that can be interpreted for the whole sample by using European firms that are headquartered in developed economies, located at relatively close geographic area, have similar accounting standards and operate within the single economic area.

In our research we conduct a multi-country analysis because, for the studied period, there are not enough spin-off observations that can be gathered from a single European country, or even a region. High number firms in the sample are based in the UK and constitute 25.8 percent of sample companies. It is interesting to note that all Nordic countries have a relatively high share of spin-off companies, and Sweden ranks second in Europe with 16.7 percent of sample companies. Unexpectedly, we cannot place Germany, being one of the largest economies, to the decile of countries with highest number of post spin-off firms. The exact distribution of sample companies by countries is presented in Table 3.

Table 3: Country distribution of companies in the final sample

The table presents the country distribution (number and percentage of total sample size) of 198 companies that were involved in the final sample of 104 spin-offs completed from 2002-2014.

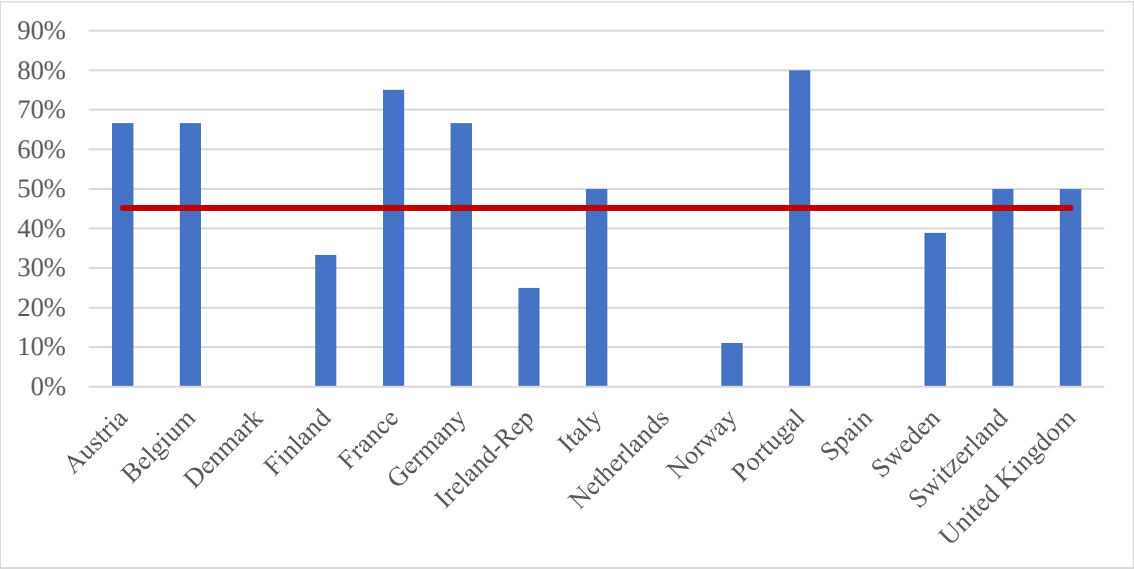
Distribution by country		
Country	Number of companies	% of Total
United Kingdom	51	25.76%
Sweden	33	16.67%
Finland	17	8.59%
France	16	8.08%
Norway	16	8.08%
Italy	12	6.06%
Switzerland	12	6.06%
Portugal	8	4.04%
Ireland-Rep	7	3.54%
Austria	6	3.03%
Belgium	6	3.03%
Germany	6	3.03%
Netherlands	4	2.02%
Denmark	2	1.01%
Spain	2	1.01%
Total	**198**	**100%**

The proportion of spin-off companies that share common directors to the total spin-offs by countries is shown in the Figure 1. The weighted average for the whole sample is 45%. Notably, the Nordic countries all rank below the average of whole sample, possibly indicating higher emphasis of separating the governance of parent and spin-off company in those countries.

Considering the high variance of dual directorship between the countries, we have decided to add country as a control variable to our regression analysis.

Figure 1: Proportion of spin-offs with dual directors

The figure shows the percentage of spin-off companies that continued to share management or board members after the spin-off completion date in each sample country.



4.4.3. Sample Period

The sample covers the period from 2002 to 2014. The chosen time frame allowed us to collect enough observations necessary to implement statistical analysis and evaluate what impact the key variables have on post spin-off performance in the long run. The most recent spin-off transactions included in our sample were completed in 2014 and have sufficiently long post spin-off performance track that can be used to assess their long-term returns.

From the practical perspective, increasing the length of the sample period to collect more observations was not feasible given the absence of information on earlier deals. It is essential to include only true spin-off transactions in our sample, thus, given the presence of misclassifications and unverifiability of earlier deals downloaded from the SDC database, the sample period was not extended beyond 2002.

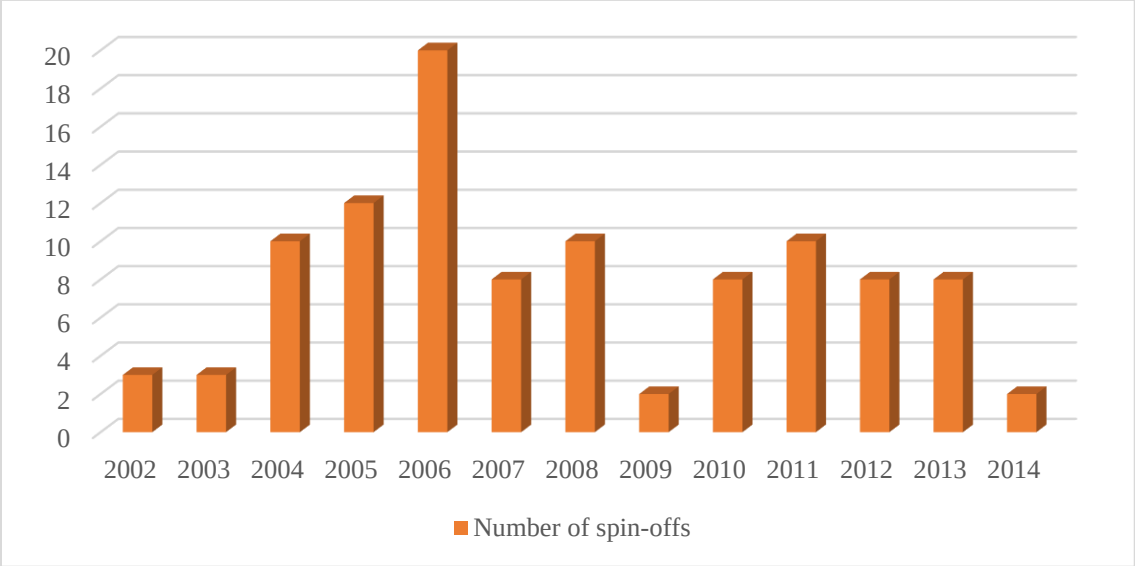
Furthermore, by analyzing a relatively recent period, we look at a set of countries that are more similar in terms of their economies and financial systems. EU directives, the adoption of single currency, common accounting requirements for listed European companies lead to a less

heterogeneous sample of countries. For instance, Lane et al (2006) found that the adoption of euro played a crucial role in the closer integration of the European financial system.

What is evident from the Figure 2 below, showing spin-off deals by year, is that there is a pattern of timing when firms are doing spin-offs. Consistent with Woo et al. (1992), our sample period is long enough to capture the effects of both economic expansion and contraction.

Figure 2: Distribution of spin-offs over the sample period

This figure shows the total number of spin-offs undertaken and completed by the companies in our sample each year from 2002 to 2014.



5. Methodology

In this section, we describe the methodology used to assess the relationship between spin-offs and the variables of interest. First, we define expected returns and what models were used to estimate long-term abnormal returns. Further, we move to the regression specifications, description of variables, and explain what robustness checks we employ in this analysis.

To assess the post spin-off market performance of sample companies, we use cumulative average abnormal return (CAAR) and average buy-and-hold abnormal return (ABHAR) measures in the first part of analysis. In the second part of our analysis, we employ both cumulative abnormal return (CAR) and buy-and-hold abnormal return (BHAR) methods to calculate dependent variables used in regressions. While CAR is widely used in empirical studies as method of choice, it can be considered as a biased predictor of BHAR as documented by Barber and Lyon (1997). BHAR accounts for compounding effects while CAR does not, providing a result more closely resembling an investor's perspective. Therefore, we include both methods in our analysis.

Abnormal Return Calculations

We calculate monthly abnormal returns in a conventional way (see Lee and Madhavan (2010)) as specified in the formula (1) below:

$$AR_{i,t} = R_{i,t} - E\left(R_{i,t}\right) \qquad (1)$$

Where $AR_{i,t}$ is abnormal return for share i in period t, $R_{i,t}$ the observed return for share i in period t, and $E\left(R_{i,t}\right)$ is the expected return for stock i in period t, and the length of the period is 1 month.

We use four different market indices to estimate $E\left(R_{i,t}\right)$ as outlined by MacKinlay (1997). In our main analysis we use country-specific indices (Appendix B) as our benchmark value. However, as pointed out by Ritter (1991), using only single benchmark index to calculate abnormal returns can lead to distorted results. Therefore, we use additional 3 market indices as a check of robustness. First, MSCI Europe that includes large and mid-cap stocks listed in developed European countries. 15 countries that constitute the index fully coincide with our sample countries. Second, the STOXX Europe 600 Index that is made up from large, mid and small-cap companies

listed mostly in East-Central Europe, and last, Euronext100 that consists of 100 largest equities listed on Euronext.

Cumulative Abnormal Returns and Buy-and-Hold Abnormal Returns

For both parts of our analysis we will need to use monthly CAR and monthly BHAR values as inputs. These values were calculated using CAR and BHAR methods shown in formulas (2) and (3) respectively, which are in line with Barber and Lyon (1997). Both approaches are commonly used in literature (Lee and Madhavan 2010).

$$CAR_{i,t} = \sum_{t=1}^{T} AR_{i,t} \qquad (2)$$

$$BHAR_{i,t} = \prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{m,t}) \qquad (3)$$

Where $R_{i,t}$ is the observed return for share i in month t and $R_{m,t}$ is the observed return for the market benchmark in month t.

In our sample, there are companies that get delisted during the period we analyze. In particular, companies may get delisted because they went bankrupt, private, or got acquired. If those companies are totally excluded from the analysis, the results may get distorted. According to Barber and Lyon (1997), the relationship between the direction of expected long-term abnormal returns and the survivorship bias is not straightforward, but they claim transactions such as acquisitions should probably have positive prospective abnormal returns while a bankruptcy would have the opposite effects on those returns. To avoid including survivorship bias in our analysis we implement the following adjustment. If a company stops trading for any reason during the three years following the completion date, CAR and BHAR returns are calculated up until the month when the last price was available. For every following period, the latest calculated CAR or BHAR is used.

5.1. Market Performance After Spin-off

To assess market performance of parent and spin-off companies and answer Research Question 1, CAAR and ABHAR values were calculated as shown in formulas (4) and (5) respectively. Methods are as in Ritter (1991).

$$CAAR_t = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,t} \qquad (4)$$

$$ABHAR_t = \frac{1}{N}\sum_{i=1}^{N} BHAR_{i,t} \qquad (5)$$

Where N is the number of companies in the sample for month t. The t-*statistics* for both CAAR and ABHAR were calculated based on the skewness adjusted formula as proposed by Hall (1992) and calculated as:

$$t - stat = \sqrt{N}\left(S + \frac{1}{3}\gamma S^2 + \frac{1}{27}\gamma^2 S^3 + \frac{1}{6N}\gamma\right) \qquad (6)$$

where

$$S = \frac{CAAR}{\sigma(CAAR)} \qquad (7)$$

$$\gamma = \frac{N}{(N-2)(N-1)}\sum_{i=1}^{N}(CAR_i - CAAR)^3\sigma(CAAR)^{-3} \qquad (8)$$

For ABHAR, the formulas are the same but $CAAR$, $\sigma(CAAR)$ and CAR_i replaced with $ABHAR$, $\sigma(ABHAR)$ and $BHAR_i$ respectively. The skewness corrections were necessary as the skewness of CAR distributions ranged between 0 – 4 and skewness of BHAR distributions ranged between 2 – 6.

5.2. Effects of Dual Directorship

In this part, we employ ordinary least squares cross-sectional regressions along with a set of control key variables that were chosen to answer Research Questions 2 – 4 and to further analyze the impact of shared directorship on performance of sample companies while controlling for firm characteristics.

The dependent variables ($CAR_{i,t}$ and $BHAR_{i,t}$) were calculated for 1 month, 3 months, 6 months, 1 year, 2 years, 3 years after the spin-off date. The explanatory variables were the following:

- $\text{Industry}_{\ i}$ – dummy variable that takes a value of firm's industry. The description of industries can be found in section 3.
- $\text{Country}_{\ i}$ – dummy variable indicating the nation where the company is headquartered.
- Ln(size)_i – is calculated as natural logarithm of market capitalization to capture the size effects on abnormal performance of sample companies.
- Spin_num_6m_i – measures number of spin-offs that took place in the period 6 month before and after the spinoff date. This control variable is used to capture the accumulation of spin-off deals across time.
- sh2num_i – measures the number of directors shared during following 5 years after the spin-off date for at least six months.
- $\text{Debt\_ratio}_{\ i}$ – the indebtedness ratio was calculated as the ratio of total company debt to its assets. Since large creditors have impactful control rights and closely monitor relatively indebted companies (see Jensen, 1986) managers might be less inclined to undertake seemingly risky projects which might negatively affect the shareholder wealth (see Shleifer and Visnhy, 1997).

Separate regressions of parent and target firms

To answer previously defined Research Questions 3 and 4, we used the following regression specification (9) shown below. To be precise, we run separate regressions for parent and target

companies mainly to find out whether the dual directorship variable has a different impact on post spin-off performance of two sets of companies.

$$Y_t = \alpha_0 + \beta_1 Industry_i + \beta_2 Country_i + \beta_3 Ln(Size)_i + \beta_4 Spin\_num\_6m_i + \beta_5 sh2num_i + \beta_6 Debt\_ratio_i \quad (9)$$

Weighted return regression

The last regression setup is implemented by combining parent and target entities together. This regression structure is used to investigate whether parent-target firm pairs that share one or more dual directors perform better on average than firms that do not share dual directors (Research Question 2). To perform this set of regressions we made several adjustments to firm data values. When observations were available for both parent and target firms we combined debt proportion, sales, asset, and market capitalization values together. Afterwards, the combined market capitalization values and separate share return series were used to recalculate the weighted stock market returns of consolidated entities. In the base regression specification, we used market capitalization as a measure of size.

$$Y_t = \alpha_0 + \beta_1 Industry_i + \beta_2 Country_i + \beta_3 Ln(Size)_i + \beta_4 Spin\_num\_6m_i + \beta_5 sh2num_i + \beta_6 Debt\_ratio_i \quad (10)$$

5.3. Robustness checks

As previously noted, we employed four different stock market benchmarks throughout the entire analysis. To check the results of regressions defined in the previous section we performed the analysis using conceptually same independent variable measuring size, but substituted input data to calculate this control variable. In both the case of weighted return regressions and the cases of separate regressions for parent and target firms, the measure of size was calculated using firms' combined sales or assets.

6. Results

In this section, we describe results that were obtained using the methodology presented in the section 5. We start with the analysis of after spin-off stock performance and proceed this chapter with robustness checks of returns using different stock market benchmarks. We examine regressions of separate sets of parent and target companies, and regressions of weighted parent-target pairs as was specified before in the equations (9) and (10) respectively. While moving through the description of regression results, we continue every sub-section with robustness checks of post spin-off performance using other proxies as control variables.

6.1. Market Performance After Spin-off

In this section, we present our findings regarding the abnormal returns of European companies post spin-offs to answer the Research Question 1. Table 4 presents the monthly CAAR over the 36 months following the spin-off for all the sample companies together and separately for spin-off parent and target companies. Similarly, Table 5 presents the monthly ABHAR over the 36 months following the spin-off following the same company grouping.

From both of those tables we can see similar trends emerging. During the first year after the spin-off, the cumulative average abnormal returns for all the companies combined are not statistically significant and have also relatively low economic significance. However, during the second year, CAAR becomes both statistically and economically significant reaching 22.3% by the end of year three. When looking at the more detailed breakdown between CAAR's of parent and target companies, we can see that target companies seem to produce considerably higher abnormal returns over the three years following the spin-off and the positive effects can already be seen during the first years. For parent companies, the abnormal returns are lower all over 36 months and even negative during the first year following the spin-off.

The average buy-and-hold abnormal returns present same trends as described for cumulative average abnormal returns, while the effects for returns of target companies are even more pronounced. The ABHAR for parent companies over one year following spin-off is not significantly different from 0 and results in 7.1% and 15.6% over two and three years respectively.

The ABHAR for target companies has steady positive trend over all the three years and results in 31.7% and 44.0% over two and three years respectively.

For better visualization purposes we have also plotted the time series of monthly CAAR's and ABHAR's, which are shown in Figure 3 and Figure 4 below.

Table 4: Market Adjusted CAAR from month 1-36

Table presents market adjusted CAAR calculated using country specific market benchmark values, number of companies and respective t-test results for all the sample companies, spin-off parent companies and spin-off target companies. Full table of country specific values can be found in Appendix C.

Market Adjusted Cumulative Average Abnormal Returns									
	All Companies			Parent Companies			Target Companies		
Month	CAAR	#	*t-test*	CAAR	#	*t-test*	CAAR	#	*t-test*
1	-0.6%	208	-0.31	-1.9%	104	-1.26	0.7%	104	0.33
3	1.7%	208	0.93	0.1%	104	0.07	3.3%	104	1.13
6	2.0%	208	0.87	-0.2%	104	-0.08	4.2%	104	1.11
12	2.8%	208	0.96	-1.3%	104	-0.34	7.0%	104	1.57
24	14.5%	208	3.94	6.5%	104	1.34	22.5%	104	4.14
36	22.3%	208	5.19	11.7%	104	1.95	32.9%	104	5.51

Table 5: Market Adjusted ABHAR from month 1-36

Table presents market adjusted ABHAR calculated using country specific market benchmark values, number of companies and respective t-test results for all the sample companies, spin-off parent companies and spin-off target companies. Full table of country specific values can be found in Appendix D.

Market Adjusted Average Buy-and-Hold Abnormal Returns									
	All Companies			Parent Companies			Target Companies		
Month	ABHAR	#	*t-test*	ABHAR	#	*t-test*	ABHAR	#	*t-test*
1	-0.6%	208	-0.31	-1.9%	104	-1.26	0.7%	104	0.33
3	1.9%	208	1.04	0.2%	104	0.14	3.7%	104	1.23
6	3.2%	208	1.50	-0.1%	104	-0.03	6.5%	104	1.83
12	5.6%	208	1.64	0.5%	104	0.15	10.7%	104	2.21
24	19.4%	208	3.93	7.1%	104	1.20	31.7%	104	4.14
36	29.8%	208	5.02	15.6%	104	2.03	44.0%	104	4.98

Figure 3: Average Cumulative Abnormal Returns from month 1-36 by company type

We plot monthly CAAR time series over 36 months separately for sample parent and target companies and all the sample companies together. Calculations have been done using country specific benchmark index and are done on equally weighted basis.

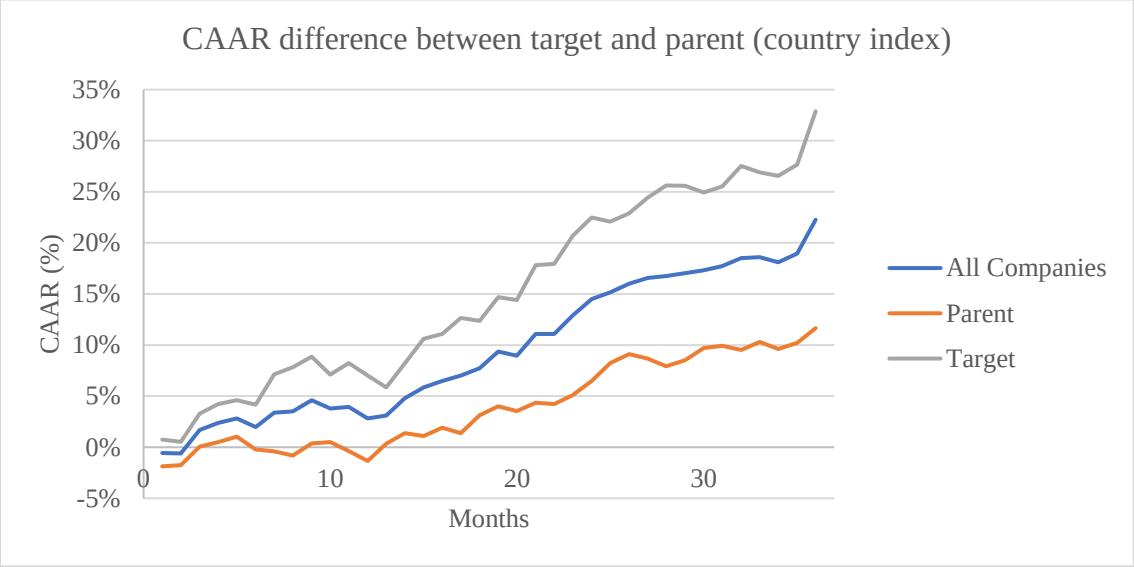
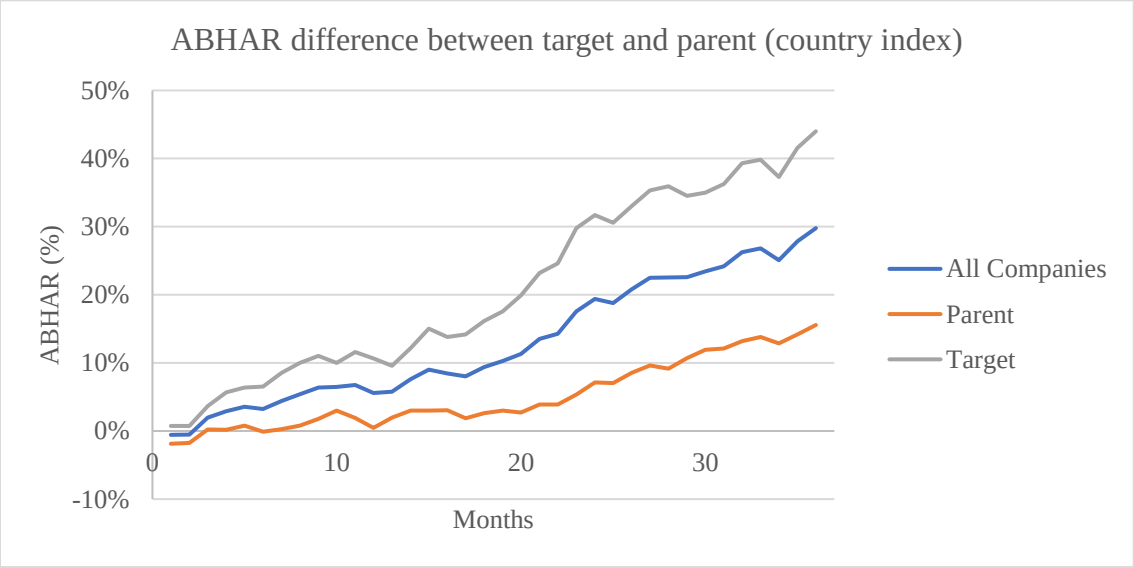


Figure 4: Average Buy-and Hold Abnormal Returns from month 1-36 by company type

We plot monthly ABHAR time series over 36 months separately for sample parent and target companies and all the sample companies together. Calculations have been done using country specific benchmark index and are done on equally weighted basis.



As already mentioned before and pointed out by Ritter (1991), using only one benchmark index to evaluate abnormal returns can lead to distorted results. Therefore, we have used 3 other general European market benchmarks to evaluate the robustness of the CAAR and ABHAR results presented above. We plot the monthly CAAR and ABHAR series calculated together for all the sample companies to visualize the differences between using different benchmark indices. As can be seen from the Figure 5 and Figure 6 below, the results remain consistent independent of the benchmark index used.

Figure 5: Average Cumulative Abnormal Returns from month 1-36

We plot 4 different monthly CAAR time series over 36 months to evaluate the robustness of using market benchmark indexes in our calculations. All calculations have been done on equally-weighted basis.

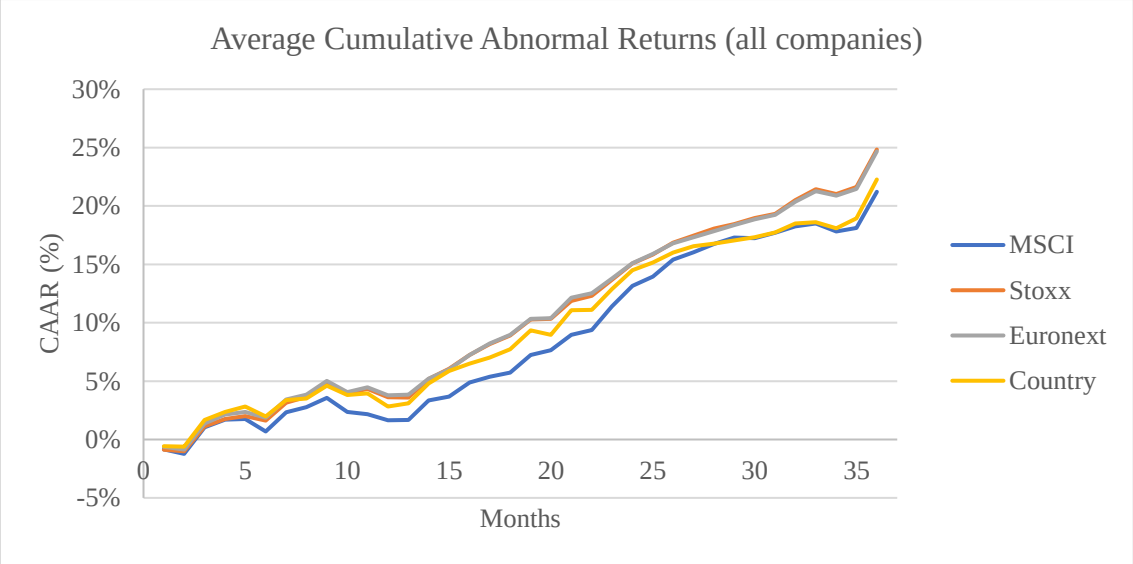
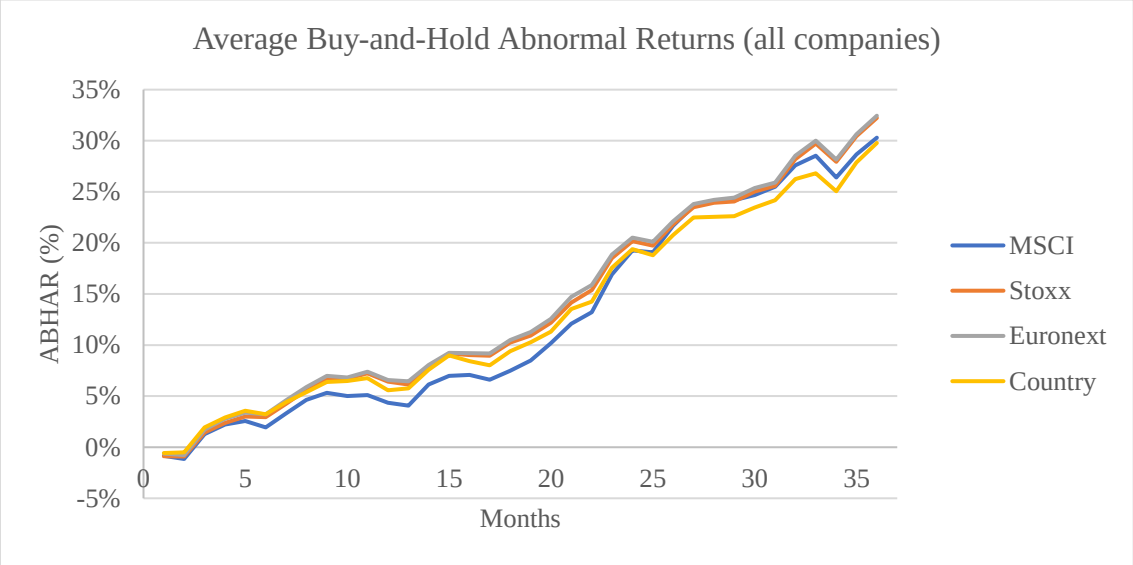


Figure 6: Average Buy-and-Hold Abnormal Returns from month 1-36

We plot 4 different monthly ABHAR time series over 36 months to evaluate the robustness of using market benchmark indexes in our calculations. All calculations have been done on equally-weighted basis.



6.2. Effects of Dual Directorship

6.2.1. Analysis of Separate regressions of parent and target firms

Parent companies

We describe the results of separate regressions of parent companies in this part. The statistical significance, and the relationship between dual directorship presence and returns of parent companies measured by CAR and BHAR obtained from the regression specification shown in the equation (9) is summarized in Table 6 below.

By using CAR as a return measure, we obtained statistically significant results for post spin-off time periods starting from 6 months up to three years using all stock market indices. Nevertheless, when using BHAR as a return proxy the statistical significance of the directorship variable is less pronounced, and only the coefficients measuring one, two, and three-year post spin-off performance periods are significant in this case. At the same time, we may observe that both return measures yield the identical coefficient signs and have approximately the same magnitude of dual directorship variable effect on performance for the return periods from 6 months to 3 years.

Table 6: Separate Regressions of Parent Companies

The table presents the coefficients and significance levels obtained from separate regressions of parent companies using market capitalization as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	-0.003	-0.008	-0.008	-0.004
3 month CAR	0.006	-0.002	-0.001	-0.001
6 month CAR	0.046**	0.047*	0.047*	0.039*
1 year CAR	0.076**	0.081**	0.083**	0.072**
2 year CAR	0.109**	0.106**	0.111**	0.1**
3 year CAR	0.142**	0.145**	0.148**	0.132**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	-0.003	-0.008	-0.008	-0.004
3 month BHAR	0.001	-0.007	-0.006	-0.005
6 month BHAR	0.033	0.035	0.036	0.028
1 year BHAR	0.078**	0.083**	0.084**	0.072*
2 year BHAR	0.129**	0.124**	0.13**	0.113**
3 year BHAR	0.165**	0.164**	0.168**	0.148**

Robustness – parent companies

As stated in the methodology part 5.3, we performed several robustness checks to verify consistency of obtained results. Overall, the impact of dual directorship variable on the long-term performance of parent firms was supported by additional regression models and yielded similar statistical significance and coefficient signs. These results were obtained using assets and sales as proxies of size and are summarized in Table 7 and Table 8 depicted below.

Table 7: Separate Regressions of Parent Companies

The table presents the coefficients and significance levels obtained from separate regressions of parent companies using total assets as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	-0.005	-0.01	-0.01	-0.006
3 month CAR	0.001	-0.007	-0.006	-0.006
6 month CAR	0.041*	0.04	0.04*	0.034
1 year CAR	0.063*	0.065*	0.067*	0.059
2 year CAR	0.1**	0.095*	0.1**	0.093**
3 year CAR	0.132**	0.132**	0.135**	0.124**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	-0.005	-0.01	-0.01	-0.006
3 month BHAR	-0.004	-0.012	-0.011	-0.01
6 month BHAR	0.027	0.028	0.028	0.023
1 year BHAR	0.066*	0.07*	0.071*	0.061*
2 year BHAR	0.117**	0.111**	0.116**	0.104**
3 year BHAR	0.147**	0.143*	0.147**	0.131*

Table 8: Separate Regressions of Parent Companies

The table presents the coefficients and significance levels obtained from separate regressions of parent companies using sales as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	-0.005	-0.01	-0.01	-0.006
3 month CAR	-0.005	-0.014	-0.012	-0.01
6 month CAR	0.034	0.031	0.031	0.027
1 year CAR	0.059*	0.06	0.062*	0.056
2 year CAR	0.096**	0.092*	0.096**	0.093**
3 year CAR	0.126**	0.128**	0.131**	0.125**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	-0.005	-0.01	-0.01	-0.006
3 month BHAR	-0.01	-0.018	-0.016	-0.014
6 month BHAR	0.021	0.019	0.02	0.017
1 year BHAR	0.062*	0.064*	0.065*	0.057
2 year BHAR	0.119**	0.114**	0.119**	0.108**
3 year BHAR	0.149**	0.147**	0.15**	0.138**

Target companies

On the other hand, the results from performing regression specified in formula (9) using the set of target firms were quite different from the outcome described for parent companies. The coefficient table is reported below in Table 9. Coefficients of dual directorship variable lost significance when CAR was used as a dependent variable. Other regressions that were performed using BHAR as a response variable produced statistically significant results only for one-year returns calculated using STOXX, and Euronext indices, and three-year BHAR returns for all indices. However, what is evident from the results of these regressions is that the dual directorship variable retained positive coefficient in in all regression specifications for time periods of 6 months, one year, two years, and

three years. This suggests that the existence of shared directors on the board of target companies might have a positive effect on post spin-off performance although, not statistically justified as much as in the case of parent companies.

Table 9: Separate Regressions of Target Companies

The table presents the coefficients and significance levels obtained from separate regressions of target companies using market capitalization as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	-0.019	-0.023	-0.024	-0.024
3 month CAR	-0.018	-0.02	-0.02	-0.024
6 month CAR	0.021	0.022	0.023	0.014
1 year CAR	0.049	0.054	0.054	0.046
2 year CAR	0.061	0.06	0.062	0.061
3 year CAR	0.037	0.041	0.04	0.046
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	-0.019	-0.023	-0.024	-0.024
3 month BHAR	-0.011	-0.013	-0.014	-0.016
6 month BHAR	0.017	0.017	0.017	0.009
1 year BHAR	0.062	0.069*	0.069*	0.06
2 year BHAR	0.156	0.155	0.158	0.147
3 year BHAR	0.206**	0.212**	0.211**	0.203**

Robustness – target companies

Additional regressions implemented as robustness checks did not reveal any considerable differences amidst regression outcomes received using different set ups as seen from Tables 10 and 11. In general, coefficients of dual directorship variable maintained positive sign for the return periods from 6 months to three years throughout all regressions of target firms' returns except for one regression that showed a negative coefficient that was very close to zero.

Table 10: Separate Regressions of Target Companies

The table presents the coefficients and significance levels obtained from separate regressions of target companies using total assets as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	-0.02	-0.023	-0.024	-0.023
3 month CAR	-0.024	-0.027	-0.027	-0.028
6 month CAR	0.009	0.008	0.009	0.002
1 year CAR	0.048	0.053	0.053	0.046
2 year CAR	0.076	0.074	0.076	0.078
3 year CAR	0.058	0.062	0.06	0.068
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	-0.02	-0.023	-0.024	-0.023
3 month BHAR	-0.018	-0.021	-0.022	-0.022
6 month BHAR	0.005	0.004	0.005	-0.001
1 year BHAR	0.059	0.066*	0.065*	0.058
2 year BHAR	0.175	0.173	0.176	0.168
3 year BHAR	0.226**	0.23**	0.231**	0.223**

Table 11: Separate Regressions of Target Companies

The table presents the coefficients and significance levels obtained from separate regressions of target companies using sales as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	-0.017	-0.022	-0.023	-0.021
3 month CAR	-0.025	-0.031	-0.031	-0.031
6 month CAR	0.021	0.017	0.017	0.011
1 year CAR	0.054	0.059	0.06	0.056
2 year CAR	0.077	0.067	0.07	0.079
3 year CAR	0.088	0.092	0.09	0.098*
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	-0.017	-0.022	-0.023	-0.021
3 month BHAR	-0.018	-0.024	-0.024	-0.024
6 month BHAR	0.019	0.015	0.015	0.01
1 year BHAR	0.072*	0.077*	0.077*	0.074*
2 year BHAR	0.22*	0.211*	0.215*	0.213*
3 year BHAR	0.3***	0.306***	0.305***	0.292***

6.2.2. Analysis of companies combined by weight

The positive relationship between returns and dual directorship was confirmed again using the main set of weighted regressions. As shown in Table 12, the results from the main regressions suggest that dual directorship has a positive impact even in the short term. However, given the statistical significance levels we may use that assertion only for some of return periods from 6 months to 3 years.

Table 12: Parent and Target Firms Using Weighted Regressions

The table presents the coefficients and significance levels obtained from the weighted regression specification using market capitalization as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	0.007	0.005	0.005	0.005
3 month CAR	0.012	0.009	0.008	0.004
6 month CAR	0.035**	0.037**	0.037**	0.029*
1 year CAR	0.055*	0.057*	0.057*	0.048
2 year CAR	0.114***	0.113***	0.115***	0.1***
3 year CAR	0.134***	0.135***	0.136***	0.116***
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	0.007	0.005	0.005	0.005
3 month BHAR	0.011	0.007	0.007	0.004
6 month BHAR	0.033**	0.035**	0.035**	0.028**
1 year BHAR	0.068*	0.071*	0.071*	0.061
2 year BHAR	0.134**	0.134**	0.134**	0.112*
3 year BHAR	0.172**	0.171**	0.171**	0.144*

In general, further robustness check of the connection between studied variables showed the same relationship as portrayed in description of previous regressions. Significance levels vary depending

on regression setups, but the overall results support trends discovered in the set of main regressions (Table 13 and Table 14).

Table 13: Parent and Target Firms Using Weighted Regressions

The table presents the coefficients and significance levels obtained from the weighted regression specification using total assets as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	0.004	0.002	0.001	0.002
3 month CAR	-0.003	-0.007	-0.008	-0.008
6 month CAR	0.022	0.021	0.02	0.017
1 year CAR	0.027	0.031	0.031	0.028
2 year CAR	0.085**	0.084**	0.084**	0.083**
3 year CAR	0.119***	0.119***	0.116***	0.116***
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	0.004	0.001	0.001	0.002
3 month BHAR	-0.004	-0.008	-0.008	-0.008
6 month BHAR	0.021	0.019	0.019	0.017
1 year BHAR	0.042	0.047	0.047	0.044
2 year BHAR	0.11*	0.108*	0.108*	0.101*
3 year BHAR	0.157*	0.154*	0.154*	0.149*

Table 14: Parent and Target Firms Using Weighted Regressions

The table presents the coefficients and significance levels obtained from the weighted regression specification using sales as a measure of size. 10%, 5%, and 1% significance levels are respectively denoted by *, **, ***.

Regression results - the dual directorship variable				
Return measure	**MSCI Europe**	**STOXX Europe 600**	**Euronext 100**	**Country indices**
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month CAR	0.011	0.008	0.008	0.01
3 month CAR	0.006	0.001	0.002	0.003
6 month CAR	0.041**	0.037*	0.037*	0.034**
1 year CAR	0.042	0.047	0.048*	0.048*
2 year CAR	0.108***	0.107**	0.108***	0.116***
3 year CAR	0.135***	0.144***	0.144***	0.149***
	Coefficient	*Coefficient*	*Coefficient*	*Coefficient*
1 month BHAR	0.011	0.008	0.008	0.01
3 month BHAR	0.005	0.001	0.001	0.003
6 month BHAR	0.036**	0.034*	0.034*	0.032**
1 year BHAR	0.062	0.069	0.069	0.069
2 year BHAR	0.146**	0.149**	0.149**	0.147**
3 year BHAR	0.193**	0.204**	0.204**	0.203**

7. Discussion

7.1. Market Performance After Spin-off

Our results are in line with results found by Cusatis, Miles and Woolridge (1992), who also report high abnormal returns for both parent and target companies involved in the spin-offs for three years following the completion date. However, in our analysis, the return differences between parent and target companies are considerably larger. The reason for target companies seemingly benefiting more from the spin-offs could be, as suggested by Krishnaswami and Subramaniam (1999), elimination of negative synergies between parent and target company. The operations of parent companies, being on average larger than target companies, would be less affected by the negative synergies while companies still operate as one, providing less improvement opportunities after the companies have been demerged. The effects being larger over the second and third year also agree with this explanation as operational negative synergies are rarely eliminated over short period.

However, this raises the question, if stock markets are efficient, why are the expected operational improvements and elimination of negative synergies not already reflected in the stock prices at the announcement and at the completion of spin-off. The reason might be due to information asymmetry between companies and stock market. It would be safe to assume that even when operating as a single unit, the parent and target companies will make every effort to provide best operating results. Thus, even when the spin-off is announced and completed, the possible operational improvements for both companies might not be very clear and easily communicated. However, over time, those operational improvements for separate companies become more evident. This would also explain the higher abnormal returns for target companies, as on average, the target companies are smaller than parents and are more affected by negative operational synergies. Target companies have more room for operational improvements and as an independent company can provide more detailed, company specific communication.

Cusatis et al. (1992) also find that there is a significant number of both parent and target companies that are acquired and subsequently delisted during the 36 months following the spin-off completion. In their sample of 146 parent firms, 18 are acquired and of 146 target firms, 21 are acquired. In our sample of 104 parent firms, 5 are acquired and of 104 target firms, 15 are acquired. They find that if acquired companies are eliminated from the sample, then the abnormal return

disappears, and conclude, that post-spinoff abnormal returns are largely attributable to take-over activity. However, if we remove the 20 acquired companies from our sample, the results remain largely the same. Therefore, the explanation that spin-off abnormal returns are due to elimination of negative synergies, still holds.

Based on our analysis, the answer to Research Question 1, whether European companies involved in spin-offs provide abnormal returns after the spin-off completion, is in line with our expectation. The average abnormal returns are positive.

7.2. Effects of Dual Directorship

To answer the Research Question 2, whether the dual directorship benefits the share performance of parent-target spin-off pair, we ran the value weighted return regression. The results from this regression show that, on average, parent-target spin-off company pairs that have dual directors outperform the pairs that do not. Based on the results described above we can, for some longer periods, confirm the findings from analysis of American spin-offs (Feldman, 2016), that dual directorship benefits the company pairs.

The effect could be explained by dual directors having better coordination power and previous experience with both companies. While demerging, both companies are given the power to rearrange in a more efficient way and eliminate negative effects that existed before spin-off. However, dual directors can manage those activities for both companies to ensure that pre-existing positive effects would remain.

To answer the Research Question 3, whether parent companies with dual directors outperform those with no dual directors, we ran the regression analysis on only sample set of parent companies. The results show that, on average, parent companies with dual directors outperform their peer group over longer period. This finding is also in line with findings from previous research.

In our analysis we could not find any statistically significant effect on the target company performance when company has or does not have dual directors. This is different from what Feldman (2016) found when analyzing American spin-off performances. While she found the effect to be negative, as was proposed also in our Research Question 4, we found the effect to be

positive, while remaining statistically insignificant. Therefore, no definitive conclusion can be drawn.

The effects on parent and target company performances separately could be explained by dual directors being inclined to act more in favor of parent companies.

8. Conclusion

In this study, we analyzed a set of 104 spin-offs completed in the period from 2002 to 2014. Our main goals were to assess the market performance of our sample companies, and effects of dual directorship presence. The sample included spin-off deals implemented across 15 European countries, and companies operating in a variety of industries.

Previous research mostly focuses on spin-offs implemented in the US and explores the performance of parent firms (see Veld and Veld-Merkoulova, 2009). Similarly, there exist some studies that investigate the post spin-off performance of target entities. However, the fundamental difference that distinguishes our research from other papers is that we conducted our analysis using a collection of datasets designed to study performance of target and parent companies as separate units of analysis, and parent-target pairs combined by their market capitalization weights. In addition to that, our study period includes the most recent observations of European spin-offs.

We examine both short and long-term performance of spin-off companies by using several periods in which we measure returns using CAR and BHAR measures commonly applied in the finance literature. To verify the consistency and reliability of results, we use diverse data inputs to calculate dependent and some of control variables, and perform our analysis using different regression frameworks. Overall, the results obtained from performance measuring models demonstrate that the relationship between returns and key variables is mostly retained across different regression specifications although with varying levels of statistical significance.

As it is consistent with previous research, we found considerable positive abnormal returns for both parent and target companies. Afterwards, we explored the relationship between dual directorship presence and performance. Our results indicate that, in general, having shared board members is positively related to the aggregate performance of parent and target pairs of companies. Additional regressions revealed statistically significant results signifying that the dual directorship variable is positively associated with post spin-off performance of parent companies. Nevertheless, the same regression models employed using the set of target companies did not allow us to make a statistically significant inference.

For further research, we suggest using other measures of interrelatedness between target and parent companies. In our paper, we used only the dual directorship variable as a measure of interrelatedness, however, one may find other measures applicable for the analysis of post spin-off

performance. For example, one could perform the analysis using the ratio of target's sales going to the pre spin-off parent company as a measure of dependence, or evaluate the performance based on the existence of common shareholders that possess large blocks of company shares. Besides, in our paper, we used market-based performance measures. However, one could perform the analysis of post spin-off performance using accounting-based measures. For instance, one could collect the accounting data for the sample of our spin-off firms and compare it to the performance of a matched sample firms or using some other benchmarks based on industry, country, company size, etc.

Finally, we are confident that our research contributes to the existing literature by providing a fresh perspective on European spin-offs of target and parent companies and including the analysis of nonstandard interrelatedness measure that was benchmarked by the shareholder variable. Moreover, we believe that findings from our research may be applied in practice. For example, taking our findings and combining them with other studies may be used as an initial step of selecting potential investment opportunities.

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10.Appendix

Appendix A. List of Final Sample of 104 Spin-offs

List of the final sample of European spin-offs used in the study from 2002-2014:

List of Spin-offs

Date	Target Name	Parent Name	Target ISIN	Parent ISIN
26.02.2002	Damartex SA	Somfy SA	FR0000185423	FR0013199916
20.03.2002	Thus Group PLC	Scottish Power PLC	GB00B0XZZ512	GB00B125RK88
01.07.2002	Univar NV	Koninklijke Vopak NV	NL0000388809	US7807431009
03.03.2003	NGP SpA	Montefibre SpA	IT0003388607	IT0003111462
15.04.2003	Mitchells & Butlers PLC	Six Continents PLC	GB00B1FP6H53	GB00BD8QVH41
07.07.2003	Kesa Electricals PLC	Kingfisher PLC	GB0033040113	GB0033195214
04.08.2003	Seat Pagine Gialle SpA- Directories Business	Telecom Italia SpA	IT0005187940	IT0003497168
18.02.2004	Creative Technology Group PLC	Avesco PLC	GB0000653229	GB0034070515
11.03.2004	ITAB Shop Concept AB	XANO Industri AB	SE0008375117	SE0009973449
25.03.2004	Yara International ASA	Norsk Hydro ASA	NO0010208051	NO0005052605
05.04.2004	South Staffordshire PLC	South Staffordshire Group PLC	GB0034321611	GB00BYYTFB60
20.07.2004	Falck A/S	Group 4 Falck A/S	DK0010305317	GB00B01FLG62
08.09.2004	Uniflex AB	Poolia AB	SE0001283607	SE0000567539
14.10.2004	Kemira GrowHow Oyj	Kemira Oyj	FI0009012843	FI0009004824
01.11.2004	DX Services PLC	Hays PLC	GB00B02RYQ29	GB0004161021
01.12.2004	Euronav NV	CMB NV	BE0003816338	BE0003817344
31.01.2005	Lanxess AG	Bayer AG	DE0005470405	DE000BAY0017
11.02.2005	Dottikon Es Holding AG	EMS-Chemie Holding AG	CH0020739006	CH0016440353
01.03.2005	Altri SGPS SA	Cofina SGPS SA	PTALT0AE0002	PTCFN0AE0003
18.04.2005	Neste Oyj	Fortum Oyj	FI0009013296	FI0009007132
29.04.2005	Cumerio	Umicore NV	BE0003819365	BE0974320526
19.05.2005	CBo Territoria	Bourbon SA	FR0010193979	FR0004548873
23.05.2005	Wihlborgs Fastigheter AB	Fabege AB	SE0001413600	SE0000950636
01.06.2005	Cargotec Oyj	KONE Oyj	FI0009013429	FI0009013403
06.06.2005	Essentra PLC	Bunzl PLC	GB00B0744359	GB00B0744B38
14.06.2005	Gunnebo Industrier AB	Gunnebo AB	SE0001447723	SE0000195570
01.07.2005	Valentino SpA	Marzotto SpA	NA	IT0000080819
08.11.2005	Christ Water Technology AG	BWT AG	AT0000499157	AT0000737705
22.12.2005	Nordic Mining ASA	Rocksource ASA	NO0010317340	NO0003987901
27.02.2006	Consafe Logistics AS	PSI Group ASA	NO0010305089	NA
12.04.2006	Smiths News PLC	WH Smith PLC	GB00B17WCR61	GB00B2PDGW16
26.04.2006	Catena AB	Bilia AB	SE0001664707	SE0009921588
12.05.2006	Blackrock International Land PLC	Fyffes PLC	IE00B134XK63	IE0003295239
18.05.2006	Arkema SA	Total SA	FR0010313833	FR0000120271
09.06.2006	LMS Capital PLC	London Merchant Securities PLC	GB00B12MHD28	GB00B12MHC11
13.06.2006	Husqvarna AB	Electrolux AB	SE0001662230	SE0000103814
23.06.2006	Medisize Holding AG	Gurit Holding AG	CH0025343259	CH0008012236
30.06.2006	Teekay Petrojarl Production AS	Petroleum Geo-Services ASA	NO0010309560	NO0010199151
03.07.2006	Oriola Oyj	Orion Oyj	FI0009014351	FI0009014377
08.07.2006	Karelian Diamond Resources PLC	Conroy Diamonds & Gold PLC	IE00BD09HK61	IE00BZ4BTZ13
12.09.2006	Cherry Casino	Betsson AB	SE0010133256	SE0009806896
25.09.2006	CODA PLC	CODASciSys PLC	GB00B18FC419	GB0001520757
29.09.2006	Securitas Systems AB	Securitas AB	SE0001785197	SE0000163594

29.09.2006	Securitas Direct AB	Securitas AB	SE0001789306	SE0000163594
06.10.2006	Biffa PLC	Severn Trent PLC	GB00B129PL77	GB00B1FH8J72
10.10.2006	Carl Lamm AB	Scribona AB	SE0001739053	SE0000188518
02.11.2006	Hutter & Schrantz Stahlbau AG	Hutter & Schrantz AG	AT0000A021K7	AT0000698253
16.11.2006	Fiberweb PLC	BBA Group PLC	GB00B1FMH067	GB00B1FP8915
28.11.2006	Rezidor Hotel Group AB	SAS AB	SE0001857533	SE0003366871
01.01.2007	Total Produce PLC	Fyffes PLC	IE00B1HDWM43	IE0003295239
22.05.2007	Blinkx	Autonomy Corp PLC	GB00BYW0RC64	GB0055007982
29.06.2007	Mondi PLC	Anglo American PLC	GB00B1CRLC47	GB00B1XZS820
16.07.2007	International Personal Finance PLC	Provident Financial PLC	GB00B1YKG049	GB00B1Z4ST84
29.08.2007	Precomp Solutions AB	Consilium AB	SE0006091724	SE0000236382
01.10.2007	Peab Industri AB	Peab AB	SE0002091496	SE0000106205
07.11.2007	PT Multimedia Servicos de Telecomunicacoes & Multimedia SGPS	Portugal Telecom SGPS SA	PTZON0AM0006	PTPTC0AM0009
16.01.2008	Portland Gas Ltd	Egdon Resources PLC	GB00B28YMP66	GB00B28YML29
28.01.2008	Sonae Capital SGPS SA	Sonae SGPS SA	PTSNP0AE0008	PTSON0AM0001
28.01.2008	Sonae Industria SGPS SA	Sonae SGPS SA	PTS3P0AM0025	PTSON0AM0001
17.04.2008	Spectrum ASA	Global Geo Services ASA	NO0010429145	NO0010052350
09.06.2008	Hexpol AB	Hexagon AB	SE0007074281	SE0000103699
18.06.2008	PCI Biotech Holding ASA	Photocure ASA	NO0010405640	NO0010000045
08.07.2008	F. Ramada Investimentos SGPS SA	Altri SGPS SA	PTFRV0AE0004	PTALT0AE0002
22.07.2008	Suez Environment SA	Suez SA	FR0010613471	FR0010208488
21.10.2008	Reinet Investments SCA	Cie Financiere Richemont SA	LU0383812293	CH0210483332
09.12.2008	Loomis AB	Securitas AB	SE0002683557	SE0000163594
30.03.2009	Athris Holding AG	Jelmoli Holding AG	CH0049864827	CH0000668472
30.07.2009	Sektkellerei J. Oppmann AG	OPPMANN IMMOBILIEN AG	DE000A0WMJJ9	DE0007228504
26.01.2010	Video Futur Entertainment Group SA	NetGem SA	FR0010841189	FR0004154060
23.03.2010	TalkTalk Telecom Group PLC	Carphone Warehouse Ltd	GB00B4YCDF59	GB00B4Y7R145
26.03.2010	Tikkurila Oyj	Kemira Oyj	FI4000008719	FI0009004824
26.03.2010	Cable & Wireless Worldwide PLC	Cable & Wireless PLC	GB00B5WB0X89	GB00B5KKT968
07.05.2010	Capital & Counties Properties PLC	Intu Properties PLC	GB00B62G9D36	GB0006834344
02.07.2010	Edenred SA	Accor SA	FR0010908533	FR0000120404
21.10.2010	Prelios SpA	Pirelli & C SpA	IT0004923022	IT0004623051
15.12.2010	CDON Group AB	Modern Times Group MTG AB	SE0003652163	SE0000412371
03.01.2011	Fiat Industrial SpA	Fiat SpA	IT0004644743	NL0010877643
13.05.2011	Autoneum Holding AG	Rieter Holding AG	CH0127480363	CH0003671440
26.05.2011	TNT Express NV	TNT NV	NL0009739424	NL0009739416
13.06.2011	Axway Software SA	Sopra Group SA	FR0011040500	FR0000050809
20.06.2011	PledPharma AB	Accelerator Nordic AB	SE0003815604	SE0005504602
05.07.2011	Distribuidora Internacional de Alimentacion SA	Carrefour SA	ES0126775032	FR0000120172
08.07.2011	Kvaerner ASA	Aker Solutions ASA	NO0010605371	NO0010716582
18.07.2011	China Africa Resources PLC	Weatherly International PLC	GB00B3ZW6Z85	GB00B15PVN63
01.08.2011	Spirit Pub Company PLC	Punch Taverns PLC	GB00B5NFV695	GB00BPXRVT80
20.10.2011	Norway Seafoods Group AS	Aker Seafoods ASA	NO0010565781	NO0010269129
01.01.2012	DeLclima SpA	De Longhi SpA	IT0004772502	IT0003115950
02.01.2012	Scanfil EMS Oy	Sievi Capital Oyj	FI4000029905	FI0009008924
12.04.2012	Angler Gaming PLC	Betsson AB	MT0000650102	SE0009806896
12.04.2012	Veripos Inc	Subsea 7 SA	KYG934001028	LU0075646355
31.05.2012	Zug Estates Holding AG	Metall Zug AG	CH0148052126	CH0039821084
08.10.2012	Xvivo Perfusion AB	Vitrolife AB	SE0004840718	SE0000816043
01.11.2012	Alent PLC	Vesuvius PLC	GB00BQ1XTV39	GB00B82YXW83
21.12.2012	Prothena Corporation PLC	Elan Corp PLC	IE00B91XRN20	IE0003072950

14.01.2013	SPAGO Imaging AB	Accelerator Nordic AB	SE0004899474	SE0005504602
11.02.2013	Gurktaler AG	Schlumberger AG	AT0000A0Z9G3	AT0000779061
08.04.2013	Redcentric PLC	Redstone PLC	GB00B7TW1V39	GB00BYV2WV72
18.06.2013	Fnac SA	PPR SA (Kering SA)	FR0011476928	FR0000121485
01.07.2013	Caverion Oyj	YIT Oyj	FI4000062781	FI0009800643
08.07.2013	OSRAM Licht AG	Siemens AG	DE000LED4000	DE0007236101
08.08.2013	Science In Sport PLC	Provexis PLC	GB00BBPV5329	GB00B0923P27
02.12.2013	Allegion PLC	Ingersoll-Rand PLC	IE00BFRT3W74	IE00B6330302
02.01.2014	Valmet Oyj	Metso Oyj	FI4000074984	FI0009007835
29.09.2014	Aker Solutions ASA	Akastor ASA	NO0010716582	NO0010215684

Appendix B. List of Country-Based Indices

List of country-based indices used in the calculation of abnormal returns from 2002-2017:

List of Country-Based Indices

Country	Index
Austria	Austrian Trading Index (ATX)
Belgium	BEL 20 (BFX)
Denmark	OMX Copenhagen 20 (OMXC20)
Finland	OMX Helsinki (OMXHPI)
France	CAC 40 (FCHI)
Germany	MDAX (MDAXI)
Ireland	ISEQ (ISEQ)
Italy	FTSE Milano Indice di Borsa (FTSEMIB)
Netherlands	Amsterdam Exchange Index (AEX)
Norway	Oslo OBX (OBX)
Portugal	PSI 20 (PSI20)
Spain	IBEX 35 (IBEX)
Sweden	OMX Stockholm 30 (OMXS30)
Switzerland	Swiss Market Index (SSMI)
United Kingdom	FTSE 100 (FTSE)

Appendix C. Market Adjusted CAAR from month 1-36

Table presents market adjusted CAAR calculated using different market benchmark values and respective t-test results for all the sample companies

Market Adjusted Cumulative Average Abnormal Returns								
Month	Country	*t-test*	MSCI	*t-test*	Stoxx	*t-test*	Euronext	*t-test*
1	-0.57%	-0.31	-0.85%	-0.47	-0.89%	-0.50	-0.62%	-0.34
3	1.68%	0.93	1.03%	0.56	1.11%	0.61	1.38%	0.75
6	1.97%	0.87	0.69%	0.30	1.61%	0.68	1.86%	0.79
9	4.61%	1.84	3.56%	1.39	4.73%	1.84	5.02%	1.97
12	2.83%	0.96	1.64%	0.55	3.63%	1.21	3.78%	1.26
15	5.85%	1.88	3.66%	1.13	6.07%	1.88	6.00%	1.86
18	7.74%	2.29	5.73%	1.64	8.90%	2.59	8.95%	2.60
21	11.08%	3.09	8.96%	2.40	11.87%	3.23	12.14%	3.33
24	14.49%	3.94	13.16%	3.50	15.08%	4.03	15.11%	4.05
27	16.56%	4.32	16.02%	4.06	17.45%	4.43	17.31%	4.42
30	17.32%	4.46	17.25%	4.27	18.97%	4.67	18.85%	4.68
33	18.61%	4.43	18.49%	4.18	21.43%	4.82	21.28%	4.81
36	22.27%	5.19	21.21%	4.67	24.83%	5.55	24.68%	5.55

Table presents market adjusted CAAR calculated using different market benchmark values and respective t-test results for spin-off parent companies

Market Adjusted Cumulative Average Abnormal Returns (parent)								
Month	Country	*t-test*	MSCI	*t-test*	Stoxx	*t-test*	Euronext	*t-test*
1	-1.87%	-1.26	-2.13%	-1.44	-2.17%	-1.48	-1.90%	-1.28
3	0.07%	0.07	-0.58%	-0.22	-0.54%	-0.21	-0.27%	-0.09
6	-0.21%	-0.08	-1.53%	-0.60	-0.62%	-0.24	-0.38%	-0.15
9	0.37%	0.13	-0.62%	-0.18	0.45%	0.15	0.73%	0.24
12	-1.34%	-0.34	-2.63%	-0.68	-0.74%	-0.18	-0.61%	-0.14
15	1.10%	0.29	-1.18%	-0.26	1.02%	0.26	0.96%	0.25
18	3.12%	0.75	1.01%	0.24	3.96%	0.92	4.04%	0.93
21	4.35%	0.99	1.88%	0.42	4.69%	1.04	4.98%	1.10
24	6.49%	1.34	4.93%	1.03	6.69%	1.36	6.77%	1.38
27	8.69%	1.72	7.87%	1.55	9.12%	1.78	9.02%	1.77
30	9.72%	1.80	9.30%	1.71	10.85%	1.98	10.75%	1.97
33	10.31%	1.79	9.70%	1.69	12.52%	2.16	12.49%	2.15
36	11.66%	1.95	10.18%	1.71	13.88%	2.32	13.75%	2.31

Table presents market adjusted CAAR calculated using different market benchmark values and respective t-test results for spin-off target companies

Market Adjusted Cumulative Average Abnormal Returns (target)								
Month	Country	*t-test*	MSCI	*t-test*	Stoxx	*t-test*	Euronext	*t-test*
1	0.74%	0.33	0.44%	0.21	0.40%	0.20	0.67%	0.30
3	3.28%	1.13	2.64%	0.87	2.77%	0.92	3.03%	1.03
6	4.15%	1.11	2.92%	0.75	3.85%	1.00	4.10%	1.07
9	8.86%	2.29	7.74%	1.93	9.00%	2.29	9.31%	2.38
12	7.01%	1.57	5.92%	1.27	8.01%	1.74	8.16%	1.79
15	10.61%	2.27	8.50%	1.71	11.11%	2.25	11.03%	2.25
18	12.36%	2.31	10.45%	1.93	13.85%	2.57	13.87%	2.58
21	17.81%	3.17	16.05%	2.72	19.06%	3.30	19.30%	3.39
24	22.48%	4.14	21.38%	3.76	23.46%	4.23	23.44%	4.25
27	24.44%	4.30	24.17%	4.02	25.78%	4.35	25.61%	4.36
30	24.92%	4.55	25.21%	4.25	27.08%	4.55	26.95%	4.60
33	26.92%	4.46	27.29%	4.06	30.33%	4.51	30.06%	4.52
36	32.88%	5.51	32.24%	4.74	35.79%	5.43	35.60%	5.45

Appendix D. Market Adjusted ABHAR from month 1-36

Table presents market adjusted ABHAR calculated using different market benchmark values and respective t-test results for all the sample companies

Market Adjusted Average Buy-and-Hold Abnormal Returns								
Month	Country	*t-test*	MSCI	*t-test*	Stoxx	*t-test*	Euronext	*t-test*
1	-0.57%	-0.31	-0.85%	-0.47	-0.89%	-0.50	-0.62%	-0.34
3	1.94%	1.04	1.29%	0.67	1.45%	0.76	1.72%	0.91
6	3.21%	1.50	1.93%	0.86	2.94%	1.31	3.21%	1.44
9	6.40%	2.24	5.34%	1.78	6.64%	2.29	6.97%	2.43
12	5.56%	1.64	4.35%	1.24	6.43%	1.87	6.58%	1.93
15	9.00%	2.18	6.98%	1.61	9.16%	2.17	9.24%	2.20
18	9.39%	2.43	7.49%	1.85	10.24%	2.63	10.48%	2.72
21	13.53%	3.11	12.09%	2.69	14.16%	3.25	14.72%	3.41
24	19.40%	3.93	19.25%	3.86	20.16%	4.09	20.52%	4.20
27	22.48%	4.37	23.61%	4.56	23.48%	4.53	23.82%	4.64
30	23.45%	4.19	24.68%	4.33	25.01%	4.42	25.36%	4.52
33	26.81%	4.66	28.54%	4.79	29.71%	5.03	30.00%	5.10
36	29.78%	5.02	30.30%	4.86	32.23%	5.29	32.45%	5.35

Table presents market adjusted ABHAR calculated using different market benchmark values and respective t-test results for spin-off parent companies

Market Adjusted Average Buy-and-Hold Abnormal Returns (parent)								
Month	Country	*t-test*	MSCI	*t-test*	Stoxx	*t-test*	Euronext	*t-test*
1	-1.87%	-1.26	-2.13%	-1.44	-2.17%	-1.48	-1.90%	-1.28
3	0.21%	0.14	-0.44%	-0.14	-0.34%	-0.10	-0.06%	0.02
6	-0.09%	-0.03	-1.40%	-0.59	-0.42%	-0.17	-0.14%	-0.06
9	1.79%	0.52	0.81%	0.26	2.01%	0.57	2.33%	0.65
12	0.46%	0.15	-0.88%	-0.12	1.06%	0.27	1.21%	0.31
15	2.99%	0.57	0.96%	0.24	2.87%	0.55	2.97%	0.57
18	2.60%	0.57	0.78%	0.20	3.22%	0.69	3.50%	0.75
21	3.87%	0.72	2.08%	0.41	3.98%	0.74	4.57%	0.85
24	7.11%	1.20	6.68%	1.14	7.33%	1.24	7.76%	1.32
27	9.62%	1.57	10.33%	1.71	9.90%	1.60	10.31%	1.68
30	11.91%	1.74	12.49%	1.81	12.52%	1.80	12.91%	1.87
33	13.79%	1.93	14.48%	2.03	15.36%	2.15	15.75%	2.21
36	15.56%	2.03	15.10%	1.93	16.94%	2.19	17.19%	2.24

Table presents market adjusted ABHAR calculated using different market benchmark values and respective t-test results for spin-off target companies

Market Adjusted Average Buy-and-Hold Abnormal Returns (target)

Month	Country	*t-test*	MSCI	*t-test*	Stoxx	*t-test*	Euronext	*t-test*
1	0.74%	0.33	0.44%	0.21	0.40%	0.20	0.67%	0.30
3	3.67%	1.23	3.01%	0.96	3.23%	1.04	3.49%	1.14
6	6.51%	1.83	5.27%	1.39	6.30%	1.68	6.57%	1.77
9	11.00%	2.60	9.87%	2.19	11.28%	2.61	11.62%	2.72
12	10.67%	2.21	9.59%	1.86	11.79%	2.37	11.95%	2.43
15	15.02%	2.59	13.00%	2.09	15.46%	2.56	15.50%	2.59
18	16.17%	2.77	14.21%	2.31	17.26%	2.92	17.47%	2.98
21	23.19%	3.60	22.11%	3.30	24.33%	3.75	24.87%	3.87
24	31.69%	4.14	31.83%	4.07	33.00%	4.31	33.29%	4.38
27	35.33%	4.26	36.88%	4.37	37.06%	4.45	37.32%	4.51
30	34.98%	4.08	36.88%	4.18	37.50%	4.32	37.81%	4.38
33	39.83%	4.52	42.59%	4.55	44.07%	4.78	44.26%	4.81
36	44.00%	4.98	45.50%	4.79	47.52%	5.16	47.71%	5.20