RISK PARAMETER SHIFTS: THE CASE OF SPINOFFS

Yermek Mustafayev

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ABSTRACT

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This study deals with measuring and testing the impact of spinoff transactions on the risk parameters of the parent firm stocks. This is achieved by employing CC-GARCH(1,1) and VC-GARCH(1,1) models to estimate the most-commonly used risk measures: the stock return total variance, made up of beta (systematic risk), and the residual variance (unsystematic risk).

We find that there are risk changes associated with spinoffs. However, only shifts in the total and residual variances last more than two years after the spinoff completion, while shocks to the betas dissipate within the year for the full sample. We observe increases in all risk measures to be permanent for more than two years only for the low-asymmetry, own-industry group of firms. Both the total and residual variance processes for the high-asymmetry, cross-industry subsample do not react significantly to the spinoff transaction. However, there is a 13.7% decrease in systematic risk significant at less than 10% confidence level. Therefore, this is the only group of spinoff parents that delivers some risk reduction for their shareholders.

As the beta shifts are on average small, spinoffs mostly increase the unsystematic part of the risk, making stock returns more unpredictable.

We fail to relate these risk changes to the debt burden variation. Therefore, we conclude that the source of the changes is possibly the diversification loss, causing increased volatility of post-event earnings and therefore increased information asymmetry. The only anomaly that we are not able to explain within the current

hypothesis framework is a highly significant and persistent shift of the risk characteristics of the low-asymmetry, own-industry parent stocks.

Such findings cast doubts on the superior benefits of the average spinoff for ordinary shareholders, who may not be able to diversify away increased risks, as well as for the institutional holders, who have strict investment policy concerning the riskiness of investment assets. Therefore, the investors must be aware that an improved operational and stock performance of the spinoff parent company may come at the price of the stock risk increase.

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

The 1980-1990s of the last century for the corporate world were marked by substantial restructuring among firms of various sizes. The market and managers learned that the old idea of diversification was not always wealth enhancing for shareholders. Therefore, many conglomerates have resorted to downsizing and focusing on their core businesses. Ravenscraft and Scherer (1987) report that 33% of acquisitions in the 1960s and 1970s were later divested, while Kaplan and Weisbach (1992), who study a sample of acquisitions completed between 1971 and 1982, find that by the end of 1989 44% of target companies have been divested.

A corporate spinoff is one of several ways in which a firm may divest a division and improve its focus. Spinoffs occur when a corporation distributes on a pro-rata basis to its existing shareholders all of the stock relating to a controlled subsidiary, creating a new, publicly traded corporation. As a result, only shareholders of the original company remain the owners of the spun-off subsidiary. Spinoffs involve no cash transactions, and hence are not motivated by management's decision to pay off debt, as is common for the sell-offs and equity carve-outs. Spinoffs unlike other divestitures could be tax-free if the parent distributes more than eighty percent of the subsidiary. After the distribution, the operations and management of the subsidiary are independent of the parent's influence.

Many studies have found that spinoffs lead to high short-term abnormal returns ranging from 2.4% to 4.3% over a period surrounding the announcement and effective dates (Hite and Owers (1983), Miles & Rosenfeld (1983), Schipper and Smith (1983), Copeland et al. (1987), etc.). We also record 4.2% and 2.43% positive abnormal returns around these dates respectively. Some researchers (Cusatis (1993), Desai and Jain (1999)) conclude that there is also a long-term abnormally high performance of spinoffs, especially of focus-increasing ones.

While these studies have concentrated on the performance of the divesting and divested companies, we examine a risk-associated side of spinoff transactions. From the perspective of a holder of the pre-spinoff company shares, it is vital not only to have at least the same return on the portfolio after a spinoff, but also to stay under an acceptable risk limit. It could be that a superior parent company's stock performance after spinoff could be explained by an increased variance or systematic risk. On the other hand, this wealth enhancement could be underestimated in the case of the declining risks.

We employ Constant Correlation and Varying Correlation Bivariate Generalized Autoregressive Conditional Heteroscedasticity models (CC-BVGARCH and VC-BVGARCH respectively) to obtain estimates of the time-varying systematic risk, stock return total and firm-specific (residual) variances. With the help of dummy variables, we examine obtained series for structural breaks in means.

Analyzing a sample of 146 tax-free spinoffs, successfully completed within the 1990-2000 period, we find that all risk parameters of the parent stock returns generally increase around the announcement, the ex-date and over the following several months, but not permanently. The only exception is a group of low-asymmetry, non-refocusing companies, which experience positive and significant shifts in risks almost over all periods studied. For the high-asymmetry, non-focus-increasing firms there are no statistically significant variance changes at all and only the systematic risk declines by a weakly significant 13.7% by the end of the second post-spinoff year.

A separate analysis of residual variance, parts of the total variance reveals that the latter is the component driving shifts in total variance.

Having failed to associate the risk changes with debt burden adjustments, we suggest that the most likely source of these adjustments is a diversification loss, especially in the case of cross-industry spinoffs.

The remainder of the paper is organized as follows. In section 2, we present a review of existing studies of why spinoffs occur, how they affect the stock price, and what kind of capital and risk changes parent firms experience. Section 3 describes our sample construction algorithm and sample characteristics. In section 4, we develop hypotheses and analysis methodology used to measure abnormal returns and risk shifts. In section 5, we discuss the results of the event studies and our empirical analysis of risk series for the full sample, focus-increasing/non-focus-increasing and high-/low-asymmetry subsamples. In this section, we also study debt-to-total assets ratio changes for the parent spinoff company. Section 6 offers a brief summary and concluding comments.

2. LITERATURE REVIEW

2.1 Reasons for spinoff equity restructuring

In complete and perfect markets, a spinoff announcement should not alter firm value unless investors expect the divestiture to increase future cash flows. Such an increase could come from the elimination of negative synergies.

Even when there are no cash-flow benefits from divestiture, market incompleteness could still enable a spinoff to enhance firm value. Hakansson (1982) shows that if financial markets are incomplete, a spinoff might expand the opportunity set available to investors. In the classic case of a parent, offering a high-dividend yield, and its subsidiary, possessing high growth opportunities, a spin off provides investors with more flexibility in their choice of dividends versus capital gains.

Another quoted reason for spinoffs is based on agency costs. Myers (1977) maintains that risky debt might prompt firms to forgo some positive net present value projects, i.e. the company may suffer from an underinvestment problem, since some of the investment benefits could go to existing bondholders leaving shareholders with less wealth. In the case of spinoffs, a subsidiary is not able to realize some of its growth potential by undertaking risky projects, as this might benefit the parent company's existing bondholders. A spinoff announcement might then increase firm value by the net present value of the investments that would otherwise be forgone because of the underinvestment problem. Moreover, as Galai and Masulis (1976) argue, even if firm value does not increase shareholders are still able to enjoy greater wealth through the erosion of the bondholders' position resulting in a wealth transfer from bondholders and shareholders. However, Hite and Owers (1983) and Schipper and Smith (1983) find little evidence of this transfer. Only two of the 93 spinoffs in Schipper and Smith's sample resulted in a bond ratings decline. The expropriation hypothesis is also not supported as a source of the abnormal returns at the announcement of a spinoff, because the wealth transfer is effectively restricted by common covenants in the bond indenture.

According to Cusatis, Miles and Woolridge (1993) the value-creating potential of spinoffs are inherent in organizational changes resulting in a reduction in agency and overhead costs, a sharpened focus, market as opposed to administrative capital allocation, and more effective incentives and compensation for management. Additionally, they argue that the value-creating potential can be induced by corporate control activity. By facilitating the transfer of the assets of either the parent or the subsidiary to higher-value uses, the spinoff transaction may create value. In short, by means of the transaction, pure play and improved corporate transparency make resulting companies more attractive to potential bidders.

Krishnaswami and Subramaniam (1999) find support for the information asymmetry explanation for spinoff abnormal returns. They argue that "investors are able to perceive value more clearly after the spinoff". With separately traded shares, an existing information asymmetry in the market about the profitability and operating efficiency of the different divisions of the firm might be greatly reduced, resulting in the sum of the separated parts being greater that the market value of the combined firm. The researchers empirically showed that firms that engage in spinoffs have higher levels of information asymmetry than their industry- and size-matched rivals do, and the asymmetry is significantly reduced after the completion of the spinoff.

Schipper and Smith (1983) examine the tax and regulatory motives for spinoffs. They argue that a regulated firm may be able to spinoff a subsidiary in a way that results in either the parent or the subsidiary escaping the constraints of government regulation. A firm may also be able to spinoff an overseas subsidiary to avoid paying U.S. taxes on the income from that division. Although the benefits to individual firms from such actions do exist, on average the authors do not find any evidence to support these hypotheses.

Aron (1991) supports the recontracting effectiveness hypothesis that argues that for a large, multi-product firm, the share price is a very noisy signal of a divisional manager's productivity. A spinoff is therefore optimal since managerial compensation based on the productivity and efficiency of individual divisions improves managers' motivation. In a study of 78 spinoffs, Seward and Walsh (1996) find that after the spinoff a majority of both the board of directors and the compensation committee members are outside directors, suggesting an introduction of more efficient internal governance and control mechanisms. They also find that the compensation of the CEO of the spun-off subsidiary is typically tied to performance. However, they find that the gains around spinoffs are not statistically related to these improvements in contracting efficiency.

John (1993) argues that, considering a diversified company as a set of different technologies or projects, the nature of the comovements of the cash flows from the realization of these projects determines the spinoff transaction's impact on shareholder wealth. In the case of a positive correlation between these cash flows, a separate incorporation of the technologies with an optimal allocation of debt across them leads to a higher value than the joint incorporation of these projects under the umbrella of the parent company even with optimal leverage. In the negative correlation case, the coinsurance effect (i.e. less volatile cash flows for the whole company) on investment incentives may dominate the advantages of the investment policy flexibility gained through spinoffs. Thus, the lower the correlation of cash flows between a parent and each subsidiary, the lower the likelihood of a spinoff.

Following this logic, we can conclude that spinoffs can increase shareholder wealth only in case of the demerger of poorly diversified companies. In contrast, Schipper and Smith (1983) found that 72 out of 93 firms in their spinoff sample involved a parent and a subsidiary in different industries. Thus, we can suggest that either managers forego coinsurance benefits in favor of some other potential gains, or bad investment decisions are common among multi-business companies. The latter is supported with a "correction-of-mistake" hypothesis studied by Porter (1987), and Kaplan and Weisbach (1992).

Ahn and Denis (2002) report evidence of the changes in value due to the elimination of internal capital allocation inefficiencies. Being a part of the conglomerate, a high-q subsidiary suffers from underinvestment; hence, the value is destroyed by poorly diversified companies. This inefficiency in the investment allocation process is corrected through the spinoff. Moreover, the change in investment allocation is significantly associated with the change in value surrounding the spinoff.

Desai and Jain (1999) conclude that the outperformance of spinoffs can be attributed entirely to focus-increasing spinoffs. They report a positive relation between the announcement period gains and future operating performance changes.

Regardless of the particular motivating factors, spinoffs are voluntary actions by the parent firms, implying that these transactions were meant to enhance shareholder wealth. The empirical evidence suggests that this is, indeed, the major outcome.

2.2 Spinoff abnormal returns studies

All studies on voluntary spinoffs seem to agree that there is a statistically significant positive abnormal return for parent firms on the announcement day.

Using the Mean Adjusted Return (MAR) approach, Miles & Rosenfeld (1983) analyzed the behavior of stock prices of 55 companies in response to the announcement of voluntary spinoffs for the period of 1962-1980. According to their findings, the announcement day (day zero) is preceded by a highly significant positive cumulative average abnormal return (CAAR) (16.65% from day -120 to day -1) and day zero alone exhibits a statistically significant average abnormal return (AAR) of 2.5%. Immediately after the announcement day, the abnormal returns have no particular trend, indicating that the spinoff news is fully incorporated in stock prices within a period of one or two days. They also found that relatively large spinoffs, which are at least 10% as large as the market value of the parent firms, generate a stronger positive effect on the stock prices in the amount of 20.70% over the (-120,+60) period.

Hite and Owers (1983) studied security price behavior around the announcement of 123 voluntary spinoffs by 116 firms over the period 1963-1981. In their detailed research, they examined the stock price reaction to the announcement of the spinoff and its completion. They found a significant positive CAAR of 7% over the period from 50 days before the announcement date to the day of spinoff completion. They also examined the hypothesis of Galai and Masulis (1976) that these abnormal gains are simply wealth transfers from bondholders to stockholders, but find no supporting evidence. Their findings confirm Miles and Rosenfeld's (1983) conclusion that the larger the spinoff the greater the abnormal gains to the parent company. They also attempted to connect varying cross-sectional abnormal returns to the officially stated reason for the spinoff transaction. Their results suggest that parent firms that engage in spinoffs to facilitate mergers or to separate diverse operating units earn positive returns (11.6% and 14.5% respectively), indicating value creation. Firms involved in spinoffs in response to legal or regulatory obstacles experience positive returns of 3.4% on the first announcement day, but negative returns (-4.7%) during the event period, implying value destruction.

Similar tests were conducted by Schipper and Smith (1983). They studied 93 voluntary spinoffs in the period 1963-1981 and found significant positive abnormal returns (2.84%) over the two-day announcement period (-1,0) and no significant stock price reaction during the four months before and the two months after the spinoff news publication date. They also found that larger spinoffs were associated with larger gains and these gains are not generated at the expense of bondholders. It was suggested that these returns result from tax and regulatory advantages, as well as improved managerial efficiency.

Positive abnormal gains surrounding spinoff announcements were also reported by Linn and Rozeff (1985), who studied 53 spinoffs in the period 1963-1972. They find positive (5.8%) but statistically insignificant CAR for the 89 days ending two days before the announcement and 2.8% return over the period days -1 and 0. They argue that these results do not support the size maximization and hubris hypotheses, but confirm the wealth-maximization hypothesis. Their tests suggest that positive gains are observed when the officially stated reason of a spinoff was to remove negative synergies, such as subsidiary underinvestment problem, lack of corporate transparency for the investors etc.

Using the above research, Copeland, Lemgruber and Mayers (1987) investigated the effect of spinoff announcements by studying two samples: a small sample of 73 spinoffs (1962-1981), which was not subject to post-selection bias (i.e., for which they did not know in advance if the spinoff was actually completed); and a larger sample of 188 successfully completed spinoffs over the period of 1962-1983. For the small sample, they find that 11% of announced spinoffs were never completed, so they conclude that the first-time-announcement AAR of 2.49% is "an unbiased estimate of the expected increase in shareholder wealth from spinoff announcements". For the larger sample, they find a 3.0% average return on the day the spinoff is announced. For the spinoffs that were never completed they find negative, though insignificant, abnormal returns (-5.9%) on the day of cancellation. The authors also studied the effect of the new information arrival about the spinoff deal through successive announcements, and they find that they also produce significant positive ARs: the first two announcements concerning the same spinoff alone generate a 5.2% abnormal gain. Confirming the results of several other researchers, they find that the abnormal returns are related to the relative size of the spinoff entities. Finally, they found a statistically significant difference in returns for taxable versus nontaxable spinoffs.

An interesting question was raised by Vijh (1994) concerning the paradoxial abnormal returns around ex-dates. Using a sample of 113 spinoffs, he documents a 3.03% excess return on the ex-date, comparable in magnitude to those over the announcement period. Since there is no new information arrival, he looked for a reason for these returns in the microstructure of this kind of transaction. Vijh found that increased trading volume, excess volatility and higher bid-ask spreads cannot explain such abnormal returns. He argues that one reason for high ex-date returns may lie in the nature of spinoffs: separation of unrelated businesses. This separation allows the firm to attract different investors. Investors can buy the stock before the ex-date, but they may delay the purchase until after the ex-date for several reasons. First, they can avoid additional transaction costs since they would not have to sell an undesired stock resulting from the spinoff. Secondly, buying the stock before spinoff restructuring requires a greater amount of money. Third, small investors will end up with an odd number of shares, which are not easy to sell. Fourth, the prices of the stocks of the parent and subsidiary are not known for sure until after the ex-date, making many investors, risk-averse by nature, reluctant to acquire the stock before the ex-date. On the other hand, the seller, who in turn already faces these costs, is interested in selling the stock before the event. Hence, there should be an excess supply of stock before the ex-date and an excess demand after it. Therefore, buyers, in avoiding these potential costs and motivating the sellers to keep the stock until after the spinoff completion, agree to pay some premium.

In contrast to above-mentioned studies, some researchers have raised an interesting question of whether spinoffs really create value in the long run or whether the U.S. results were a consequence of chance. The latter explanation was suggested by Fama (1998). He argues that studies finding significant long-run returns receive more attention in the academic and the popular literature because they are more interesting. For this reason, it is useful to study spinoffs outside the United States.

Veld and Veld-Merkoulova (2003) study announcement effects and long-run performance for a sample of 161 European spinoffs announced from January 1987 to September 2000. They find that the announcement of a spinoff is associated with a positive abnormal return of 2.35% over a three-day window. There is some evidence that the abnormal returns are related to an increase in either industrial or geographical focus. There does not seem to be a relationship between the abnormal returns and the level of information asymmetry at the time of the spinoff. In line with the efficient market hypothesis, they do not find any significant long-run excess return in the period after the spinoff. If the return on the parent corporation, subsidiaries and the pro-forma combined firms is compared to the return on a matching portfolio, the excess returns are both economically and statistically insignificant. Therefore, they conclude that spinoffs create value in the short term, but not in the long term.

McConnell, Ozbilgin and Wahal (2001) also question the long-run value enhancing properties of spinoff transactions. Analyzing parent and subsidiary buy-and-hold and cumulative monthly returns over various periods up to 36 months after the separation, they conclude that the results heavily depend on the choice of a benchmark. In comparison with a sample of industry- and size-matched stocks, the strategy of investing in spinoff parents and subsidiaries has at best a break-even result. Only one outlier observation could make it work. However, based on size and book-to-market ratio matching both spinoff parents and spinoff subsidiaries are winners. Again, superior performance is attributable to the one outlier sample firm. Using the Fama-French three-factor model, they find no significant abnormal returns for any benchmark.

Overall, these two studies indicate that the post-spinoff stock returns provide no grounds to reject semistrong market efficiency theory.

2.3 Parent company post-event capital structure changes studies

A growing body of the research has examined various aspects of corporate spinoffs. Among them, more attention is getting attracted to the topic on how spinoffs affect the capital structure. For our study purposes, it is essential to understand the general characteristics of debt allocation in spinoff deals, because any changes in capital structure directly affect equity riskiness.

Schipper and Smith (1983) report that the average ratio of book value of debt to total assets is 0.59 prior to the spinoff and is 0.51 for the spun-off subsidiary firms. Therefore, there is little indication that the spun-off company is disproportionately burdened or eased with debt.

Michaely and Shaw (1995), however, provide evidence that spinoffs of master limited partnerships result in increases in leverage for the spun-off companies and reductions in leverage for the parent companies.

According to Dittmar (2002) the average debt to value ratio of the subsidiaries is significantly lower than that of their pre- and post-spinoff parents. The subsidiaries' and the pre- and post-spinoff parent's leverage ratios are higher than their industry;

however, the subsidiaries' industry-adjusted leverage ratio is significantly lower than the parents' industry-adjusted ratio. Having in general higher debt carrying capacities, the parent firm chooses a lower leverage ratio for the subsidiary and higher for itself.

Daley, Mehrotra, and Sivakumar's study (1997) of spinoffs provides some evidence related to the main question examined in our study. They contrast cross-industry spinoffs, involving a parent and subsidiary in different lines of business, with own-industry spinoffs, involving firms in the same industry. They find that cross-industry spinoffs lead to a small decline in the leverage ratio of the combined assets following the spinoffs, but there is no change in leverage associated with own-industry spinoffs. This pattern is consistent with the argument that spinoffs that undo diversification, and therefore are likely to increase the variability of cash flows, lead to declines in financial leverage.

Mehrotra, Mikkelson, and Partch (2002) analyzed 104 spinoffs occurring between 1979 through 1997. They argue that firms with more variable cash flows use less debt financing. Debt is costlier for firms with greater variability in cash flows because of the greater likelihood of default, hence, the need for costly external financing is greater. Greater variability leads not only to higher expected default costs, but also to higher agency costs associated with conflicts of interest between creditors and stockholders. For example, the underinvestment problem identified by Myers (1977) is aggravated when debt is riskier. To minimize these costs, greater financial leverage should be allocated to the firm with lower variability of cash flows. Their empirical findings provide evidence that the median difference in leverage ratios of the parents and spun off companies are insignificant. Following the spinoff, the median ratio of debt to assets is 0.18 for parent companies, and is 0.17 for the spun off firms. The median ratios of cash and equivalents to assets also do not differ between the parents and spun off firms. However, they find that the median of the inverse of the interest coverage ratio (the ratio of interest to operating income before depreciation) is 50% higher for the parent firms. In almost two-thirds of spinoffs, this ratio is higher for the parent. We should note that the coverage ratio measures only the short-term (up to one year) commitment of the company to pay interest. Therefore, we suggest that after the first post-spinoff year this coverage ratio difference is likely to disappear.

2.4 Structural breaks in risk parameters

Many financial actions taken by companies, in theory, may affect security return behavior in the short- or long -term. For example, Ohlson and Penman (1985) find that stock return volatilities increase significantly following split ex-dates. Lamoureux and Poon (1987) document that volatilities tend to decline following reverse split ex-dates. Brennan and Copeland (1988) find that beta coefficients estimated from daily data increase by almost 30 percent in the week surrounding the stock split ex-date and by 18 percent over 75 days subsequent to the ex-dates. However, replicating their research, Wiggins (1992) finds that a longer return measurement interval (week, month, and year) generally reduces any stock split ex-date permanent beta shift found by other researchers to zero. This fact supports the logic that fully anticipated events that leave the real asset and liability structure of a firm unchanged do not affect the long-term sensitivity of its stock price to the market information.

Tuna (2002), analyzing a sample of 29 tracking stocks (also known as alphabet stocks) over 1984-2000 period, finds that the risk-return characteristics of the parent stocks differ before and after the equity restructuring transaction. The mean beta of the parent stock decreases from 1.07 to 0.92 (significant at 0.001 level). However, the volatility of the parent stock increases significantly from 0.026 to 0.032. The results also show that the betas of the new tracking stocks are only marginally higher than the betas of the parent stocks (significant at 0.1 level, one-tailed test). On the other hand, returns of the "trackers" are significantly more volatile relative to their parent stocks. Therefore, this kind of equity restructuring is able to create new stocks that have different risk-return characteristics and are therefore expected to attract a different type of investors, making the market more complete.

D'Mello, Krishnaswami and Larkin (2002) come closer to the topic of our study. They also examine the equity and assets of spinoff equity restructuring. Using a modified Fama-French factor model, they find that there is no significant change in equity risk for the parent firm before the spinoff and for the weighted combination of the parent and the subsidiary after the event. Separate analysis of focus-increasing and non-focus-increasing spinoffs revealed no significant pattern either. However, studying a subsample of spinoffs by parent firms with relatively high pre-spinoff information asymmetry, they find some weak decrease in the cost of equity. This decrease is more pronounced (almost 8%) for the parent company's stocks. They argue that since the parent firms are more reliant on external financing, particularly equity issuing, this equity cost reduction can be more value enhancing than any possible loss of value due to increased riskiness of the subsidiary. They also find that there is a significant positive relation between the decrease in the cost of equity and the stock price performance over the period of spinoff event for this group of high information asymmetry parent firms. D'Mello et al conclude that typically spinoff gains are primarily an anticipation of improved cash flows and operating performance with no significant equity cost reduction. In contrast, for the high information asymmetry parent companies, a spinoff is a way to effectively signal positive information and achieve some equity cost reduction.

Summarizing all past studies on spinoff topic, we conclude that a spinoff is not just a company split facilitated through a brute-force approach. A spinoff is a well-structured transaction that affects a parent company at all levels: assets, human resources, clients etc. Therefore, we hypothesize that this type of equity restructuring should more or less affect risk-related characteristics of the parent company's stock.

3. DATA DESCRIPTION

An initial sample of firms has been obtained from the Securities Data Corporation's (SDC) Mergers and Acquisition Database. The SDC database is a financial database provided by *Thomson Financial Securities Data Corporation (TFSD)*.

The extracted data was required to satisfy the following criteria:

a) Completed spinoffs with at least 80% of a subsidiary being spun off, so that only candidates for tax-free spinoffs are included in the sample.

b) Ex-date of a spinoff must be between 1990 and 2000 inclusively.

c) Transaction value should be $5 million at minimum.

This preliminary search resulted in 360 observations. Thirty-four carve-outs (two-step spinoffs) were excluded. Two spinoff transactions were taxable and therefore were deleted.

Sometimes companies engage in spinoff activity to facilitate a merger or acquisition. Usually they do it to dispose of unwanted subsidiaries to comply with federal regulations. Forty-nine spinoffs like the ones just mentioned were excluded from the sample.

Spinoff distributions carried out under liquidation plan are also ruled out. Only three such cases were found in the SDC output.

Twenty-four occurrences of tracking stock spinoffs, split-ups and spinoffs by means of a tax-free exchange or rights offering were also filtered out.

Many companies in the sample made two or more studied announcements within the period. To avoid contamination effects we apply the following criteria:

a) those companies which made any spinoff announcement within a year before the announcement or after the ex-date are excluded;

b) companies with several spinoff announcements made on the same event day are not rejected.

We obtained 238 cases of voluntary spinoffs which were then checked for tax-free status, announcement dates, ex-dates, and distribution ratios. Lexis-Nexis network resources (Wall Street Journal news and SEC filings) and a sample provided by Dr. S.Ahn[1] were used for these verification purposes. Ten distributions were not confirmed and were discarded. For some events it was impossible to identify an exact ex-date, especially for small spinoffs and spinoffs completed in the early 1990s, in this case we checked stock prices of parent companies for the adjustments and set the first day of the adjusted trading as an effective date.

Another reason the data set is reduced is due to the unavailability of stock records on CRSP or Standard & Poor's COMPUSTAT tapes. To be included in the sample for further analysis, it is required that the parent firm's shares be traded on either of NYSE, NASDAQ and AMEX for at least a year before the spinoff announcement and a year after the ex-date. Analogously, there must be at least a year of stock price history after the ex-date available on CRSP tapes for every spun-off

[1] Dr. Ahn (Concordia University, Montreal, Canada) collected his sample of spinoffs for 1980-1996 using CCH's Capital Changes Reports.

subsidiary. These criteria reduced the sample to 146 cases in which 159 subsidiaries were divested. In ten out of 146 cases of spinoff transactions, a parent company spun-off two subsidiaries and in one case, four divisions were divested.

The distribution of the sample spinoffs completed over the 1990-2000 period is reported in Table 1. A deal value is available on SDC tapes and based on the closing price of the subsidiary on the first trading day.

Table 1. Sample distribution

Distribution of the sample of 146 firms that completed a spinoff in the period 1990-2000, by completion year, the total and average value of the transactions. Spinoffs are identified from the SDC tapes, news wires and articles from Lexis-Nexis and the Wall Street Journal.

Year	**Number**	**Total Value (mln. USD)**	**Average Deal Value (mln. USD)**
1990	10	2,544.63	254.46
1991	6	2,214.34	369.06
1992	10	4,445.79	444.58
1993	10	3,900.31	390.03
1994	12	10,682.05	890.17
1995	14	15,944.04	1,138.86
1996	19	19,982.27	1,051.70
1997	15	17,005.85	1,133.72
1998	20	17,081.17	854.06
1999	15	9,218.27	614.55
2000	15	36,400.26	2,426.68

From Table 1 we can see that the total and average deal values increase with time, except for the fall in 1998-1999, and reach a peak in 2000.

4. METHODOLOGY AND HYPOTHESES

4.1 Spinoff announcement and ex-date event studies

As a first step in our analysis, we conduct event studies to assess abnormal performance over the initial announcement period and on the ex-date. This step is primarily aimed at confirming the qualitative similarity of our sample of 146 spinoffs with the samples employed in other studies. Therefore, we theorize that both of these events are associated with an abnormal positive price response.

For computing abnormal returns (ARs) and cumulative abnormal returns (CARs) we use the "Eventus" software. As a regression model we use the widely employed market model. Our choice is supported by empirically demonstrated deviations from the CAPM, meaning that the validity of the restrictions imposed by the CAPM is questionable.[2] Moreover, Brown and Warner (1980) report that the market model produces estimates, which do not differ significantly from those, obtained using more complex methodologies.

The market model in our case relates the log-transformed returns of the j^{th} firm stock on day t ($R_{j,t}$) to the log-transformed returns of the value-weighted market portfolio (NYSE + NASDAQ + AMEX) (R_{mt}) in the following manner:

(1) $R_{j,t} = \alpha_j + \beta_j R_{m,t} + \varepsilon_{jt}$

Where:

ε_{jt} = a zero mean disturbance term;

α_j = an intercept;

β_j = a slope that measures sensitivity of the j^{th} stock return to the market portfolio return.

An abnormal return for the stock of j^{th} firm on day t ($AR_{j,t}$) can be defined as follows:

(2) $AR_{j,t} = R_{j,t} - (\alpha_j + \beta_j R_{m,t})$

[2] Fama and French (1996) describe CAPM anomalies in detail.

An average measure of AR_{jt} for the whole sample is called an Average Abnormal Return (AAR_t) and is computed in a following manner:

(3) $AAR_t = \frac{\sum_{j=1}^{N} AR_{j,t}}{N}$, where N is a number of companies in the sample.

As we are interested not only in excess returns on a single event day, we evaluate a Cumulative Abnormal Return (CAR_{j,T_1T_2}) and Cumulative Average Abnormal Return ($CAAR_{T_1T_2}$) over event windows using the following formulas:

(4) $CAR_{j,T_1T_2} = \sum_{t=T_1}^{T_2} AR_{j,t}$ and

(5) $CAAR_{T_1T_2} = \sum_{j=1}^{N} \sum_{t=T_1}^{T_2} AR_{j,t}$, where T_1 and T_2 are the first and last trading days of an event window.

In the first event study we assess the announcement event performance of the parent stock over 18 event windows: (-10,+5), (-3,+3), (-3,0), (-3,+1), (-1,+1), (-1,0), (0,0), (0,+1), (0,+3), (0,+5) , (+1,+3), (+1,+5), (+1,+7), (0,+10), (-5,+1), (-5,+3), (-3,+5), (-10,+10). The market model is estimated over a 200-day period ending thirty-one days before an announcement date. The event period is not allowed to overlap with the estimation period and for this reason is specified to be 10 days before the event and 10 days after it.

Admitting a deviation of stock return distribution from normality, we verify statistical significance of calculated AARs and CAARs by applying both parametric and nonparametric tests: Z-test and Generalized Signed Z test respectively.

A similar event study is done to evaluate abnormal performance of a parent stock around an ex-date, i.e. around a distribution date, when parent's stock price is adjusted to signify the spinoff completion. In this study, however, we estimate market model over the 200 trading day period starting 31 days after the ex-date. An event period also spans over the period (-30, 30). We adopt this approach to avoid a distortion of model parameters. If we use the 200-day estimation period prior to the ex-date, there would be many cases when the initial announcement date lies within this period, causing biased estimates of the market model. We have to admit that by using post-spinoff parent model parameters to estimate abnormal performance of the parent company's stock prior to the ex-date we introduce some bias. Nevertheless, only the pre-separation period is subject to this bias, meaning that ARs on and after the effective date are more or less bias free.

A number of studies find that the wealth effects are larger when the portion of assets that is divested is larger (see e.g. Hite and Owers (1983), Miles and Rosenfeld (1983), and Krishnaswami and Subramaniam (1999)). We define the relative size of subsidiary in two ways: 1) relative size-after as a ratio of market value of equity of the divested subsidiary right after the spinoff relative to the sum of the equity capitalizations of the parent and the subsidiary on the day of the completion of the spinoff; 2) relative size-before as a ratio of market value of equity of the divested subsidiary on the ex-date relative to the equity capitalizations of the parent on the eve of the spinoff completion. We then regress announcement abnormal returns on these two relative size measures.

4.2 Multivariate GARCH models

One of the most intensive areas of research in the finance in the last two decades has been concentrated on the idea that the volatility of financial returns is time-varying and that such time-variation can have a large impact on the way all financial activities (and data about them) should be measured, interpreted and modeled. A prominent article by Engle (1982) set a foundation for the ARCH (Autoregressive Conditional Heteroscedasticity) family of models, which explicitly model time-varying conditional variances by relating them to the past squared errors. Subsequently, Bollerslev (1986) introduced the generalized ARCH or GARCH model by adding lagged variances to measure long-term shocks. Although, dozens of variations have been proposed and applied in many contexts, applications of such models have been generally restricted to cases where only univariate data is considered, even though the vast majority of financial activity involves decisions where multivariate information must be considered.

For the last fifteen years multivariate GARCH models (BGARCH) has been successfully applied in many financial areas. For example, Bollerslev (1990) studied the changing variance structure of the exchange rate regime in the European Monetary System, assuming the correlations to be time invariant. Kroner and Claessens (1991) applied the models to calculate the optimal debt portfolio in multiple currencies. Baillie and Myers (1991) estimated the optimal hedge ratios of commodity futures and argued that these ratios are nonstationary. Bollerslev et al. (1992), Bera and Higgins (1993) conducted a survey on the methodology and applications of GARCH and BGARCH models. Lien and Luo (1994) evaluated the multiperiod hedge ratios of currency futures in a BGARCH framework. Karolyi (1995) examined the international transmission of stock returns and volatility, using different versions of BGARCH models. Gourieroux (1997) presented a survey of several versions of BGARCH models.

Bollerslev, Engle and Wooldridge (1988) originally provided the basic framework for a BGARCH model. They extended the GARCH representation in the univariate case to the vectorized conditional-variance matrix (VECH). Their very general specification follows the traditional autoregressive moving average time series analog. However, such generalizations would inevitably increase the number of parameters to be estimated and complicates specifications of the conditional variance and covariance matrix to ensure its positive definiteness. Empirical applications, on the other hand, require maximum parsimony.

In 1990, Bollerslev introduced the constant conditional correlation multivariate GARCH (CC-GARCH) specification to overcome these difficulties, where univariate GARCH models are estimated for each asset and then the correlation matrix is estimated using the standard closed form MLE correlation estimator using standardized residuals. The assumption of constant correlation makes estimating a large model feasible and ensures that the estimator is positive definite, simply requiring each univariate conditional variance to be non-zero and the correlation matrix to be of full rank.

In our study we employ a bivariate CCC-GARCH(1,1) model to obtain estimates of time-varying variances of market and company returns, as well as their time-varying covariances. The model is specified as follows:

(6) $R_{i,t} = \mu_i + \varepsilon_{i,t}$

(7) $R_{m,t} = \mu_m + \varepsilon_{m,t}$

(8) $\sigma_{m,t}^2 = \alpha_{m0} + \alpha_{m1}\varepsilon_{m,t-1}^2 + \alpha_{m2}\sigma_{m,t-1}^2$

(9) $$\begin{aligned}\sigma_{i,t}^2 &= \alpha_{i0} + \alpha_{i1}\varepsilon_{i,t-1}^2 + \alpha_{i2}\sigma_{i,t-1}^2 + \alpha_{i3}D_{(-1)} + \alpha_{i4}D_{annday} + \alpha_{i5}D_{anneff} + \alpha_{i6}D_{effday} \\ &+ \alpha_{i7}D_1 + \alpha_{i8}D_2 + \alpha_{i9}D_3 + \alpha_{i10}D_4\end{aligned}$$

(10) $\sigma_{im,t} = \rho\sigma_{i,t}\sigma_{m,t}$

where $R_{j,t}$ and $R_{m,t}$ are log-transformed prewhitened[3] returns of the j^{th} firm stock on day t and the value-weighted market portfolio respectively; μ_i and μ_m are constant mean of returns; ρ is a constant correlation, and $\sigma_{im,t}$ is the time-varying covariance of the returns. We intentionally do not include any dummy variables in Equations 6 and 7, because we need to capture the "raw" variance dynamics around the announcement and the effective dates. This way we can observe the event shock to the variance and its dissipation path over time. Besides, the number of daily observations is large enough (between 650 and 1200) to reduce the influence of the short-term ARs around the announcement and the ex-date upon the mean in Equations 6 and 7.

There are restrictions to be imposed to ensure that the variance matrices are positive semidefinite:

$$\alpha_{m0}, \alpha_{m1}, \alpha_{m2}, \alpha_{i1}, \alpha_{i2} > 0$$

$$\alpha_{m1} + \alpha_{m2} \leq 1$$

$$\alpha_{i1} + \alpha_{i2} \leq 1$$

$$\alpha_{i0} + \alpha_{ij} > 0 \text{, for j = (3,10)}$$

As we try to measure any possible change in the firm stock return variance, we introduced into equation (9) eight binary (dummy) variables:

D_{annday} and D_{effday} - take the value of 1 for trading days lying within (-15,+15) period around the date of spinoff announcement and the ex-date respectively and zero otherwise.

D_{anneff} - takes the value of 1 starting 16 trading days after the announcement and ending 16 days before the ex-date and zero value otherwise;

[3] Before estimating the market model, we remove autocorrelation in returns by regressing them on the mean with autoregressive errors up to 24 lags. Then we add back the intercept to the obtained prewhitened residuals.

D_1, D_2, D_3, D_4 - take the value of 1 for the first, second, third and fourth half year (62 trading days except for the first half year, which consists of 47 trading days) correspondingly after the ex-date and zero otherwise.

$D_{(-1)}$ - is a dummy variable with the value of 1 for days within the half year prior to the announcement day (effectively 47 trading days, taking into account the initial announcement event period) and zero otherwise.

Thus dummy variables, including the intercept, cover a period starting a year before the initial announcement of the spinoff transaction and up to 2 years after the effective completion of the deal without overlapping with each other.

The maximum likelihood estimation (MLE) method is used to estimate all parameters of the model.

11) $$L = -\frac{1}{2}\sum_{t=1}^{T}(k\log(2\pi) + \log(|H_t|) + (\xi_{i,t}\xi_{m,t})H_t^{-1}\begin{pmatrix}\xi_{i,t}\\ \xi_{m,t}\end{pmatrix})$$

where

$$H_t = \begin{pmatrix}\sigma_{i,t}^2 & \\ \sigma_{im,t} & \sigma_{m,t}^2\end{pmatrix}$$ and

12) $\xi_{k,t} = \frac{\varepsilon_{k,t}}{\sigma_{k,t}}$ for k = i,m , are the residuals standardized by their conditional standard deviations.

Optimization calculations were done in RATS using the BHHH (Berndt, Hall, Hall and Hausman, 1974)[4] method. Initial values for $\mu_i, \mu_m, \alpha_{m0}, \alpha_{i0}, \sigma_{m,t-1}^2, \sigma_{i,t-1}^2$ and ρ were obtained from OLS regressions of market and company returns on their

[4] BHHH provides a method of estimating the asymptotic covariance matrix of a Maximum Likelihood Estimator. In particular, the covariance matrix for a MLE depends on the second derivatives of the log-likelihood function. However, the second derivatives tend to be complicated nonlinear functions. BHHH estimates the asymptotic covariance matrix using first derivatives instead of analytic second derivatives. Thus, BHHH is usually easier to compute than other methods.

respective means. Since most of nonlinear optimization methods are derivative-based, including BHHH, they are very sensitive to the choice of initial estimates. Therefore, OLS estimates were then refined by the Simplex method to partially circumvent this problem. We constrain the number of iterations by this method to five, since initial conditions should be slightly pulled away from the optimum. Thus, we give the algorithm a chance to estimate standard errors correctly.

Although CCC-GARCH offers parsimony and clear-cut interpretation of results, the constant correlation estimator, as proposed, does not provide a method to construct consistent standard errors using the multi-stage estimation process. Tse and Tsui (2002) and other scholars have found that constant correlation can be rejected for certain assets. Thus, there is a need to extend the BVGARCH models to incorporate time-varying correlations and yet retain the appealing feature of satisfying the positive-definite condition during the optimization.

We chose the most recent variant of the time-varying correlation models developed by Tse and Tsui (2002). In their Varying Correlation Bivariate GARCH (VC-BGARCH) each conditional-variance term is assumed to follow a univariate GARCH formulation as in CCC-GARCH, however the conditional-correlation is assumed to follow an autoregressive moving average process:

13) $\rho_{im,t} = (1-\theta_1-\theta_2)\rho + \theta_1\rho_{im,t-1} + \theta_2\psi_{t-1}$

ψ_t is a function of the lagged standardized errors ξ_{it} and ξ_{mt} and has a functional form:

14) $\psi_t = \dfrac{\sum_{h=0}^{1}\xi_{i,t-h}\xi_{m,t-h}}{\sqrt{(\sum_{h=0}^{1}\xi_{i,t-h}^2)(\sum_{h=0}^{1}\xi_{m,t-h}^2)}}$

The parameters θ_1 and θ_2 are postulated to be non-negative with an additional constraint embedded in the equation that $\theta_1 + \theta_2 \leq 1$. It can be observed that ψ_{t-1} is analogous to $\varepsilon_{i,t-1}^2$ in Equation 9. However, ψ_{t-1} depends on the standardized lagged residuals and, by construction, is the sample correlation matrix of $(\xi_{it}, \xi_{i,t-1})$. Thus, the time-varying correlation is a weighted average of some constant correlation ρ, $\rho_{im,t-1}$ and ψ_{t-1}.

The rest of the model mimics CCC-GARCH one, including dummy variables and the maximum likelihood function.[5]

Although VC-GARCH(1,1) is a somewhat complicated model, it still retains the intuition and interpretation of the univariate GARCH model and yet satisfies the positive-definite condition as found in the constant-correlation models.

4.3 Conditional betas and variances analysis methodology

In our study, we examine two hypotheses regarding changes in the risk parameters. First, by divesting an unrelated business, the parent company is risking the loss of some diversification advantages, such as low earnings volatility. Since 72% of our sample firms fall into this group, on average, we would expect an increasing parent stock return variance after the spinoff. Second, as Dittmar (2002), Daley, Mehrotra and Sivakumar (1997) report, subsidiaries end up with a lower debt burden right after the spinoff than their former parent companies. Hence, an increased debt proportion, especially coupled with the increased earnings variation, may adversely affect the riskiness of the parent's stock. However, we suspect that being able to raise equity funds at lower costs, the parent company can decrease this ratio

[5] We also tried to include the same dummy variables in the dynamic correlation equation, but because of the large number of parameters to be estimated in many cases we could not reach convergence even after 400 iterations.

after the spinoff completion by issuing additional equity and using the proceeds to repay the debt. Therefore, we expect to observe only temporary systematic risk shifts.

In our study, we calculate systematic risks indirectly as follows:

$$15)\ \beta_{it} = \frac{\sigma_{mi,t}}{\sigma^2_{m,t}} = \frac{\rho_{im,t}\sigma_{i,t}\sigma_{m,t}}{\sigma^2_{m,t}} \text{ or just } \rho_{im,t}\frac{\sigma_{i,t}}{\sigma_{m,t}}$$

where $\rho_{im,t}$ is a conditional correlation between the market returns and the parent company returns.

To capture any possible changes in mean we run the following regression:

$$16)\ \begin{aligned}&\beta_{i,t} = \alpha_{i0} + \alpha_{i1}D_{(-1)} + \alpha_{i2}D_{annday} + \alpha_{i3}D_{anneff} + \alpha_{i4}D_{effday} + \alpha_{i5}D_1 + \alpha_{i6}D_2 + \\ &\alpha_{i7}D_3 + \alpha_{i8}D_4 + v_{i,t}\end{aligned}$$

$$17)\ v_{i,t} = -\sum_{k=1}^{12}\varphi_k v_{i,t-k} + \varepsilon_{i,t},\ \varepsilon_{i,t} \sim IN(0,\sigma^2)$$

where an autoregressive error $v_{i,t}$ is to adjust for possible autocorrelation and $D_j, j \in (1,8)$ are the same dummies as in BGARCH equation (9).

Some studies find that a change in the systematic risk around or after events like dividend changes, stock splits etc is not necessarily accompanied by a change in variances. Therefore, we analyze the total and residual variances of the sample parent companies for shifts in the means over periods studied.

We can estimate the residual, or firm-specific, variance using the following formula:

$$18)\ \sigma^2_{\varepsilon_{i,t}} = \sigma^2_{i,t} - \beta^2_{i,t}\sigma^2_{m,t},$$

where $\sigma^2_{i,t}, \sigma^2_{m,t}$ and $\beta_{i,t}$ are conditional variances and betas obtained earlier from the BGARCH regressions.

We employ the same analysis method as in the case of the beta analysis.

19) $\sigma^2_{\varepsilon_{i,t}} = \alpha_{i0} + \alpha_{i1}D_{(-1)} + \alpha_{i2}D_{annday} + \alpha_{i3}D_{anneff} + \alpha_{i4}D_{effday} + \alpha_{i5}D_1 + \alpha_{i6}D_2 + \alpha_{i7}D_3 + \alpha_{i8}D_4 + v_{i,t}$

20) $v_{i,t} = -\sum_{k=1}^{12} \varphi_k v_{i,t-k} + \varepsilon_{i,t},\ \varepsilon_{i,t} \sim IN(0, \sigma^2)$

Krishnaswami and Subramaniam (1999) report a significant decrease in information asymmetry for the parent stocks following the spinoff. The reduced asymmetry, in turn, should manifest itself in the decreased unsystematic, i.e. firm-specific or diversifiable, risk, since more information is revealed to the investors during and after the spinoff.

We expect that partitioning the sample into high-/low-asymmetry and focus-increasing/non-focus-increasing subsamples will reveal patterns that are more distinct.

Spinoffs are defined as focus-increasing, or cross-industry, if a divested subsidiary has a two digit SIC code different from that of its parent. For this purpose, we extract SIC codes from the Compustat database for both parents and subsidiaries.

If the parent company spins off a subsidiary, which is not related to its core business, we would expect increases in the total volatility and/or the systematic risk because of the loss of diversification and increasing asset beta, as a consequence of more volatile future cash flows. On the other hand, an elimination of negative synergies, agency costs and internal capital market inefficiencies may partly compensate these risk changes. As to non-focus-increasing, or own industry, spinoff parents, we suppose that there will be no significant change in either risk parameter. It has been shown by Daley, Mehrotra and Sivakumar (1997) and Desai and Jain (1999) that these companies have little improvement in the future cash flows. Daley, Mehrotra, and Sivakumar (1997) also find that only own-industry spinoffs are not associated with combined parent and subsidiary leverage change.

In our study, we would also like to test the hypothesis that high-asymmetry parent firms experience a significant reduction in information asymmetry. We do not exclude the possibility of changes either in beta or the total variance of the returns for this group of the parent companies.

To split the sample by the level of the information asymmetry, we adopt an approach proposed by Dierkens (1991), and by Krishnaswami and Subramaniam (1999). They use the dispersion in the market-adjusted daily stock returns in the year preceding the announcement. In our case, we use the results of the firm-specific (residual) conditional variance analysis. The intercept in the dummy regression (19) is the average residual variance for the first half of the year before the announcement for each company. We characterize a parent company with a high level of information asymmetry if it has an above-average variance and vice versa.[6]

4.4 Pre- and post-spinoff parent company leverage comparison

We do not exclude other possible reasons negatively or positively affecting risk parameters under study. For example, an increased leverage may lead to the rise in financial risks: higher beta and variance.

The Hamada (1972) equation (21), measuring the effect of the capital structure on the equity systematic risk, provides the basis for this leverage hypothesis.

21) $$\beta_s = \beta_a \left(1 + (1-\tau)\frac{D}{S} \right)$$

We can see that an equity beta β_s mainly depends on the debt to equity ratio $\frac{D}{S}$ and an asset beta β_a, reasonably assuming a corporate tax rate τ to be

[6] We obtained the same patterns using median variances instead of average ones to classify the stocks into high- or low-asymmetry groups.

constant within the studied 3-4 year period.

Keeping in mind this dependence, we examine our sample of the parent companies for the possible leverage changes over seven periods starting 6 months before the spinoff announcement. In our study, we define leverage as total book-value debt to total book-value assets. We assume the total debt to be a sum of the long-term debt and the debt in current liabilities, so that to exclude non-debt liabilities.

First, we extract quarterly data from Compustat for eight time points: for the fourth and second quarters before the announcement, for the quarters when the announcement and the effective separation happened, and over the next two years with a two-quarter step. We then measure changes of the ratios relative to the first one, i.e. relative to a year prior to the spinoff announcement.

To be able to relate the results of this analysis with other results, we study leverage shifts adjusting for the level of asymmetry and the refocusing factor.

5. EMPIRICAL FINDINGS

5.1 Event studies' results

The results of the study shown in Tables 2 and 3 are quite similar to those reported in previous empirical studies. A spinoff announcement is indeed a value-creating event, conveying positive information about a parent's future. We find that there is a small run-up AAR (0.24%) on day (-1), implying some intentional or unintentional spinoff announcement information leakage. The announcement day (day zero) AAR of 4.2% is, as expected, significant both statistically and economically.

It is interesting to observe a series of negative returns over seven trading days right after the announcement date, reported, but not explained, in a number of studies. Starting from day t=+1 through day t=+7 we observe a CAAR of -1.43% (significant at 5%). Hite and Owers (1983) find CAR of -1.8% over the same range. Perhaps, this downward price pressure is a result of post-event short-term active trading: some investors, who are not willing or able to hold the parent shares after the spinoff, sell them.

An analysis of obtained CAARs reveals a more lasting effect of the announcement. CAARs over a period (-10,+10) average 3.11%, reaching a maximum of 4.67% over four days (-3,0).

We regress the estimated event day ARs on the two subsidiary relative size ratios defined earlier. The results in Table 4 confirm the positive relationship between size and ARs for both ratios. However, the correlation ranges from 16% to 20%, which means that there are factors better explaining the ARs rather than size ratios. Moreover, these results could be distorted because of AR measurement errors and sample post-selection bias.

Table 4. Relative subsidiary size effect regression
146 parent firms.

Days	Relative size-before	Relative size-after
Intercept	2.973**	3.203**
Coefficient	4.173**	3.705*
DW	1.966	1.986
Pearson correlation	0.204*	0.167*
Spearman correlation	0.206*	0.182*

* and ** - significant at the 0.05 and 0.01 levels respectively (2-tailed).

A more interesting phenomenon observed by other researchers is the abnormal performance of the spinoff parent shares around the ex-date. Our findings, reported in Table 5, document highly significant day-zero excess returns of 2.43%, which is consistent with the findings of Vijh (1994). ARs are only observed on the ex-date without any run-up supporting Vijh's hypothesis that these ARs have nothing to do with new positive information arrival.

Post-ex-date parent stock price movement exhibits almost the same pattern as it did after the announcement. Negative AARs are detected from day t= +2 through day t= +10, perhaps even further. A CAAR over this period is roughly -3.00% (significant at 1%). Again, none of the past papers, to our knowledge, investigate the reasons for this anomaly.

As in the announcement event study, we find that cumulative abnormal returns (Table 6) are significant over several days, though with a smaller magnitude. The largest CAARs of +2.43% is obtained over the (-5,+1) period.

5.2 Conditional variances and betas regressions

Tables 7 and 8 report the results of the analysis of the conditional total variances. We detect a considerable increase in the total variance of the parent stock returns for the full sample. It may be justified by the composition of our sample: about 72% of parent companies are focus-increasing. Both BGARCH models produced almost identical results. All dummy parameters for the full sample are highly significant except for the last 6 months before the announcement and for the interim period - a period between the announcement and the ex-date. The variance shifts exhibit a U-shape trend: an initial variance jump around the ex-date declines over the following 12 months, followed by an increase over the next 12 months. An absence of variance reversion to the pre-split level and the magnitude of the shifts may suggest that the shock dissipation period is much longer than two years.

We can obtain a better insight into the pattern if we consider a ratio of the dummy coefficients to the conditional variance mean, i.e. intercept α_{i0}. The results are reported in Tables 9 and 10. Within the 30-day period around the spinoff announcement, the unconditional variance rises by almost 28-32% for the full sample.

Within the period between the announcement and the effective completion, it is still higher than a year before the event by 15-19%, although the difference is statistically insignificant. The highest surge (81%-85%) in the variance is observed around the spinoff completion. For the following two years, the variance remains significantly higher by, on average, 60%.

We should note that according to equation (15), the total variance process is defined by two subprocesses: systematic and unsystematic. We, therefore, may suggest that an obtained pattern of the total variance shifts is a result of shifts in these two processes. A further analysis, presented later in this section, may help shed some light on this issue.

A separate analysis of focus-increasing and non-focus-increasing companies reveals the expected results. We can observe a statistically significant increase in the variance for the focus-increasing sample, while non-focus-increasing firms, on average, do not have significant stock return variance changes, except close to the spinoff completion period. Therefore, consistent with the findings of Daley et al. (1997), we see that the diversification loss, caused by the focus increase, may be a source of the variance increase.

To check for a possible information asymmetry reduction, as a decreasing variance factor, we split our sample into high- and low-asymmetry subsamples. The results of the separate analyses are not clear-cut. The variance shift parameters for the low-asymmetry group of parents are disproportionally high relative to the intercept. The shifts are not only highly significant but also reach a maximum magnitude by the end of the second year. For the high-asymmetry group of parents, there is, on the contrary, no permanent shift in the total variance. The ex-date shock dissolves within a year of the spinoff completion.

Assuming a constant debt structure, which will be examined further in this study, and assuming that there should be a minimal information asymmetry decrease for the low-asymmetry parents, we may suggest that the observed shifts are purely due to the loss of the benefits of diversification. This would explain the reduced surge in the variance for high-asymmetry companies: the diversification loss is partly offset by the improved information awareness of investors.

It may be seen that by controlling for the level of information asymmetry and refocusing we obtain different variance parameter results. Of the four sub-samples examined only the high-asymmetry and non-focus-increasing sample of firms did not experience variance shifts. This pattern supports our hypothesis that own-industry spinoff parent companies may experience an increase in operational performance volatility. However, there is also little reduction in the total variance. Therefore, from the stock riskiness point of view, spinoff transactions in this subsample (high-asymmetry and non-focus increasing) bring neither harm nor good to parent company shareholders.

In contrast, focus-increasing companies with high pre-spinoff information asymmetry exhibit positive variance shifts lasting for a year and a half after the completion of the spinoff. For this group of parent firms, we may conclude that despite variance mean-reversion, shareholders may suffer higher bid-ask spreads for the parent company's stock in the short-term due to the increased volatility and higher information asymmetry.

The low-asymmetry sub-samples have very similar variance change patterns. After a surge of variance around the ex-date, it declines over the next six months. Over the following year, we observe an upward trend in the variance. The differences start a year and a half after deal completion. For cross-industry spinoffs, the parameter goes up from 103.77% to 163.64% (i.e. by 58% relative to the previous half year). For own-industry spinoffs, the variance shift parameter drops from 121.77% to 85% (i.e. by 30%). These upward-trend patterns of the variance movements of both subsamples are not consistent with any of the hypotheses we proposed. We can only establish that the shareholders of both low-asymmetry parent firm groups may find themselves with much riskier parent company shares on hand after the spinoff. The problem is aggravated by a generally large weight of the parent shares in a post-spinoff portfolio. In addition, although we study only risk parameters of the parent company stocks, we may presume that newly spun off subsidiary shares, being much smaller than their parents and having higher cash flow volatility, are not likely to alleviate the increasing risk problem.

These surprising and disturbing results prompt us to consider other sources of the variance instability, e.g. debt leverage increases etc.

In equation (15) we can see that the total variance of stock returns is a sum of systematic ($\beta_{i,t}^2 \sigma_{m,t}^2$) and unsystematic or residual ($\sigma_{\varepsilon_{i,t}}^2$) components. Perhaps, the observed significant breaks in the total variance could be driven by the changes in one of the parts.

Tables 11 and 12 report the results of the conditional beta analysis for CC-BGARCH and VC-BGARCH models. First, we notice a considerable variation in initial mean betas (intercepts) across all subsamples. Apparently, the higher the beta the higher the information asymmetry and the higher probability that the spinoff will be cross-industry. Adjusting our sample for information asymmetry and refocusing factors, we obtain a consistent picture. The highest beta is observed for the high-asymmetry, focus-increasing parent-firms and the lowest for the low-asymmetry, non-refocusing ones.

These results let us conclude that, despite being a component of the unsystematic risk, information asymmetry also has some connection to the level of systematic risk, i.e. the beta. We propose that volatile earnings and capital structure create some uncertainty about the firm's future and adversely affect the quality of information about the parent company.

The reasons why higher beta companies choose to divest unrelated businesses are not obvious. We may only advocate that the management of a high-beta firm may feel that its shares are undervalued since the market considers them too risky. Therefore, the management initiates a cross-industry spinoff to shed high-growth, high-risk businesses to bring the equity cost down. Low-beta firms, perhaps, choose to divest poor-performing subsidiaries to improve diversification efficiency.

A further analysis of beta movements across studied periods brings both predicted and unforeseen results.

For the full sample, systematic risk shifts, ranging from 6.5% to 12.8%, are significant at 5% and positive over the announcement, completion periods and over the first year after the ex-date. It is not surprising because 72% of the spinoffs in our sample are cross-industry. Starting from the second year, beta changes become insignificant and gradually revert to the mean. Thus, beta shifts appear to contribute to the variance changes only in the first year. However, this contribution is much less than the observed 60%-80% shift in the total variance. Therefore, on average, spinoffs do not cause parent-firm stock systematic risk changes in the long-run, which is good for a long-term investor.

From Table 11 we can infer that parent companies divesting a related business unit, in general, do not experience significant shifts in betas after the separation. This result is in line with the argument that non-refocusing spinoffs do not destroy diversification advantages and keep volatility of earnings and other internal factors constant. However, for this group of firms we observe an unexplainable significant 8.4% increase in systematic risk over the 6 months prior to the announcement. Over the same 6- month period there is a negative, although weakly significant, shift (-3.34%) for focus-increasing parent firms. In addition, focus-increasing parent companies experience a statistically significant 8%-14% beta increase over the first post-spinoff year.

An information asymmetry level analysis reveals that low-asymmetry companies have a 7-12% higher systematic risk over the ex-date period and over the following 18 months than the year before the announcement day. On the other hand, parameters for the high-asymmetry firms do not change significantly, and the ex-date shock subsides quickly within the first 6 months. Comparing these patterns to the total variance ones for the same groups, we can see that systematic risk shifts have a lower magnitude and dissipate much faster. It means that they are not a major cause of significant variance surge over the same periods.

For further analysis, we form four subsamples combining focus and asymmetry factors. Each of the obtained subsamples exhibits a specific trend.

Starting 6 months before the announcement and up to the ex-date period, the betas of high-asymmetry, focus-increasing companies decline insignificantly by 3%-5%, and then rise by 12.8% around the effective day, diminishing to a statistically insignificant 1.5% by the end of the second year. We expected that there would be the highest decrease in systematic risk for this group as a result of the information asymmetry reduction. However, the results do not support this hypothesis.

High-asymmetry and non-focus-increasing parents display an opposite pattern. Beta changes are insignificantly positive up to the second quarter after separation inclusively, but become increasingly negative afterwards. The decrease over the last 6 months of the whole study period approaches minus 13.7% with a significance level less than 10%. Over the very same period, the total variance increases by a weakly significant 22.7%. It seems this is the only group of firms that reaches equity systematic risk reduction with minor changes in the total variance, benefiting shareholders and bondholders.

Low-asymmetry and focus-increasing companies have the highest beta spike (15.4%) over the completion period across all subsamples. Parameter estimates for the low-asymmetry focus-increasing and non-increasing are almost the same, except for two points: refocusing firms within this subsample have a decreasing beta (-3.25%) over the 6 months before the announcement date; betas are not statistically different from the intercept for refocusing firms during the second year after the spinoff. The total variance, in contrast, actively grows over these periods. Non-refocusing companies' betas experience a positive 9%-13.8% growth in systematic risk over all periods, continuing well into the third year after the ex-date. The shift in total variance for this subsample is also high over all periods. Presuming that low-asymmetry companies are more likely to have stable cash flows and high dividend payout, and therefore their stocks can be considered as a defensive long-term investment, we suggest that shareholders would have to reconsider their portfolio structure, as both the total variance and beta significantly increase.

The patterns of beta shifts for the VC-BGARCH model (Table 12) are similar to the CC-BGARCH one, apart from a lower parameter estimate magnitude of the former model. This difference may mean that risk structural breaks are partly alleviated by the varying correlation.

The above analysis of beta changes suggest that in general spinoff parents are subject to increased systematic risk after the spinoff completion. Only high-asymmetry, non-refocusing spinoff parent firms achieve a reduction in systematic risk in the long-term. On the other hand, low-asymmetry, own-industry spinoffs result in a significant and permanent beta surge for their parent firms. For other group of firms, the shocks dissipate quite quickly and cannot contribute to the observed total variance surge afterwards.

These findings allow us to suggest that the unsystematic risk is a major source of the stock return total variance growth. In Tables 13 and 14, we present our empirical results of regressions of the residual variance on the set of period dummies for different samples.

For the full sample, we observe a significant growth of the variance by 25% on the announcement and by 59%-60% on and after completion. Krishnaswami et al. (1999), however, comparing stock return residual standard deviations before and after the spinoff, find about 71% decrease or in terms of the residual variance a 51% reduction.

Comparing focus-increasing and non-focus-increasing, we obtain a different picture. It seems that the residual risk shifts are not permanent and are relatively small for companies separating subsidiaries with similar business focus. Parents choosing to divest unrelated businesses, on the other hand, may face an increase of the variance by up to 107% two years after the successful spinoff completion. Moreover, for 18 months after the ex-date, the parameters of the regression for this subsample are not only substantially higher than an intercept, but they are also statistically higher than the corresponding parameters of the non-focus-increasing companies. A further detailed analysis may find explanations for these findings which contradict the extant studies' results.

A high- vs. low-asymmetry cut exposes a disproportionately high growth of the firm-specific variance for low-asymmetry parents. The variance jump for high pre-spinoff information asymmetry parents reaches 82% over the effective completion period, gradually decreasing to 48% at the end of the second year, whereas risk shifts for low-asymmetry firms display the reverse trend, increasing from 92% on the ex-date to 165% over the last period studied. We should also note a significant variance difference between these two groups, ranging from two to four times.

Analyzing the four sub-samples, obtained by controlling for the levels of asymmetry and refocusing, we find that only high-asymmetry, non-focus-increasing parent firms do not experience firm-specific risk changes. We therefore conclude that by means of spinoff this group of firms fails to improve the quality of the information available about future operating performance. However, there is some decrease in the systematic risk after spinoff.

The most striking changes happen to the subsample of low-asymmetry, focus-increasing parents. Over the periods around and following the ex-date, the variance shifts increase by 100%-200%. This pattern is similar to the total variance movements for the same group of firms, suggesting that residual variance is a major long-term contributor to total variance shifts.

Both high-asymmetry, focus-increasing and low-asymmetry, non-focus-increasing parent groups have the same trend in the variance parameters: a surge around the ex-date which slowly dissolves over the following periods. However, a diversification loss cannot explain the variance growth for the latter group of firms. As they divest related business, they are unlikely to experience significant cash flow volatility increases. In addition, by having the low information asymmetry, hence, better predictability of stock returns, this group of the companies is more likely to have relatively good analyst coverage. Therefore, either spinoff restructuring creates some uncertainty about the parent firm operating future due to worsened information dissemination or there are some other qualitative changes affecting the post-spinoff parents. If this hypothesis is true then the information asymmetry reduction is not a major motive for the spinoff.

5.3 Analysis of parent company leverage before and after spinoff

In an attempt to find an explanation for the systematic shifts, we analyze the most probable source – capital structure changes.

The results of this study, displayed in Table 15, demonstrate that for the full sample there are no significant shifts in the debt-to-assets (DTA) ratio for the parent companies before or after spinoff. Only around the separation effective date, we detect an 8.5% increase relative to the intercept (the 4^{th} quarter before the announcement). Most probably, the parent firms quickly manage to decrease the debt burden through the issuance of additional equity and/or through debt repayment. These results are in line with those of the most of the previous studies on spinoff debt structure.

Further sample partitioning reveals some unexpected results. Contrary to the variance and beta trends, focus-increasing companies do not experience any significant debt burden reduction. There is only a 5% decrease (significant at 10% level) around the announcement date. Non-refocusing firms, on the other hand, exhibit a 9%-22% DTA ratio growth, whereas the beta and variance do not change significantly. While these results may seem conflicting, they could be explained within the diversification loss hypothesis framework. Since own-industry spinoff parents, in theory, should not have more volatile operating performance after spinoff, they can take on a greater debt burden than the divested subsidiaries. Focus-increasing parents, in contrast, should try to shed some debt or at least to keep the same debt level, so that the bankruptcy risks do not outweigh spinoff gains.

A high- vs. low-asymmetry cut uncovers no significant changes for either sample.

A more detailed analysis reveals no additional information, except for the significant negative (14.8%) and significant positive (14.0%) shifts of the DTA ratio around the spinoff announcement for high-asymmetry, focus-increasing and high-asymmetry, non-refocusing parents respectively. The difference between these shifts is highly significant.

Overall, the debt-to-total assets analysis cannot explain long-term changes in the total, residual variances and betas. Only a debt loading increases around the ex-date and in some cases around the announcement date can be related to the risk growth over these periods.

6. SUMMARY AND CONCLUSIONS

Most studies of spinoffs mainly examine the spinoff parent or subsidiary's short -, long-term abnormal returns, operating performance and capital structure changes etc. We also document positive short-term abnormal returns around the spinoff announcement and ex-date, suggesting that spinoffs are generally a positive event, conveying possible operating improvements, and elimination of negative synergies etc.

However, only a few papers examine the risk-associated side of this kind of equity restructuring. This study employs advanced bivariate GARCH models to examine three basic risk components: total variance of stock returns, systematic risk or beta, and residual variance. The results of the study are partially unexpected and disturbing for the shareholders of a corporation planning a spinoff.

We document strong evidence of the risk growth after the separation for the full sample. Taking into account parent pre-spinoff information asymmetry and whether it divests related or unrelated business, we obtain different patterns of risk evolution. The most prominent risk increase is observed for the low-asymmetry, focus-increasing group of firms. High-asymmetry, focus-increasing companies experience temporary risk changes. We find that both the total and residual variance processes for the high-asymmetry, non-focus-increasing subsample do not react significantly to the spinoff transaction. However, there is a 13.7% decrease in the systematic risk significant at less than 10%. Therefore, this is the only group of spinoff parents that delivers some risk reduction for their shareholders.

We notice that though total and residual variances increase by 30-150%, in some cases by 210%, the systematic risk rise at maximum by 14%. Therefore, spinoffs mostly increase the unsystematic part of the total risk, making stock returns more unpredictable.

Searching for the sources of these risk changes, we analyze debt burden variation. However, we are unable to relate any changes in this factor to the observed parent stock risk parameter changes.

Therefore, we conclude that the source of these changes is possibly the diversification loss, causing increased volatility of post-event earnings and therefore an increased information asymmetry. The only anomaly that we are not able to explain within the current hypothesis framework is a highly significant and persistent shift of the risk characteristics of the low-asymmetry, own-industry parent stocks.

Such findings cast doubts on the superior benefits of the average spinoff for ordinary shareholders, who may not be able to diversify away increased risks, as well as for the institutional holders, who have strict investment policy concerning the riskiness of investment assets. Therefore, investors must be aware that an improved operational and stock performance may come at the price of an increase in stock risk.

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APPENDICES

Table 2. Announcement event study AARs

The market model is estimated over 200 days ending 31 days before the announcement for the sample of 146 parent firms. Both parametric (Z) and non-parametric (Generalized Sign Z) tests are applied.

Day	N	Mean Abnormal Return	Positive: Negative	Z	Generalized Sign Z
-10	146	-0.32%	61:85	-1.930$	-1.291
-9	146	0.14%	61:85	1.088	-1.291
-8	146	-0.07%	69:77	-0.448	0.021
-7	146	-0.03%	65:81	-0.844	-0.635
-6	146	-0.02%	70:76	-0.642	-0.307
-5	146	0.10%	65:81	-0.131	-1.127
-4	146	-0.17%	66:80	-1.259	-0.963
-3	146	0.23%	81:65	1.769$	1.496
-2	146	0.00%	83:63	0.297	1.824$
-1	146	0.24%	76:70	2.029*	0.676
0	146	4.15%	119:27	27.287***	8.218***
+1	146	-0.04%	72:74	1.002	0.021
+2	146	-0.53%	62:84	-2.498*	-1.619
+3	146	-0.36%	62:84	-1.724$	-1.619
+4	146	-0.25%	66:80	-2.243*	-0.471
+5	146	-0.22%	62:84	-1.823$	-1.127
+6	146	-0.06%	66:80	-0.504	-0.635
+7	146	0.03%	75:71	-0.172	0.676
+8	146	-0.30%	55:91	-1.474	-2.603**
+9	146	0.53%	77:69	2.287*	1.004
+10	146	0.01%	66:80	0.240	-0.799

The symbols $,*,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a 2-tail test.

Table 3. Announcement event study CAARs

The market model is estimated over 200 days ending 31 days before the announcement for the sample of 146 parent firms. Both parametric (Z) and non-parametric (Generalized Sign Z) tests are applied.

Days	N	Mean Cumulative Abnormal Return	Positive: Negative	Z	Generalized Sign Z
(-10,+5)	146	2.89%	104:42	4.982***	5.267***
(-3,+3)	146	3.74%	111:35	10.644***	6.415***
(-3,0)	146	4.67%	123:23	15.691***	8.382***
(-3,+1)	146	4.63%	119:27	14.482***	7.726***
(-1,+1)	146	4.40%	117:29	17.504***	7.398***
(-1,0)	146	4.44%	121:25	20.730***	8.054***
(0,0)	146	4.20%	122:24	27.287***	8.218***
(0,+1)	146	4.15%	110:36	20.003***	6.251***
(0,+3)	146	3.27%	106:40	12.033***	5.595***
(0,+5)	146	2.79%	97:49	8.165***	4.119***
(0,+10)	146	3.01%	97:49	6.144***	4.119***
(+1,+3)	146	-0.93%	63:86	-1.860$	-1.455
(+1,+5)	146	-1.40%	62:87	-3.259**	-1.619
(+1,+7)	146	-1.43%	60:89	-3.010**	-1.947$
(-5,+1)	146	4.55%	117:29	11.715***	7.398***
(-5,+3)	146	3.67%	113:33	8.924***	6.742***
(-3,+5)	146	3.27%	100:46	8.032***	4.611***
(-10,+10)	146	3.11%	103:43	4.431***	5.103***

The symbols $,*,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a 2-tail test.

Table 5. Ex-date event study AARs

The market model is estimated over 200 days starting 31 days after the ex date for the sample of 146 parent firms. Both parametric (Z) and non-parametric (Generalized Sign Z) tests are applied.

Day	N	Mean Abnormal Return	Positive: Negative	Z	Generalized Sign Z
-10	146	-0.16%	66:80	-0.551	-0.753
-9	146	-0.42%	68:78	-1.086	-0.425
-8	146	0.28%	77:69	0.631	1.050
-7	146	0.09%	71:74	0.077	0.231
-6	146	-0.31%	76:70	-1.303	0.886
-5	146	0.34%	73:73	1.857$	0.395
-4	146	-0.15%	67:79	-0.471	-0.589
-3	146	0.25%	69:77	0.674	-0.261
-2	146	0.11%	74:72	-0.232	0.559
-1	146	0.29%	80:65	1.476	1.627
0	146	2.43%	102:44	10.792***	5.246***
+1	146	0.44%	74:72	2.379*	0.559
+2	146	-0.10%	76:70	1.076	0.886
+3	146	-0.14%	61:85	-0.089	-1.573
+4	146	-0.03%	63:83	-0.615	-1.245
+5	146	-0.35%	74:72	-1.056	0.559
+6	146	-0.34%	66:80	-1.449	-0.753
+7	146	-0.62%	57:89	-2.108*	-2.229*
+8	146	-0.76%	60:86	-2.655**	-1.737$
+9	146	-0.54%	70:76	-1.562	-0.097
-10	146	-0.16%	66:80	-0.551	-0.753

The symbols $,*,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a 2-tail test.

Table 6. Ex-date event study CAARs

The market model is estimated over 200 days starting 31 days after the ex date for the sample of 146 parent firms. Both parametric (Z) and non-parametric (Generalized Sign Z) tests are applied.

Days	N	Mean Cumulative Abnormal Return	Positive: Negative	Z	Generalized Sign Z
(-10,+5)	146	2.54%	82:67	3.310***	1.706$
(-3,+3)	146	3.26%	93:56	6.059***	3.510***
(-3,0)	146	3.06%	99:50	6.334***	4.494***
(-3,+1)	146	3.50%	105:44	6.768***	5.478***
(-1,+1)	146	3.14%	101:48	8.565***	4.822***
(-1,0)	146	2.70%	105:44	8.689***	5.478***
(0,0)	146	2.43%	103:45	10.843***	5.246***
(0,+1)	146	2.85%	95:54	9.492***	3.838***
(0,+3)	146	2.61%	94:55	7.118***	3.674***
(0,+5)	146	2.23%	92:57	5.096***	3.346***
(+1,+3)	146	0.20%	74:75	1.943$	0.395
(+1,+7)	146	-1.15%	65:84	-0.704	-1.081
(+2,+10)	146	-3.00%	60:89	-3.183**	-1.95*
(0,+10)	146	-0.15%	85:64	1.087	2.198*
(-5,+1)	146	3.69%	98:51	6.194***	4.330***
(-5,+3)	146	3.45%	94:55	5.764***	3.674***
(-3,+5)	146	2.88%	96:53	4.765***	4.002***
(-10,+10)	146	0.16%	79:70	0.991	1.214

The symbols $,*,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a 2-tail test.

Table 7. Structural breaks in parent returns' conditional variances. CCC-BGARCH(1,1) model

The log-transformed and autocorrelation adjusted parent stock returns are used in the model. Eight dummy variables are introduced to capture variance shifts (Equations 6–10): α_{i3} - a parameter for the dummy variable over the 47 days prior to the announcement , α_{i4}, α_{i6} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i5} - over the period between the announcement and the ex-date, $\alpha_{i7}, \alpha_{i8}, \alpha_{i9}, \alpha_{i10}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation. The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The spinoff parent company is regarded as focus-increasing if it separates a subsidiary with different 2-digit SIC code. High-asymmetry parents should have above the mean residual variance a year before the announcement date.

The symbol * denote at least 5% level statistical significance of the parameter difference between focus-increasing and non-focus-increasing or between high- and low-asymmetry samples. T-statistics is given in parentheses.

Variables	CC-BGARCH Full sample	CC-BGARCH Focus-increasing	CC-BGARCH Non-refocusing	CC-BGARCH High-asymmetry	CC-BGARCH Low-asymmetry	CC-BGARCH High-asymmetry, Focus-increasing	CC-BGARCH High-asymmetry, Non-refocusing	CC-BGARCH Low-asymmetry, Focus-increasing	CC-BGARCH Low-asymmetry, Non-refocusing
μ_m	0.000795 (25.7)	0.000789 (22.7)	0.000808 (12.4)	0.000674 (10.8)	0.000854 (25.75)	0.000698 (9.44)	0.000613 (5.16)	0.000834 (22.9)	0.000905 (12.52)
α_{m0}	0.000005 (16.4)	0.000005 (13.5)	0.000005 (9.3)	0.000006 (11.74)	0.000004 (12.56)	0.000006 (10.09)	0.000007 (5.89)	0.000004 (10.08)	0.000004 (7.55)
α_{m1}	0.088 (29.6)	0.085* (23.6)	0.096* (18.8)	0.094 (19.77)	0.085 (22.78)	0.092 (16.22)	0.098 (11.09)	0.081 (17.93)	0.096 (14.98)
α_{m2}	0.854 (189.7)	0.851 (150.8)	0.861 (123)	0.842 (106.24)	0.86 (159.21)	0.84 (89.87)	0.849 (55.22)	0.857 (122.41)	0.868 (121.9)
μ_i	0.000614 (7.4)	0.000583 (5.5)	0.000692 (5.8)	0.000348 (1.69)	0.000745 (10.95)	0.000316 (1.17)	0.000425 (1.56)	0.000713 (8.46)	0.000825 (7.35)
α_{i0}	0.000292 (9.7)	0.000298 (8.7)	0.000278 (4.6)	0.000624 (9.23)	0.00013 (13.51)	0.000639 (8.67)	0.000586 (3.87)	0.000132 (11.27)	0.000124 (7.4)
α_{i1}	0.122 (19.6)	0.125 (17.5)	0.115 (9.2)	0.152 (11.76)	0.107 (17.04)	0.155 (11.27)	0.147 (4.86)	0.111 (14.2)	0.099 (9.54)
α_{i2}	0.388 (16.3)	0.363 (12.9)	0.450 (10.1)	0.351 (8.49)	0.406 (13.91)	0.32 (7.06)	0.427 (4.8)	0.384 (10.86)	0.462 (9.11)
α_{i3}	0.000006 (0.29)	-0.000021 (-0.9)	0.000073 (1.6)	-0.000028 (-0.47)	0.000023 (2.07)	-0.000073 (-1.13)	0.000081 (0.62)	0.000005 (0.48)	0.000069 (2.37)
α_{i4}	0.000091 (2.7)	0.000092 (2.2)	0.000088 (1.6)	0.00006 (0.79)	0.000106 (3.06)	0.000044 (0.52)	0.000098 (0.6)	0.000115 (2.43)	0.000083 (3.07)
α_{i5}	0.000056 (1.53)	0.000058 (1.2)	0.000052 (1)	0.000056 (0.58)	0.000056 (2)	0.000099 (0.76)	-0.00005 (-0.51)	0.000038 (1.25)	0.000103 (1.63)
α_{i6}	0.000249 (4.2)	0.000305* (3.8)	0.00011* (2.5)	0.000499 (2.91)	0.000126 (5.98)	0.000658 (2.83)	0.000113 (0.97)	0.000133 (5.01)	0.000109 (3.32)
α_{i7}	0.000184 (4.3)	0.000221 (3.9)	0.000092 (1.7)	0.000353 (2.95)	0.000101 (4.13)	0.000443 (2.86)	0.000135 (0.86)	0.000113 (3.4)	0.000071 (3.39)
α_{i8}	0.000138 (3.8)	0.00018* (3.7)	0.000036* (0.9)	0.000203 (1.98)	0.000107 (4.88)	0.000309 (2.3)	-0.000054 (-0.51)	0.000117 (4.18)	0.000081 (2.61)
α_{i9}	0.000177 (4.1)	0.000203 (3.7)	0.000112 (1.8)	0.000251 (2.24)	0.000141 (4.32)	0.00034 (2.32)	0.000036 (0.26)	0.000137 (3.6)	0.000151 (2.35)
α_{i10}	0.000202 (3.4)	0.000237 (3)	0.000115 (1.6)	0.000237 (1.73)	0.000185 (3.13)	0.00028 (1.6)	0.000133 (0.63)	0.000216 (2.65)	0.000106 (3.68)
ρ	0.290 (29.5)	0.290 (23.8)	0.290 (17.7)	0.237 (16.63)	0.315 (26.04)	0.238 (13.9)	0.235 (8.81)	0.314 (20.63)	0.317 (16.75)

Table 8. Structural breaks in parent returns' conditional variances. VC-BGARCH(1,1) model

The log-transformed and autocorrelation adjusted parent stock returns are used in the model. Eight dummy variables are introduced to capture variance shifts (Equations 6–10): α_{i3} - a parameter for the dummy variable over the 47 days prior to the announcement , α_{i4}, α_{i6} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i5} - over the period between the announcement and the ex-date, $\alpha_{i7}, \alpha_{i8}, \alpha_{i9}, \alpha_{i10}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation. The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The spinoff parent company is regarded as focus-increasing if it separates a subsidiary with different 2-digit SIC code. High-asymmetry parents should have above the mean residual variance a year before the announcement date.
The symbol * denote at least 5% level statistical significance of the parameter difference between focus-increasing and non-focus-increasing or between high- and low-asymmetry samples. T-statistics is given in parentheses.

Variables	VC-BGARCH Full sample	VC-BGARCH Focus-increasing	VC-BGARCH Non-refocusing	VC-BGARCH High-asymmetry	VC-BGARCH Low-asymmetry	VC-BGARCH High-asymmetry, Focus-increasing	VC-BGARCH High-asymmetry, Non-refocusing	VC-BGARCH Low-asymmetry, Focus-increasing	VC-BGARCH Low-asymmetry, Non-refocusing
μ_m	0.000794 (25.48)	0.000792 (21.98)	0.000798 (12.86)	0.000671 (10.7)	0.000854 (25.58)	0.000689 (9.08)	0.000627 (5.49)	0.000842 (22.26)	0.000884 (12.73)
α_{m0}	0.000005 (16.73)	0.000005 (13.92)	0.000005 (9.22)	0.000006 (11.86)	0.000004 (12.91)	0.000006 (10.26)	0.000007 (5.91)	0.000004 (10.47)	0.000004 (7.53)
α_{m1}	0.088 (30.14)	0.085 (24.19)	0.096 (18.72)	0.093 (19.65)	0.086 (23.3)	0.092 (16.12)	0.098 (11.00)	0.082 (18.54)	0.096 (14.89)
α_{m2}	0.853 (187.9)	0.849 (149.76)	0.862 (121.45)	0.843 (100.53)	0.857 (160.79)	0.84 (83.83)	0.849 (53.98)	0.853 (124.3)	0.868 (122.08)
μ_i	0.000611 (7.27)	0.000581 (5.31)	0.000688 (6.2)	0.00039 (1.84)	0.00072 (10.5)	0.000334 (1.18)	0.000525 (2.16)	0.0007 (8.27)	0.000769 (6.71)
α_{i0}	0.000287 (9.76)	0.000297 (8.65)	0.000262 (4.57)	0.000601 (8.86)	0.000133 (13.81)	0.000628 (8.29)	0.000536 (3.68)	0.000136 (11.63)	0.000125 (7.4)
α_{i1}	0.122 (19.65)	0.125 (17.4)	0.116 (9.33)	0.149 (11.24)	0.109 (17.49)	0.15 (10.39)	0.147 (4.92)	0.112 (14.68)	0.101 (9.57)
α_{i2}	0.388 (16.37)	0.359 (12.88)	0.461 (10.57)	0.376 (8.87)	0.394 (13.73)	0.339 (7.08)	0.465 (5.45)	0.368 (10.7)	0.459 (9.04)
α_{i3}	-0.000002 (-0.11)	-0.000024 (-1.08)	0.000052 (1.25)	-0.000051 (-0.91)	0.000022 (1.96)	-0.000081 (-1.23)	0.00002 (0.18)	0.000003 (0.32)	0.000068 (2.36)
α_{i4}	0.00008 (2.35)	0.000086 (2.04)	0.000065 (1.14)	0.000025 (0.33)	0.000107 (3.11)	0.000023 (0.28)	0.00003 (0.18)	0.000116 (2.48)	0.000083 (3.06)
α_{i5}	0.000043 (1.4)	0.00004 (1.07)	0.000051 (0.93)	0.000014 (0.2)	0.000057 (2.03)	0.000042 (0.43)	-0.000052 (-0.5)	0.000039 (1.28)	0.000103 (1.63)
α_{i6}	0.000235 (4.00)	0.000291 (3.64)	0.000097 (2.19)	0.000453 (2.66)	0.000129 (6.11)	0.000608 (2.63)	0.000074 (0.63)	0.000137 (5.18)	0.000108 (3.28)
α_{i7}	0.00017 (3.93)	0.00021 (3.71)	0.000073 (1.36)	0.000313 (2.59)	0.000101 (4.2)	0.000408 (2.62)	0.000081 (0.51)	0.000113 (3.49)	0.000069 (3.34)
α_{i8}	0.000132 (3.6)	0.000176 (3.7)	0.000022 (0.48)	0.000184 (1.78)	0.000106 (5.00)	0.0003 (2.25)	-0.000099 (-0.87)	0.000116 (4.28)	0.000082 (2.63)
α_{i9}	0.000169 (3.94)	0.000198 (3.65)	0.000098 (1.53)	0.000225 (1.98)	0.000142 (4.43)	0.000321 (2.18)	-0.000007 (-0.05)	0.000139 (3.74)	0.00015 (2.34)
α_{i10}	0.000195 (3.24)	0.000234 (2.96)	0.000099 (1.36)	0.000201 (1.48)	0.000192 (3.16)	0.000248 (1.45)	0.000087 (0.41)	0.000227 (2.7)	0.000104 (3.64)
ρ	0.293 (25.76)	0.295 (20.67)	0.289 (15.99)	0.231 (13.84)	0.323 (23.28)	0.227 (10.8)	0.24 (8.99)	0.328 (18.95)	0.313 (13.93)
θ_1	0.069963 (1.19)	0.106838 (1.52)	-0.021347 (-0.2)	0.122071 (1.22)	0.04444 (0.61)	0.172369 (1.43)	-0.00008 (0)	0.075008 (0.86)	-0.03198 (-0.24)
θ_2	0.03305 (6.07)	0.02715 (4.35)	0.04766 (4.44)	0.034894 (3.45)	0.032147 (4.98)	0.036309 (3.04)	0.031458 (1.59)	0.022701 (3.14)	0.05576 (4.39)

Table 9. Parent returns' unconditional total variances relative changes. CCC-BGARCH(1,1) model.

The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The Table shows changes of the total variance relative to the intercept (α_{i0} - mean variance over the first 6 months of the year prior to the announcement, α_{i3} - a parameter for the dummy variable over the 47 days prior to the announcement, α_{i4}, α_{i6} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i5} - over the period between the announcement and the ex-date, $\alpha_{i7}, \alpha_{i8}, \alpha_{i9}, \alpha_{i10}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation (Equation 9). The symbols *, ** denote a statistical significance of the change at 5% and 1% or less level respectively.

Models/Variables	Number of obs	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}	α_{i9}	α_{i10}
CC-BGARCH Full sample	146	2.05%	31.16%**	19.18%	85.27%**	63.01%**	47.26%**	60.62%**	69.18%**
CC-BGARCH Focus-increasing	104	-7.05%	30.87%*	19.46%	102..35%**	74.16%**	60.40%**	68.12%**	79.53%**
CC-BGARCH Non-refocusing	42	26.26%	31.65%	18.71%	39.57%*	33.09%	12.95%	40.29%	41.37%
CC-BGARCH High-asymmetry	48	-4.49%	9.62%	8.97%	79.97%**	56.57%**	32.53%*	40.22%*	37.98%
CC-BGARCH Low-asymmetry	98	17.69%*	81.54%**	43.08%*	96.92%**	77.69%**	82.31%**	108.46%**	142.31%**
CC-BGARCH High-asymmetry, Focus-increasing	34	-11.42%	6.89%	15.49%	102.97%**	69.33%**	48.36%*	53.21%*	43.82%
CC-BGARCH High-asymmetry, Non-refocusing	14	13.82%	16.72%	-8.53%	19.28%	23.04%	-9.22%	6.14%	22.70%
CC-BGARCH Low-asymmetry, Focus-increasing	70	3.79%	87.12%*	28.79%	100.76%**	85.61%**	88.64%**	103.79%**	163.64%**
CC-BGARCH Low-asymmetry, Non-refocusing	28	55.65%*	66.94%**	83.06%	87.90%**	57.26%**	65.32%*	121.77%**	85.48%**

Table 10. Parent returns' unconditional total variances relative changes. VC-BGARCH(1,1) model.

The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The Table shows changes of the total variance relative to the intercept (α_{i0} - mean variance over the first 6 months of the year prior to the announcement, α_{i3} - a parameter for the dummy variable over the 47 days prior to the announcement , α_{i4}, α_{i6} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i5} - over the period between the announcement and the ex-date, $\alpha_{i7}, \alpha_{i8}, \alpha_{i9}, \alpha_{i10}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation (Equation 9). The symbols *, ** denote a statistical significance of the change at 5% and 1% or less level respectively.

Models/Variables	Number of obs	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}	α_{i9}	α_{i10}
VC-BGARCH Full sample	146	-0.70%	27.87%*	14.98%	81.88%**	59.23%**	45.99%**	58.89%**	67.94%**
VC-BGARCH Focus-increasing	104	-8.08%	28.96%*	13.47%	97.98%**	70.71%**	59.26%**	66.67%**	78.79%**
VC-BGARCH Non-refocusing	42	19.85%	24.81%	19.47%	37.02%*	27.86%	8.40%	37.40%	37.79%
VC-BGARCH High-asymmetry	48	-8.49%	4.16%	2.33%	75.37%*	52.08%*	30.62%	37.44%*	33.44%
VC-BGARCH Low-asymmetry	98	16.54%*	80.45%**	42.86%*	96.99%**	75.94%**	79.70%**	106.77%**	144.36%**
VC-BGARCH High-asymmetry, Focus-increasing	34	-12.90%	3.66%	6.69%	96.82%*	64.97%*	47.77%*	51.11%*	39.49%
VC-BGARCH High-asymmetry, Non-refocusing	14	3.73%	5.60%	-9.70%	13.81%	15.11%	-18.47%	-1.31%	16.23%
VC-BGARCH Low-asymmetry, Focus-increasing	70	2.21%	85.29%*	28.68%	100.74%**	83.09%**	85.29%**	102.21%**	166.91%**
VC-BGARCH Low-asymmetry, Non-refocusing	28	54.40%*	66.40%**	82.40%	86.40%**	55.20%**	65.60%*	120.00%*	83.20%**

Table 11. Parent returns' conditional betas. CCC-BGARCH(1,1) model.

The log-transformed and autocorrelation adjusted parent stock returns are used in the model Eight dummy variables ($\alpha_{i1} - \alpha_{i8}$) are introduced to capture variance shifts relative to the intercept (α_{i0}): α_{i1} - a parameter for the dummy variable over the 47 days prior to the announcement , α_{i2}, α_{i4} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i3} - over the period between the announcement and the ex-date, $\alpha_{i5}, \alpha_{i6}, \alpha_{i7}, \alpha_{i8}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation. The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The spinoff parent company is regarded as focus-increasing if it separates a subsidiary with different 2-digit SIC code. High-asymmetry parents should have above the mean residual variance a year before the announcement date. The symbol * denote at least 5% level statistical significance of the parameter difference between focus-increasing and non-focus-increasing or between high – and low-asymmetry samples. T-statistics is given in parentheses.

Models/Variables	Number of obs	α_{i0}	α_{i1}	α_{i2}	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}
CC-BGARCH Full sample	146	0.8085 (25.83)	-0.0023 (-0.16)	0.0607 (3.07)	0.0082 (0.42)	0.1037 (4.58)	0.0794 (3.31)	0.0524 (2.3)	0.0403 (1.7)	0.0293 (1.13)
CC-BGARCH Focus-increasing	104	0.8399 (21.47)	-0.0281 (-1.67)*	0.059 (2.3)	-0.0034 (-0.137)	0.1207 (4.1)	0.0861 (2.84)	0.0676 (2.27)	0.046 (1.48)	0.0366 (1.06)
CC-BGARCH Non-refocusing	42	0.7307 (15.9)	0.0615 (2.32)*	0.065 (2.42)	0.037 (1.31)	0.0616 (2.13)	0.0629 (1.71)	0.0147 (0.51)	0.0267 (0.87)	0.0124 (0.39)
CC-BGARCH High-asymmetry	48	0.9552 (15.9)*	-0.0274 (-0.91)	-0.0178 (-0.53)*	-0.036 (-0.93)	0.1082 (2.31)	0.0969 (1.81)	0.009 (0.19)	-0.0065 (-0.16)	-0.0152 (-0.29)
CC-BGARCH Low-asymmetry	98	0.7366 (22.42)*	0.01 (0.63)	0.0991 (4.2)*	0.0298 (1.34)	0.1015 (4.08)	0.0709 (2.87)	0.0737 (2.97)	0.0633 (2.19)	0.0504 (1.72)
CC-BGARCH High-asymmetry, Focus-increasing	34	0.9881 (13.39)	-0.0519 (-1.52)	-0.0304 (-0.69)	-0.0478 (-0.95)	0.1262 (2.1)	0.1085 (1.68)	0.0452 (0.72)	0.0214 (0.4)	0.0144 (0.21)
CC-BGARCH High-asymmetry, Non-refocusing	14	0.8754 (8.54)	0.0319 (0.53)	0.0127 (0.29)	0.0072 (0.13)	0.0645 (0.94)	0.0685 (0.7)	-0.0788 (-1.45)	-0.0722 (-1.36)	-0.1195 (-1.72)
CC-BGARCH Low-asymmetry, Focus-increasing	70	0.7679 (17.61)	-0.0165 (-0.89)*	0.1023 (3.37)	0.0181 (0.64)	0.118 (3.58)	0.0752 (2.31)	0.0785 (2.41)	0.058 (1.51)	0.0469 (1.18)
CC-BGARCH Low-asymmetry, Non-refocusing	28	0.6583 (14.38)	0.0763 (2.9)*	0.0911 (2.74)	0.0591 (1.81)	0.0601 (2.16)	0.06 (2.17)	0.0615 (2.02)	0.0762 (2.22)	0.0589 (1.93)

Table 12. Parent returns' conditional betas. VC-BGARCH(1,1) model.

The log-transformed and autocorrelation adjusted parent stock returns are used in the model Eight dummy variables ($\alpha_{i1} - \alpha_{i8}$) are introduced to capture variance shifts relative to the intercept (α_{i0}): α_{i1} - a parameter for the dummy variable over the 47 days prior to the announcement, α_{i2}, α_{i4} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i3} - over the period between the announcement and the ex-date, $\alpha_{i5}, \alpha_{i6}, \alpha_{i7}, \alpha_{i8}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation. The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The spinoff parent company is regarded as focus-increasing if it separates a subsidiary with different 2-digit SIC code. High-asymmetry parents should have above the mean residual variance a year before the announcement date. The symbol * denote at least 5% level statistical significance of the parameter difference between focus-increasing and non-focus-increasing or between high – and low-asymmetry samples. T-statistics is given in parentheses.

Models/Variables	Number of obs	α_{i0}	α_{i1}	α_{i2}	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}
VC-BGARCH Full sample	146	0.8073 (25.62)	-0.0013 (-0.08)	0.0688 (3.04)	0.0194 (0.9)	0.1227 (4.59)	0.0818 (3.17)	0.0353 (1.47)	0.0319 (1.24)	0.0099 (0.35)
VC-BGARCH Focus-increasing	104	0.8335 (21.31)	-0.0276 (-1.45)*	0.0684 (2.44)	0.0112 (0.41)	0.1486 (4.32)	0.0936 (2.91)	0.0549 (1.81)	0.0445 (1.32)	0.0304 (0.82)
VC-BGARCH Non-refocusing	42	0.7422 (15.21)	0.0639 (2.13)*	0.0699 (1.86)	0.0397 (1.2)	0.0586 (1.62)	0.0524 (1.27)	-0.0132 (-0.36)	0.0015 (0.04)	-0.038 (-1.12)
VC-BGARCH High-asymmetry	48	0.9511 (15.88)*	-0.0237 (-0.69)	-0.0394 (-1.05)*	-0.0201 (-0.46)	0.1333 (2.24)	0.1105 (1.93)	-0.0133 (-0.27)	-0.0093 (-0.19)	-0.0372 (-0.7)
VC-BGARCH Low-asymmetry	98	0.7368 (21.23)*	0.0097 (0.55)	0.1218 (4.55)*	0.0387 (1.62)	0.1175 (4.28)	0.0677 (2.56)	0.0591 (2.28)	0.052 (1.73)	0.0322 (0.98)
VC-BGARCH High-asymmetry, Focus-increasing	34	0.9759 (13.23)	-0.043 (-1.08)	-0.0424 (-0.9)	-0.02 (-0.34)	0.1661 (2.19)	0.1288 (1.91)	0.0232 (0.37)	0.0277 (0.45)	0.0035 (0.05)
VC-BGARCH High-asymmetry, Non-refocusing	14	0.8906 (8.7)	0.0234 (0.35)	-0.032 (-0.53)	-0.0204 (-0.38)	0.0538 (0.62)	0.0663 (0.6)	-0.102 (-1.26)	-0.0965 (-1.48)	-0.1478 (-1.83)
VC-BGARCH Low-asymmetry, Focus-increasing	70	0.7644 (17.21)	-0.02 (-0.97)*	0.1221 (3.7)	0.0264 (0.9)	0.1401 (3.92)	0.0765 (2.18)	0.0703 (2.09)	0.0526 (1.31)	0.0429 (0.96)
VC-BGARCH Low-asymmetry, Non-refocusing	28	0.668 (13.96)	0.0841 (2.73)*	0.1208 (2.66)	0.0697 (1.69)	0.061 (1.79)	0.0454 (1.5)	0.0312 (0.9)	0.0505 (1.43)	0.0066 (0.2)

Table 13. Parent returns' conditional residual variance. CCC-BGARCH(1,1) model.

The log-transformed and autocorrelation adjusted parent stock returns are used in the model. Eight dummy variables ($\alpha_{i1} - \alpha_{i8}$) are introduced to capture variance shifts relative to the intercept (α_{i0}): α_{i1} - a parameter for the dummy variable over the 47 days prior to the announcement, α_{i2}, α_{i4} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i3} - over the period between the announcement and the ex-date, $\alpha_{i5}, \alpha_{i6}, \alpha_{i7}, \alpha_{i8}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation. The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The spinoff parent company is regarded as focus-increasing if it separates a subsidiary with different 2-digit SIC code. High-asymmetry parents should have above the mean residual variance a year before the announcement date. The symbol * denote at least 5% level statistical significance of the parameter difference between focus-increasing and non-focus-increasing or between high – and low-asymmetry samples. T-statistics is given in parentheses.

Models/Variables	Number of obs	α_{i0}	α_{i1}	α_{i2}	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}
CC-BGARCH Full sample	146	0.00056 (12.36)	0.00002 (0.54)	0.00014 (2.81)	0.00012 (1.8)	0.00048 (4.65)	0.00038 (4.48)	0.00033 (3.96)	0.00041 (3.68)	0.00047 (3.17)
CC-BGARCH Focus-increasing	104	0.00055 (10.39)	-0.00002 (-0.39)	0.00015 (2.49)	0.00015 (1.65)	0.00057 (4.1)*	0.00047 (4.12)*	0.00043 (3.82)*	0.00051 (3.38)*	0.00059 (2.9)
CC-BGARCH Non-refocusing	42	0.00058 (6.63)	0.0001 (1.36)	0.00011 (1.28)	0.00006 (0.74)	0.00025 (2.82)*	0.00016 (2.07)*	0.00009 (1.18)*	0.00016 (1.7)*	0.00018 (1.56)
CC-BGARCH High-asymmetry	48	0.00117 (14.63)*	-0.00002 (-0.22)	0.00011 (0.9)	0.00017 (0.92)	0.00096 (3.35)*	0.00068 (3.27)*	0.00052 (2.42)	0.0006 (1.99)	0.00056 (2.15)
CC-BGARCH Low-asymmetry	98	0.00026 (21.25)*	0.00004 (2.5)	0.00015 (3.71)	0.00009 (2.53)	0.00024 (5.07)*	0.00024 (3.25)*	0.00024 (3.61)	0.00031 (4.22)	0.00043 (2.36)
CC-BGARCH High-asymmetry, Focus-increasing	34	0.00116 (12.44)	-0.00008 (-0.66)	0.00014 (0.9)	0.0003 (1.16)	0.00122 (3.18)*	0.0009 (3.33)*	0.00076 (2.72)*	0.00086 (2.1)	0.00076 (2.22)
CC-BGARCH High-asymmetry, Non-refocusing	14	0.0012 (7.47)	0.00011 (0.48)	0.00006 (0.24)	-0.00012 (-0.73)	0.00032 (1.3)*	0.00012 (0.59)*	-0.00008 (-0.37)*	-0.00001 (-0.06)	0.00011 (0.33)
CC-BGARCH Low-asymmetry, Focus-increasing	70	0.00025 (18.11)	0.00001 (0.96)*	0.00016 (2.94)	0.00007 (1.69)	0.00025 (4.0)	0.00026 (2.62)	0.00026 (2.9)	0.00034 (3.37)	0.00052 (2.02)
CC-BGARCH Low-asymmetry, Non-refocusing	28	0.00027 (11.09)	0.0001 (2.64)*	0.00013 (2.94)	0.00015 (2.01)	0.00021 (4.01)	0.00018 (3.29)	0.00018 (3.57)	0.00025 (3.57)	0.00021 (4.54)

Table 14. Parent returns' conditional residual variance. VC-BGARCH(1,1) model.

The log-transformed and autocorrelation adjusted parent stock returns are used in the model. Eight dummy variables ($\alpha_{i1} - \alpha_{i8}$) are introduced to capture variance shifts relative to the intercept (α_{i0}): α_{i1} - a parameter for the dummy variable over the 47 days prior to the announcement, α_{i2}, α_{i4} - over (-15,+15) period around the announcement and the ex-date respectively, α_{i3} - over the period between the announcement and the ex-date, $\alpha_{i5}, \alpha_{i6}, \alpha_{i7}, \alpha_{i8}$ - over first 6 months, the second half of the first year, the first and second halves of the second year after the separation. The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. The spinoff parent company is regarded as focus-increasing if it separates a subsidiary with different 2-digit SIC code. High-asymmetry parents should have above the mean residual variance a year before the announcement date. The symbol * denote at least 5% level statistical significance of the parameter difference between focus-increasing and non-focus-increasing or between high – and low-asymmetry samples. T-statistics is given in parentheses.

Models/Variables	Number of obs	α_{i0}	α_{i1}	α_{i2}	α_{i3}	α_{i4}	α_{i5}	α_{i6}	α_{i7}	α_{i8}
VC-BGARCH Full sample	146	0.00056 (11.9)	0.00002 (0.41)	0.00013 (2.73)	0.0001 (1.84)	0.00045 (4.78)	0.00037 (4.5)	0.00034 (4.04)	0.00041 (3.68)	0.00046 (3.11)
VC-BGARCH Focus-increasing	104	0.00056 (9.92)	-0.00002 (-0.46)	0.00015 (2.45)	0.00012 (1.65)	0.00053 (4.18)*	0.00046 (4.15)*	0.00043 (3.87)*	0.00051 (3.37)*	0.00058 (2.83)
VC-BGARCH Non-refocusing	42	0.00057 (6.49)	0.00009 (1.27)	0.0001 (1.19)	0.00006 (0.83)	0.00025 (2.86)*	0.00015 (2.01)*	0.0001 (1.29)*	0.00017 (1.77)*	0.00018 (1.62)
VC-BGARCH High-asymmetry	48	0.00119 (13.67)*	-0.00004 (-0.36)	0.00009 (0.74)	0.00012 (0.77)	0.00088 (3.34)*	0.00064 (3.22)	0.00053 (2.46)	0.00059 (1.96)	0.00051 (2.04)
VC-BGARCH Low-asymmetry	98	0.00025 (20.97)*	0.00004 (2.48)	0.00016 (3.81)	0.0001 (2.59)	0.00024 (5.16)*	0.00024 (3.29)	0.00024 (3.71)	0.00032 (4.22)	0.00043 (2.37)
VC-BGARCH High-asymmetry, Focus-increasing	34	0.00119 (11.35)	-0.00008 (-0.71)	0.00012 (0.81)	0.00021 (1.03)	0.00111 (3.15)	0.00087 (3.34)*	0.00077 (2.77)*	0.00085 (2.07)	0.0007 (2.1)
VC-BGARCH High-asymmetry, Non-refocusing	14	0.0012 (7.35)	0.00007 (0.33)	0.00002 (0.08)	-0.00011 (-0.63)	0.00032 (1.28)	0.00009 (0.45)*	-0.00007 (-0.35)*	-0.00002 (-0.08)	0.0001 (0.32)
VC-BGARCH Low-asymmetry, Focus-increasing	70	0.00025 (17.83)	0.00001 (0.87)*	0.00016 (3.01)	0.00008 (1.74)	0.00026 (4.04)	0.00027 (2.64)	0.00026 (2.94)	0.00034 (3.34)	0.00053 (2.04)
VC-BGARCH Low-asymmetry, Non-refocusing	28	0.00026 (10.92)	0.00011 (2.72)*	0.00013 (3.08)	0.00015 (2.07)	0.00022 (4.21)	0.00018 (3.34)	0.00019 (3.76)	0.00026 (3.68)	0.00022 (4.63)

Table 15. Parent pre- and post-spinoff debt to assets ratio changes.

The sample consists of 146 parent firms: 104 refocusing (70 low-asymmetry) and 42 non-refocusing (28 low-asymmetry) spinoff parents. Quarterly debt-to-assets ratio changes relative to first half of the year before the announcement (Intercept) are analyzed for the second half of the year prior to the announcement ($D_{(-2)}$), on the announcement (D_{annday}) and effective dates (D_{effday}), and over the next two years with a two-quarter step ($D_{(+2)}$ - $D_{(+8)}$). We define debt as a sum of the long-term debt and debt in current liabilities. The ratio shifts are multiplied by 100. T-statistics is given in parentheses.

Models/Variables	Number of obs	Intercept, %	$D_{(-2)}$	D_{annday}	D_{effday}	$D_{(+2)}$	$D_{(+4)}$	$D_{(+6)}$	$D_{(+8)}$
Full sample	146	26.6558 (19.25)	0.3048 (0.69)	-0.2685 (-0.41)	2.2663 (1.95)	1.9053 (1.54)	1.8747 (1.45)	0.7957 (0.59)	0.9607 (0.62)
Focus-increasing	104	26.9593 (17.82)	-0.0395 (-0.07)	-1.3685 (-1.84)*	0.8963 (0.74)	0.7306 (0.53)	0.9865 (0.65)	-0.1653 (-0.1)	-0.6691 (-0.35)
Non-refocusing	42	25.8934 (8.45)	1.1697 (1.55)	2.495 (2.02)*	5.708 (2.13)	4.8564 (1.87)	4.106 (1.67)	3.1164 (1.35)	5.0142 (1.91)
High-asymmetry	48	25.4031 (8.52)	-0.7997 (-1.62)	-1.8174 (-1.47)	1.5421 (0.76)	2.3586 (0.93)	1.8717 (0.73)	1.0038 (0.35)	-1.1692 (-0.34)
Low-asymmetry	98	27.2628 (18.53)	0.84 (1.39)	0.482 (0.64)	2.6172 (1.85)	1.6857 (1.23)	1.8761 (1.28)	0.7004 (0.48)	1.9124 (1.15)
High-asymmetry, Focus-increasing	34	26.5876 (8.04)	-1.3686 (-2.38)	-3.9354 (-2.59)*	-0.019 (-0.01)	1.1911 (0.36)	0.4835 (0.14)	-0.2515 (-0.06)	-3.6885 (-0.8)
High-asymmetry, Non-refocusing	14	22.6109 (3.52)	0.5414 (0.62)	3.1752 (2.19)*	5.2219 (1.49)	5.1105 (1.41)	5.1439 (1.6)	3.694 (1.11)	4.4507 (1.16)
Low-asymmetry, Focus-increasing	70	27.1345 (16.87)	0.5871 (0.8)	-0.1584 (-0.2)	1.3278 (0.99)	0.5135 (0.38)	1.2236 (0.78)	-0.1278 (-0.08)	0.6186 (0.33)
Low-asymmetry, Non-refocusing	28	27.5955 (8.36)	1.4955 (1.41)	2.1423 (1.23)	5.9601 (1.62)	4.7246 (1.34)	3.5678 (1.05)	2.8169 (0.91)	5.296 (1.52)