SHORT TERM MARKET REACTIONS TO EQUITY CARVE-OUTS OF U.S. TRADED COMPANIES

by

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ABSTRACT

Equity carve-outs have become one of the most important types of specialized equity claims used by corporations to refocus on their core activities. Because they consist of a public sale of a subsidiary, equity carve-outs allow the market to independently value not only the carved-out unit, but also the parent company after the transaction is announced. Thus, this study explores the short term effects of equity carve-outs on the distribution of the returns of the parent company's common shares. An event study methodology with a sample of 92 announcements over the period from 1995 to 2000 is implemented. Mean and mean-variance disturbances are tested under the null hypothesis of equity carve-out neutrality using event windows ranging from 1 to 5 trading days around the announcement day. Consistent with previous research, it is found that equity carve-outs entail short term average cumulative abnormal returns in the order of 1.66 to 2.48%.

Keywords: Equity carve-outs; event study; abnormal returns; specialized equity claims; industrial focus.

A mis padres, que siempre me han brindado su apoyo incondicional

y el abrigo de sus consejos.

y

A mis hermanas que con cariño me motivan a dar lo mejor de mí.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

One of the most distinguishing features of corporate activity around the world during the last couple of decades is the trend followed by companies to refocus on their core lines of business. This has been achieved by implementing restructuring actions that often take the form of equity carve-outs[1], spin-offs and asset sell-offs. These restructuring methods are similar to one another in that they provide companies with a mean by which they can divest an operating unit through a market transaction. However, they differ from each other in terms of the types of claims that they create on the divested assets and the level of control that they convey over them. For example, equity carve-outs are initial public offerings of subsidiary equity, which represents an independent claim on the subsidiary's cash flows. As it is the case with any public offering, the sale of the equity of the carved-out unit creates an initial cash inflow to the parent company, which in most of the cases retains control over the subsidiary. In contrast, spin-offs are pro-rata distributions of subsidiary ownership, usually in the form of tax-free stock dividends, to shareholders of the parent company. Unlike an equity carve-out, the spin-off does not generate any cash flows to the parent company and the subsidiary becomes administratively and financially independent from the parent; but with an identical initial set of shareholders. Finally, asset sell-offs usually involve private sales of subsidiaries to third parties, and as such, they create a cash transaction that completely divests an asset from the parent company. However, contrary to equity carve-outs and spin-offs, asset sell-offs involve very little public disclosure due to their private nature.

[1] Equity carve-outs are also known as *partial public offerings*.

While all of these restructuring methods pursue the common goal of asset divestiture, equity carve-outs are particularly interesting because they represent the sale of a subset of the company's assets in public markets. Consequently, once a carve-out is announced, the market incorporates this information into the valuation of both, the carved-out subsidiary and the parent company. Equity carve-outs are also interesting because, contrary to the well documented corporate value detriment occurring after most public offerings (e.g. Schipper and Smith, 1986; Asquith and Mullins, 1986; Masulis and Korwar, 1986; and Ritter, 1991), they generally convey positive market reactions. Nevertheless, the ultimate effect on the parent company's traded securities depends on the perceived efficiency gains conveyed by its new asset and managerial structure (e.g. Nanda, 1991; and Boone *et al.*, 2003; Veld and Veld-Merkoulova, 2004), and on the information asymmetry that remains after the carve-out transaction is completed (e.g. Habib *et al.*, 1997; and Krishnaswami and Subramaniam, 1999).

Thus, in order to assess the average effect of equity carve-outs on the value of the firm that originates them, this study investigates the short term effects of equity carve-out announcements on the distribution of the returns of the parent company's common shares. Based on a sample of 92 carve-out announcements from January 1995 to May 2000, both mean and mean-variance disturbances are analysed using an event study methodology which resembles that suggested by Campbell *et al.* (1997) and Wooldridge (2003). The null hypothesis of equity carve-out neutrality is adopted and it is tested against the cumulative abnormal returns obtained over event widows that range from 1 to 5 trading days around the carve-out announcement day. The results obtained are then compared to the evidence available from previous research, and potential explanations for any value effects are also presented based on the empirical relationships found in the sample. Consistent with previous research (e.g. Schipper and Smith, 1986; Slovin *et al.*, 1995; Allen and McConnell, 1998; Hulburt *et al.*, 2002; and Boone *et al.*, 2003), it is found that equity carve-outs entail, on average, cumulative abnormal returns of 1.66%, 2.42%, 2.48% and 2.05% on the day of the carve out announcement and on the three days following it, respectively.

The rest of the paper is organized as follows. Section 2 provides a survey of previous research done in the area of specialized equity claims and it explains some of the hypothesized relationships behind the value effects of equity carve-outs. Section 3 describes the data and the methodology that is used to obtain the empirical results of the study, and it describes the technical details required for testing the relevant hypotheses. Finally, section 4 summarises the empirical results found in the sample, which are then used to reach the conclusions outlined in section 5.

2 SOURCES OF VALUE IN EQUITY CARVE-OUTS

Prior research done in the area of specialized equity claims has consistently reported corporate value enhancements derived from implementing spin-offs, asset sell-offs and equity carve-outs. For example, Hite and Owers (1983), Miles and Rosenfeld (1983), Cusatis, Miles and Woolridge (1993), Mulherin and Boone (2000), and Veld and Veld-Merkoulova (2004), among others, find significantly positive abnormal stock returns around spin-off announcements. Similarly, Klein (1986), John and Ofek (1995) and Lang *et al.* (1995) document positive excess returns around the announcements of asset sell-offs. Finally, Schipper and Smith (1986), Slovin *et al.,* (1995), Allen and McConnell (1998), Mulherin and Boone (2000), Hulburt *et al.* (2002), and Boone *et al.* (2003), find positive abnormal returns around carve-out announcements. Therefore, in order to place into context the empirical results of the next sections, it is convenient at this point to discuss the most important ways in which these restructuring actions relate to the operating performance of the parent company and to the value of its traded stock.

Four main sources of value derived from equity carve-outs and other forms of specialized equity claims are commonly acknowledged in the literature (e.g. Nanda, 1991; Boone *et al.*, 2003; and Veld and Veld-Merkoulova, 2004 and 2005; among others); namely, focus improvements in the parent company, realignment of managerial incentives, decrease in information asymmetry, and timing ability of the initiating firm. The next sub-sections summarize each one of these sources and their relationships with the operating performance of the parent company.

2.1 Focus Improvements

This is the motive for pursuing equity carve-outs and other forms of specialized equity claims that is most frequently mentioned in the literature. The argument behind it states that the parent company seeks to improve the management of its assets and those of its subsidiary by decreasing the range of operations in which each one is involved; thus, increasing their level of specialization. Following this logic, if a parent company expects to obtain any significant gains from specialization, it would have to relinquish its majority ownership in the subsidiary being divested. This relationship is in fact consistent with the evidence documented by John and Ofek (1995), and Daley *et al.* (1997), for asset sell-offs, and by Krishnaswami and Subramaniam (1999), and Veld and Veld-Merkoulova (2004) for corporate spin-offs. However, for equity-carve outs, studies such as those by Allen and McConnell (1998) and Vijh (2002) do not find any significant relationships. This situation is primarily attributed to the fact that parent companies rarely relinquish their controlling stakes on the carved out subsidiaries.

2.2 Realignment of Managerial Incentives

According to Schipper and Smith (1986), the creation of specialized equity claims on a subsidiary can improve managerial incentives by better aligning managers' interests with those of shareholders. The argument states that once a subsidiary is publicly traded, its managerial performance and that of its parent company becomes easier to assess because of observable market reactions that permit the independent evaluation of both entities. Nevertheless, the direct measurement of managerial incentives is a task that results difficult at best.

2.3 Decrease in Information Asymmetry

Models such as that of Habib *et al.* (1997) imply that corporate spin-offs decrease the level of information asymmetry in the market by making its price system more informative. When a company decides to publicly trade one of its subsidiaries, both the subsidiary and the parent company become independently evaluated and priced by the marked; thus, making their stock prices more sensitive to publicly available information. The same logic applies to equity carve-outs.

Studies on corporate spin-offs such as those of Krishnaswami and Subramaniam (1999) and Veld and Veld-Merkoulova (2004) hypothesise that information asymmetry results in the undervaluation of the parent company. Once a subsidiary is publicly traded, they argue, the level of information asymmetry decreases and, as a consequence, the parent company increases in value. However, while Krishnaswami and Subramaniam (1999) find a positive relationship between the initial level of information asymmetry and the posterior value enhancements obtained from pursuing specialized equity claims, Veld and Veld-Merkoulova (2004) find an opposite, yet not statistically significant relationship.

2.4 Timing Ability of the Parent Company

The level of asymmetric information in the market determines managers' ability to time public corporate transactions. However, in contrasts to the relationships described in the previous section, managerial timing ability implies an overvaluation of the subsidiary being divested. For example, Nanda (1991) states that the managers of a parent company have an incentive to undertake equity carve-outs when they believe that a subsidiary is overvalued. Such an overvaluation, he argues, might arise because of a temporary increase in the subsidiary's operating performance that cannot be sustained in the future. This relationship is in fact consistent with the findings of Mikkelson *et al.* (1997), which document a decrease in the operating performance of firms that decide to place a public offering. Similarly, Boone *et al.* (2003) state that during an equity carve-out a parent company will be willing to give up more of its ownership on a given subsidiary if the perceived overvaluation of the subsidiary in question increases. Therefore, the level of retained ownership after the carve-out takes place serves as a proxy for both the initial overvaluation perceived by the parent company, and the subsequent decline in performance of the carved-out entity. Nevertheless, the direct effect of the parent company's timing ability on its operating performance is unclear.

3 DATA AND METHODOLOGY

3.1 Data Description and Selection Criteria

A set of 181 equity carve-out filings from US traded companies, occurring from November 1993 to May 2000, was initially considered for this study. However, because of data restrictions and inconsistencies, the original set of 181 filings had to be reduced to a sample of 92 observations, covering the sample period from January 1995 to May 2000 (see Appendix 1). This reduced sample is the subject of the analysis conducted in this study. Filing dates and financial data on the parent companies included in the sample were obtained from the Lexis-Nexis and SDC databases during the first quarter of 2006. Stock market data was obtained from Bloomberg Data Services throughout May and June 2006.

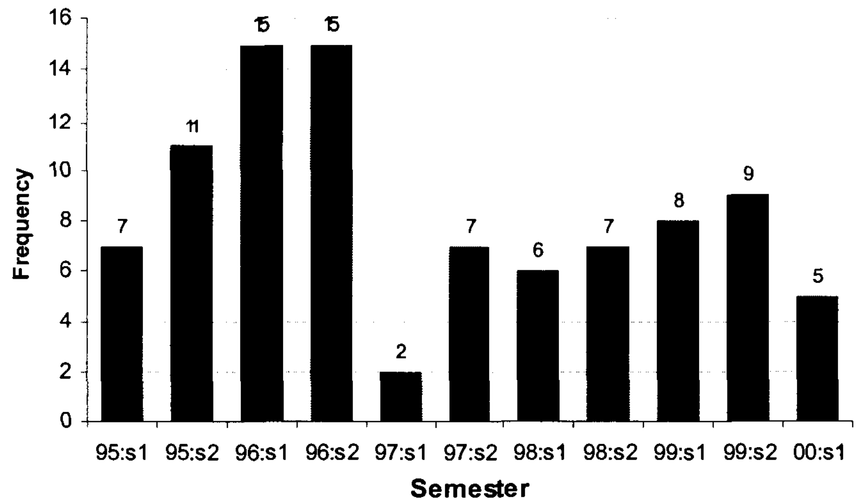
Of the original set of 181 equity carve-out filings, 22 came from companies that were no longer traded and for which data availability was restricted for at least one month around the filing date. Thus, data requirements for the estimation process were not met by these observations and they needed to be removed from the sample. In addition, 56 announcements from the original set came from companies that had become inactive on their exchanges shortly before or after the filing date. From this subset of 56 observations, relevant data on only 17 cases was obtained; thus decreasing the original sample by an additional 39 observations. Finally, of the 103 filings in the original sample that came from companies that were actively traded for at least 1,100 days before and after the filing date, only 75 could be matched with common stock price data for the date range required for the estimation window. Therefore, a total of 89 observations had to be excluded from the original set of equity carve-out filings. The table below shows the full breakdown of this original set of observations.

Table 3.1 Depuration of the original sample.

	Number of observations
Initially considered	181
Parent company is no longer traded and its stock price data is not available for at least one month around the announcement day	22
Parent company became inactive around the announcement day and its stock price data does not meet the estimation window requirements	39
Parent company is actively traded but its stock price data does not meet the estimation window requirements	28
Total excluded	89
Remaining in the sample	92
Date range covered by the remaining sample	01/04/1995 to 05/04/2000

Figure 3.1 shows the distribution of the 92 carve-out announcements in the sample being considered over the 11 semesters comprised in the January 1995 to May 2000 sample period. The distribution shows some clustering during the first couple of years covered by the sample, from 1995 to 1996. During this period 48 of the 92 announcements in the sample were recorded. The peak of the distribution is reached in 1996, with a total of 30 observations spread evenly over its two semesters. After the 1995-1996 period there seems to be a significant decay in carve-out activity. In fact, the minimum frequency of carve-out announcements occurs in the first semester of 1997, which holds only 2 observations. This year is also the year with the lowest carve-out activity in the sample, with a total of 9 announcements throughout the year. Finally, the rest of the period covered by the sample, from 1998 to 2000, shows a more even distribution.

Figure 3.1 Distribution of equity carve-out announcements throughout the sample period.



This figure shows the distribution of the 92 equity carve-out announcements in the sample over the sample period from January 1995 to May 2000. The horizontal axis shows the 11 semesters covered by the sample period. The vertical axis shows the number of equity carve-outs that occurred during a given semester. The exact number is shown on the top of each of the bars in the graph. Data source: Lexis-Nexis (2005).

The 92 announcements in the sample came from a total of 87 different parent companies. Five of these parent companies accounted for 12 of the 92 observations being considered. Table 3.2 lists the most relevant characteristics of these parent companies and their carve-out transactions. As it can be seen from the table, on average, the parent firms decreased their ownership in the carved-out subsidiaries by around 26% (i.e. from 95.4% to 69.5%), resulting in the market valuing the carved-out units at approximately $1.4 billion. In addition, the parent companies obtained proceeds for over $350 million from the sale of their subsidiaries, of which, $53 million contributed to the parent company's earnings during the announcement year. However, notice that most of these values tend to be skewed, as it is shown by their medians being significantly different than their average values.

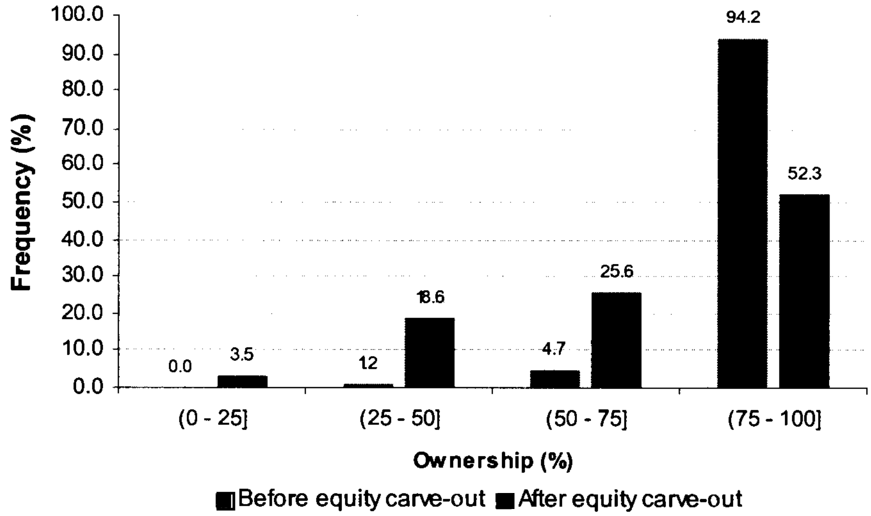
Table 3.2 **Characteristics of the parent companies and the equity carve-outs in the sample.**

	Mean	St. dev	Median
Ownership before equity carve-out (%)	95.38	11.21	100.00
Ownership after equity carve-out (%)	69.48	20.50	79.50
Offer price	17.41	5.90	16.75
Shares offered (mil)	16.67	28.30	6.00
Total proceeds ($ mil)	355.33	663.18	95.00
Earnings before interest and taxes ($mil)	52.87	139.39	7.50
Net income after taxes ($ mil)	37.26	190.36	4.10
Shares outstanding after the offering (mil)	120.50	322.37	33.80
Total capitalization ($ mil)	1,402.39	4,756.52	206.40

Data source: Lexis-Nexis (2005).

Figure 3.2 further illustrates the distribution of subsidiary ownership for the sample of 92 announcements. The figure shows the proportion of subsidiary ownership held by the parent companies before and after the carve-out transaction was concluded. Notice that in most of the cases (77.9%) the parent companies decided to retain a controlling stake on the carved-out subsidiaries. Also notice that only in 22.1% of the cases the parent companies gave up their controlling ownership position; however, in none of these cases the parent companies fully divested the carved-out entity.

Figure 3.2 Distribution of subsidiary ownership before and after the equity-carve out.



The figure shows the proportion of subsidiary ownership held by the parent companies in the sample before and after the equity carve-out transaction was concluded. The horizontal axis shows four different intervals illustrating the percentage of the subsidiary owned by the parent company. The vertical axis shows the frequency of each ownership interval in the sample of 92 companies expressed as a percentage. Data source: Lexis-Nexis (2005).

Another important characteristic of any equity carve-out is the way in which the parent company decides to use the proceeds from the sale of its subsidiaries. Out of the 92 equity carve-outs in the sample, the proceeds were used for general corporate purposes in 53% of the cases, for refinancing or retiring any type of debt in 49% of the cases, and for increasing working capital in only 12% of the cases. Table 3.3 shows a full breakdown of the use of equity carve-out proceeds for the observations in the sample. The first column lists the 17 different expenditure categories that were identified in the official filings of the parent companies included the sample. The second column shows the number of carve-out filings that listed a given expenditure category as way in which the parent company used the proceeds from the transaction. The last column states this number as a percentage of the 92 observations in the sample. Notice that the proceeds of a given equity carve-out could have been used to pursue one or more of the expenditure categories listed in Table 3.3. Therefore, the sum of the numbers in the second and the third columns is greater than the total number of observations in the sample.

Table 3.3 Use of proceeds by equity carve-out announcement.

Use of proceeds	Number of equity carve-outs	%
General corporate purposes	49	53.3
Refinancing / retiring bank debt	20	21.7
Payment on Borrowings	14	15.2
Refinancing / retiring fixed income debt	11	12.0
Working capital	11	12.0
Future acquisitions	7	7.6
Capital expenditures	5	5.4
Acquisition financing	4	4.3
Marketing and sales	4	4.3
Secondary	4	4.3
Acquisition of securities	3	3.3
Operative funds / cash reserves	2	2.2
Product development / RandD	2	2.2
Working fund	2	2.2
Investment / loan	1	1.1
Investment in Liquid Assets	1	1.1
Project finance	1	1.1

The table shows the uses of equity carve-out proceeds as reported in the official filings of the parent companies included in the sample. The first row lists the 17 different expenditure categories that were identified in the sample. The second column shows the number of carve-out filings that listed a given expenditure category as way in which the parent company used the proceeds from the transaction. The last column states this number as a percentage of the 92 observations in the sample. Data source: Lexis-Nexis (2005).

Finally, notice that total the number of observations included in the sample does not reflect the total number of equity carve-out announcements that occurred during the sample period. As it was described before, the restrictions and the inconsistencies in the data that was available precluded the inclusion of all of the relevant observations. Also, notice that there are parent companies which conducted two or more carve-outs during the sample period.

However, any potential biases introduced by specific market reactions to the activities of any individual company are dissipated because of the sample size and its dispersion across time and companies. Therefore, the sample being considered can be used to obtain informative results.

3.2 Methodology

3.2.1 Event Study Methodology[2]

Share price reactions to equity carve-out announcements are estimated by using an event study methodology that very closely resembles that suggested by Campbell *et al.* (1997) and Wooldridge (2003), with the exception that different event windows of length L_{EW} are used for conducting comparisons and for analysing the sensitivity of the results derived from the model. As it is traditionally done in event studies of specialized equity claims, the announcement date is denoted as time zero ($t=0$), and time is measured in trading days from this initial point. Thus, an event window of length L_{EW} centred around the filing day (i.e. from $t=-(L_{EW}-1)/2$ to $t=(L_{EW}-1)/2$) is considered for the analysis. Following this notation, the initial analysis uses an event window of one trading day around the filing day (i.e. from $t=-1$ to $t=1$), or equivalently, an event window with a length of three days. Hence, the price effects of the announcements that occur after the stock market closes are captured during the next trading day (i.e. at $t=1$), and they are measured with respect to a reference point that lies outside the announcement day (i.e. $t=-1$). In the same way, two additional event windows, with $L_{EW}=7$ and $L_{EW}=11$, are considered for comparing the sensitivity of the results obtained from the original analysis.

[2] Brown and Warner (1980), Boehmer *et al.* (1991) and Hulburt *et al.* (2002) follow similar approaches.

In order to estimate the normal returns for each of the relevant securities in the sample, the market model (MM), with the S&P-500 index as a proxy for the market portfolio, is implemented. The estimation window used for calculating the MM parameters ranges from $t=-219$ to $t=-20$ and it is common to the three event windows being considered. This is done so that there are enough observations to estimate reliable normal return coefficients which are not influenced by the announcement being analysed.

In addition, two main hypotheses, under the null of equity carve-out neutrality, are investigated to assess the impact of carve-out transactions on the distributional properties of the parent company's stock returns. The first hypothesis tests the impact of carve-out announcements on both the mean and the variance of the distribution of the stock returns. The second hypothesis only tests for changes in the mean of the distribution. In order to conduct these tests, two different test statistics are computed based on different estimators of the variance of the average cumulative abnormal returns.

Finally, at this point it is important to notice that each equity carve-out announcement in the sample has three relevant components. The first one is the parent company for which the analysis is conducted. The second one is the estimation window over which the normal return parameters are estimated. The last one is the event window over which the analysis is implemented.

3.2.2 Computation of Normal and Abnormal Returns

The market model is implemented for computing the normal and the abnormal returns of the common stocks of the parent companies in the sample. In its most general form, the model computes the abnormal return of the security relevant to a given equity carve-out announcement i, at time t, by estimating ϵ_{it}^* in the following equation[3],

$$\varepsilon_{it}^{*} = R_{it} - E[R_{it} | R_{mt}] \tag{1}$$

where R_{it} is the return, at time t, of the security relevant to announcement i, and R_{mt} is the market return at time t. In this way, the abnormal return of the security relevant to a given carve-out is given by the discrepancy between the actual return of the security and its conditional expected return during a given time period. For the purposes of this study, the relevant security for each carve-out announcement is the common stock of the parent company filing the carve-out.

The market model parameters necessary to compute the abnormal returns of announcement i are specified by

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{2}$$

This equation is estimated by an OLS regression of the form

$$\mathbf{R}_i = \mathbf{X}_i \boldsymbol{\theta}_i + \boldsymbol{\varepsilon}_i \tag{3}$$

where $\mathbf{R_i} = [R_{i,t=-219} \ldots R_{i,t=-20}]'$ is a (200 x 1) column vector comprising the estimation window stock returns relevant to announcement i; $\mathbf{X_i} = [\iota \; R_m]$ is a (200 x 2) matrix with a vector of ones in the first column and a vector $\mathbf{R_m} = [R_{m,t=-219} \ldots R_{m,t=-20}]'$ in the second column comprising the market returns during the estimation window of announcement i; and

[3] For this study, i denotes an equity carve-out announcement instead of the company itself. This is done because, as it was mentioned in Section 3.1, there are parent companies with two or more equity carve-out filings present in the sample. Therefore, the current notation states that the calculations are conducted for each one of the equity carve-out announcements in the sample, instead of for each one of the parent companies.

$\boldsymbol{\theta}_i = [\alpha_i\ \beta_i]'$ is the (2 x 1) parameter vector of the common stock of the parent company filing equity carve-out i.

Under general OLS assumptions, (3) provides consistent estimators for the market model parameters and, consequently, for the relevant abnormal returns. Furthermore, if it is assumed that the components of $\mathbf{R}_i$ are independently multivariate normally distributed with mean μ and covariance matrix $\boldsymbol{\Omega}$ for all t, then the OLS estimators are efficient. Given the estimation window of 200 observations (i.e. from $t=-219$ to $t=-20$), the OLS estimators are specified by

$$\hat{\boldsymbol{\theta}}_i = (\mathbf{X}'_i \mathbf{X}_i)^{-1} \mathbf{X}'_i \mathbf{R}_i \qquad (4)$$

$$\hat{\sigma}^2_{\varepsilon i} = \frac{1}{200-2} \hat{\boldsymbol{\varepsilon}}'_i \hat{\boldsymbol{\varepsilon}}_i \qquad (5)$$

$$\hat{\boldsymbol{\varepsilon}}_i = \mathbf{R}_i - \mathbf{X}_i \hat{\boldsymbol{\theta}}_i \qquad (6)$$

$$Var[\hat{\boldsymbol{\theta}}_i] = (\mathbf{X}'_i \mathbf{X}_i)^{-1} \sigma^2_{\varepsilon i} \qquad (7)$$

Once the parameter estimates have been computed, a (L_{EW} x 1) vector of sample abnormal returns for the common stock relevant to filing i, ϵ_i^*, can be estimated by

$$\hat{\boldsymbol{\varepsilon}}^*_i = \mathbf{R}^*_i - \mathbf{X}^*_i \hat{\boldsymbol{\theta}}_i \qquad (8)$$

where $\mathbf{R}^*_i = [R_{i,t=-(LEW-1)/2} \ldots R_{i,t=(LEW-1)/2}]'$ is a (L_{EW} x 1) column vector comprising the event window returns of the common stock relevant to announcement i; $\mathbf{X}^*_i = [\iota\ R_m]$ is a (L_{EW} x 2) matrix with a vector of ones in the first column and a vector $\mathbf{R_m} = [R_{m,t=-(LEW-1)/2} \ldots R_{m,t=(LEW-1)/2}]'$ in the second column, comprising the market returns during the event window of announcement i; and $\hat{\boldsymbol{\theta}}_i = [\hat{\alpha}_i\ \hat{\beta}_i]'$ is the (2 x 1) parameter vector estimate for the common stock of the parent company filing equity carve-out i.

Under optimal OLS conditions and the distributional assumptions stated before, conditional on the market return over the event window, the abnormal returns will have a joint normal distribution with a zero conditional mean and a conditional covariance matrix $\mathbf{V}_i$; algebraically,

$$\mathbf{E}\left[\hat{\boldsymbol{\varepsilon}}_i^* \mid \mathbf{X}_i^*\right] = \mathbf{E}\left[(\mathbf{R}_i^* - \mathbf{X}_i^* \hat{\boldsymbol{\theta}}_i) - \mathbf{X}_i^*(\hat{\boldsymbol{\theta}}_i - \boldsymbol{\theta}_i) \mid \mathbf{X}_i^*\right] = 0 \tag{9}$$

$$\mathbf{V}_i = \mathbf{I}\sigma_{\varepsilon i}^2 + \mathbf{X}_i^*(\mathbf{X}'_i\,\mathbf{X}_i)^{-1}\mathbf{X}_i^{*\prime}\sigma_{\varepsilon i}^2 \tag{10}$$

where **I** is a (L_{EW} x L_{EW}) identity matrix.

Equation (9) shows that the abnormal return estimator is unbiased with an expectation of zero. Equation (10) shows that the covariance matrix, $\mathbf{V}_i$, has two components; namely, the variance from future disturbances, $\mathbf{I}\sigma_{\varepsilon i}^2$ and the variance derived from the sampling error in the estimation of the $\boldsymbol{\theta}_i$ vector, $\mathbf{X}_i^*(\mathbf{X}'_i\,\mathbf{X}_i)^{-1}\mathbf{X}_i^{*\prime}\sigma_{\varepsilon i}^2$. Because this sampling error is common to all of the abnormal return observations in the $\hat{\boldsymbol{\varepsilon}}_i^*$ vector, the abnormal returns estimated for each filing will exhibit serial correlation. Nevertheless, because the estimation window being considered uses a sufficiently large sample for the estimation of the $\boldsymbol{\theta}_i$ vector, $\mathbf{X}_i^*(\mathbf{X}'_i\,\mathbf{X}_i)^{-1}\mathbf{X}_i^{*\prime}\sigma_{\varepsilon i}^2 \rightarrow 0$, and the abnormal returns over the event window are (asymptotically) independent. Thus, under the initial null hypothesis that the equity carve-out filing has no impact on the distribution (i.e. mean or variance) of the common stock returns of the parent company,

$$\hat{\boldsymbol{\varepsilon}}_{\mathbf{i}}^{*} \sim N(0,\mathbf{V}_i) \qquad (11)$$

which will be used in the construction of statistical tests in Section 3.2.4.

3.2.3 Aggregation of Abnormal Returns[4]

The abnormal returns are aggregated through time and across filing events. The aggregation along the time dimension is conducted by calculating the cumulative abnormal return (CAR) of the common stock relevant to a specific carve-out filing. Consistent with previous notation, $CAR(t)_i$ denotes the cumulative abnormal return on the common stock relevant to a given carve-out filing *i*, that comprises from the first day of the event window (i.e. $t=-(L_{EW}-1)/2$) to day *t*. Therefore, given the (L_{EW} x 1) vector of abnormal return estimates for filing *i*, $\hat{\boldsymbol{\varepsilon}}_{\mathbf{i}}^{*}$, the CAR estimate is obtained from

$$C\hat{AR}(t)_i = \boldsymbol{\lambda}'\hat{\boldsymbol{\varepsilon}}_{\mathbf{i}}^{*} \qquad (12)$$

where λ is a (L_{EW} x 1) column vector with ones from row 1 to row $t + (L_{EW}-1)/2 + 1$ and zeroes everywhere else.

Following this procedure $CAR(t)_i$ is calculated for each day in the event window of every announcement. For the initial analysis of this paper, for example, where $L_{EW} = 3$ and the event window ranges from $t=-1$ to $t=1$, $CAR(t)_i$ will be calculated for $t=-1$, $t=-0$ and $t=1$.

[4] The methodology described in this section resembles that of and Campbell *et al.* (1997), however, the notation is specific to this paper.

Given (9) and (10), the variance of the estimated CARs is given by

$$Var\left[\hat{CAR}(t)_i\right] = \sigma_i^2(t) = \lambda' \mathbf{V}_i \lambda \tag{13}$$

Thus, under the initial null hypothesis that the equity carve-out filing has no impact on the distribution (i.e. mean or variance) of the common stock returns of the parent company,

$$\hat{CAR}(t)_i \sim N(0, \sigma_i^2(t)) \tag{14}$$

which will be used in the construction of statistical tests in Section 3.2.4.

In order to conduct the aggregation of CARs across different carve-out filings, it is necessary to assume that the abnormal returns derived from different announcements are conditionally uncorrelated (conditional on the level of the market index), so that the abnormal returns and CARs of different filings are independent and the covariance terms can be assumed to be equal to zero. However, because there is some overlapping in the event windows of some announcements in the sample and because two or more announcements might be related to a single parent company, there is the potential for correlation across the abnormal returns of different filing events. Section 4, however, shows that this correlation is not significant, so the aggregation across companies is valid. Therefore, given our sample of 92 filings, $\bar{\varepsilon}^*$ denotes the sample average abnormal return at time t and $\overline{CAR(t)}$ denotes the sample average CAR at time t, where

$$\bar{\varepsilon}^* = \frac{1}{92}\sum_{i=1}^{92} \hat{\varepsilon}_i^* \tag{15}$$

$$Var\left[\bar{\boldsymbol{\varepsilon}}^{*}\right] = \mathbf{V} = \frac{1}{92^{2}}\sum_{i=1}^{92}\mathbf{V}_{i} \quad (16)$$

$$\overline{CAR(t)} \equiv \lambda'\bar{\boldsymbol{\varepsilon}}^{*} = \frac{1}{92}\sum_{i=1}^{92}\hat{CAR}(t)_{i} \quad (17)$$

$$Var\left[\overline{CAR(t)}\right] \equiv \bar{\sigma}^{2}(t) = \lambda'\mathbf{V}\lambda = \frac{1}{92^{2}}\sum_{i=1}^{92}\sigma_{i}^{2}(t) \quad (18)$$

Consequently, given (9), inferences about the aggregate CARs can be obtained from

$$\overline{CAR(t)} \sim N\left(0, \bar{\sigma}^{2}(t)\right) \quad (19)$$

Finally, notice from equation (10) that $\mathbf{V_i}$ cannot be estimated since it depends on $\sigma_{\varepsilon i}^{2}$, which is unknown. Thus, **V** in (16) and $\bar{\sigma}^{2}(t)$ in (18) cannot be directly computed. However given the distributional assumptions of independence across the abnormal returns of different filing events that were previously mentioned, one can use $\sigma_{\varepsilon i}^{2} = \hat{\sigma}_{\varepsilon i}^{2}$ in the estimation of (10), such that[5]

$$\hat{\mathbf{V}}_{i} = \mathbf{I}\hat{\sigma}_{\varepsilon i}^{2} + \mathbf{X}_{i}^{*}(\mathbf{X'}_{i}\mathbf{X}_{i})^{-1}\mathbf{X}_{i}^{*}{}'\hat{\sigma}_{\varepsilon i}^{2} \quad (20)$$

Consequentially, equation (13) becomes

$$\hat{\sigma}_{i}^{2}(t) = \lambda'\hat{\mathbf{V}}_{i}\lambda \quad (21)$$

and equation (16) can be approximated by

$$\hat{\mathbf{V}} = \frac{1}{92^{2}}\sum_{i=1}^{92}\hat{\mathbf{V}}_{i} \quad (22)$$

[5] This approach is commonly implemented in the relevant econometric literature (Campbell *et al.* 1997).

Therefore, equation (18) can be estimated by

$$\hat{\bar{\sigma}}^2(t) = \lambda'\hat{\mathbf{V}}\lambda = \frac{1}{92^2}\sum_{i=1}^{92}\hat{\sigma}_i^2(t) \qquad (23)$$

and the (asymptotic) distribution of the average CAR becomes

$$\overline{CAR(t)} \overset{a}{\sim} N\left(0, \hat{\bar{\sigma}}^2(t)\right) \qquad (24)$$

which will be used in the next section to conduct statistical tests.

3.2.4 Testing Procedure

In this section we explain the econometric procedures that are used for testing the significance of the aggregate CARs across filing events. As it was mentioned before, two different null hypotheses are considered to assess the short term effects of equity carve-outs on the distribution of the common stock returns of the parent company:

1. HA_0: Equity carve-out announcements have no impact on the distribution (i.e. mean and variance) of the returns of the parent companies' common stock.

2. HB_0: Equity carve-out announcements have no impact on the mean of the distribution of the returns of the parent companies' common stock (i.e. average CARs are zero).

To test the first hypothesis, we rely on the consistent estimator obtained in (23) in the previous section. Thus, the test for HA_0 follows[6],

---

[6] This testing methodology is implemented because, on average, the abnormal return is larger for securities with higher variance. This situation is consistent with the fact that the risk of the relevant stock varies over the event window. Therefore, using a methodology that gives equal weighting to the realized CARs of each security produces test statistics that have a higher power than those following other weighting procedures (see Campbell *et al.*, 1997 for a full description of power testing in event studies).

$$Z_1 = \frac{\overline{CAR(t)}}{\left[\hat{\bar{\sigma}}^2(t)\right]^{\frac{1}{2}}} \overset{a}{\sim} N(0,1) \qquad (25)$$

Notice that Z_1 reflects only an asymptotic distribution because an estimator of the variance, $\hat{\bar{\sigma}}^2$, is being used for its computation. Nevertheless, the sample of 92 companies is large enough to provide us with meaningful test statistics.

To test the second null hypothesis, HB_0, a methodology similar to that illustrated by Boehmer *et al.* (1991) is implemented. In order to test HB_0, HA_0 has to be modified so that only mean effects are captured by the test. This is accomplished by eliminating the dependence of the estimator of the variance of abnormal returns, given by (20), on past observations. The simplest way to achieve this is by constructing an estimator of the variance of the abnormal returns which is estimated from a cross section of CARs across the sample. Such an estimator is shown in (26).

$$CMM\ \hat{Var}\left[\overline{CAR(t)}\right] = \hat{\bar{\sigma}}^2_{CMM}(t) = \frac{1}{92^2}\sum_{i=1}^{92}\left[CAR(t)_i - \overline{CAR(t)}\right]^2 \qquad (26)$$

Thus, given a sufficiently large sample and the assumption that CARs are uncorrelated across equity carve-out announcements,

$$Z_{CMM} = \frac{\overline{CAR(t)}}{\left[\hat{\bar{\sigma}}^2_{CMM}(t)\right]^{\frac{1}{2}}} \overset{a}{\sim} N(0,1) \qquad (27)$$

which is used to test HB_0.

Such a test is important as the risk of the common equity of the parent company might change during the event window due to the uncertainty introduced by the announcement and the variation on the company's asset composition and operational structure[7]. These changes in the underlying risk of the company can potentially increase or decrease the variance of its stock returns; thus, under or overestimating the results obtained by Z_I when testing for mean effects on the distribution. However, since Z_{CMM} is not affected by changes in the variance of stock returns, it is optimal for isolating mean changes during the event window and for testing them; therefore, such a test is implemented.

[7] See Kane and Unal (1988) for a complete treatment of risk changes after public announcements in equity markets.

4 EMPIRICAL RESULTS

4.1 Abnormal Returns and Cumulative Abnormal Returns

Given the methodology described in the previous section, abnormal returns and CARs are estimated for the shares relevant to each of the 92 equity carve-outs in the sample. As it was mentioned before, given a common estimation window, different event windows of length $L_{EW} = 3$, $L_{EW} = 7$ and $L_{EW} = 11$ are considered for comparison purposes. Table 4.1 to 4.3 show the development of these computations for a set of typical announcements in the sample. This information is also depicted graphically in Figure 4.1 to 4.3. The first row of Table 4.1 to 4.3 shows the announcement number in the extended set of 181 equity carve-out filings. This number is used as a reference for programming purposes (see Appendix 1). Rows 2 and 3 of Table 4.1 show the market model coefficients, α_i and β_i, and the corresponding t-statistics, for each of the three common stocks linked to the announcements being analysed. The remaining rows in Table 4.1 are the same as those for the other two tables. These rows show the components of the $\mathbf{R}^*_i$, $\mathbf{R}_m$ and $\hat{\boldsymbol{\varepsilon}}^*_i$ column vectors, described in the previous section, and the values of $\hat{CAR}(t)_i$ for each day in the event window being considered. Notice how some common stocks in the sample show positive CARs at the end of every event window regardless of its length. This case is illustrated by the stock linked to announcement 145, depicted in Figure 4.3. On the other hand, for other stocks, such as those linked to announcements 70 and 83 (see Figure 4.1 and Figure 4.2), the terminal value of the CAR is very sensitive to the length of the event window that is selected. This is one of the motivations for including different event windows in the analysis.

Most common stocks in the sample, however, show patterns similar to those depicted by the stock related to announcement 83 in Figure 4.2. These patterns reflect that shortly after the equity carve-out takes place, the CARs remain stable at a given level (i.e. the abnormal returns tend to go back to zero). This situation is consistent with moderately efficient markets, in which all public information is absorbed by the market and it is incorporated into all asset prices shortly after it is realized.

A word of caution is important at this point, however. Notice that it is possible that other events affecting the stock returns in the sample could have taken place around the announcement day. Thus, CAR patterns such as those related to announcement 83, which exhibit a jump at $t=2$, or those related to announcement 70, which exhibit a non-zero slope at the end of some of the event windows, could appear in some of the observations in the sample. Alternatively, these patterns could be the result of market over-reactions to equity carve- out announcements, or the result of inefficiencies that do not allow the market to adjust rapidly to the public information that is realized on the filing day[8]. In any case, however, as the sample size increases these events tend to get filtered out of the aggregate results (i.e. they cancel each other out by properties of the central limit theorem).

Another general characteristic of the securities included in the sample, is that most of them exhibit market model parameters that are statistically significant; thus, showing the appropriateness of the market model to estimate normal return coefficients and increasing the reliability of the final results. This situation is illustrated by the securities related to announcements 83 and 145, depicted in the table below, which have β parameters that are significant at the 5% level.

[8] Rigorous tests of these situations fall outside the scope of this paper.

Table 4.1 Computation of abnormal returns and CARs for a set of representative announcements in the sample (L_{EW}=3).

(Values expressed as percentages)

	Announcement 70				Announcement 83				Announcement 145			
	0.0001324		0.20019		-0.0018368		0.72677		0.0023461		0.92776	
	(0.089611)		(1.5355)		(-1.3681)		(6.4513)		(1.2776)		(2.6243)	
t	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$
-1	0.34	-0.39	0.41	0.41	0.24	0.49	0.06	0.06	-0.96	0.93	-2.06	-2.06
0	-0.34	-0.37	-0.28	0.13	-3.29	-0.75	-2.57	-2.51	2.91	0.38	2.32	0.26
1	0.39	-0.16	0.41	0.53	-0.73	-0.49	-0.19	-2.70	8.96	-0.41	9.11	9.37

The table shows the abnormal returns and the cumulative abnormal returns for the stocks liked to three representative announcements in the sample over an event window of 3 days of length. The first row denotes the announcement being analysed according to the reference number used for this study. Rows 2 and 3 show the market model coefficients and the t-statistics, respectively, for each one of the stocks being analyzed. Finally, rows 5 to 7 show the parent company's stock returns, the market returns, the abnormal returns and the cumulative abnormal returns, respectively, for each of the three announcements listed in the table.

Table 4.2 Computation of abnormal returns and CARs for a set of representative announcements in the sample (L_{EW}=7).

(Values expressed as percentages)

	Announcement 70				Announcement 83				Announcement 145			
t	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$
-3	-0.68	0.33	-0.76	-0.76	2.40	-1.37	3.58	3.58	-1.90	0.42	-2.52	-2.52
-2	0.00	0.86	-0.19	-0.95	-0.47	0.72	-0.81	2.77	0.48	0.95	-0.63	-3.15
-1	0.34	-0.39	0.41	-0.54	0.24	0.49	0.06	2.83	-0.96	0.93	-2.06	-5.21
0	-0.34	-0.37	-0.28	-0.82	-3.29	-0.75	-2.57	0.27	2.91	0.38	2.32	-2.89
1	0.39	-0.16	0.41	-0.41	-0.73	-0.49	-0.19	0.08	8.96	-0.41	9.11	6.22
2	-0.77	0.49	-0.88	-1.30	1.23	0.94	0.73	0.80	-2.60	0.88	-3.65	2.57
3	-1.36	-0.62	-1.25	-2.54	-0.48	1.00	-1.03	-0.22	0.44	0.76	-0.50	2.07

The table shows the abnormal returns and the cumulative abnormal returns for the stocks liked to three representative announcements in the sample over an event window of 7 days of length. The first row denotes the announcement being analysed according to the reference number used for this study. Rows 3 to 9 show the parent company's stock returns, the market returns, the abnormal returns and the cumulative abnormal returns, respectively, for each of the three announcements listed in the table.

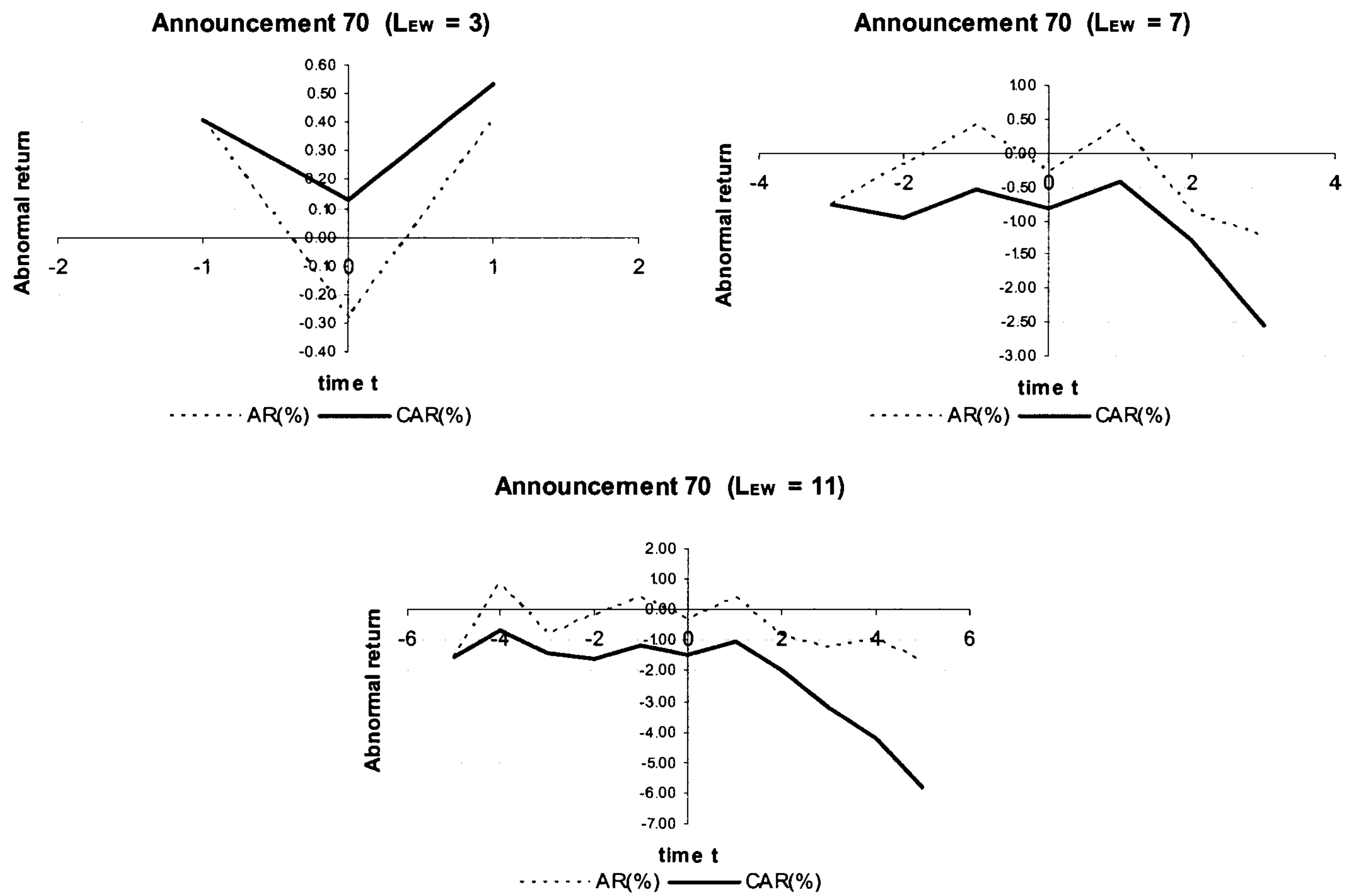
Table 4.3 Computation of abnormal returns and CARs for a set of representative announcements in the sample (L_{EW}=11).

(Values expressed as percentages)

	Announcement 70				Announcement 83				Announcement 145			
t	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$	R_{it}	R_{mt}	ϵ^*_{it}	$CAR(t)_i$
-5	-1.69	-0.77	-1.55	-1.55	2.72	-1.06	3.68	3.68	-0.49	-0.47	-0.29	-0.29
-4	0.86	-0.26	0.90	-0.65	0.24	0.05	0.39	4.06	3.94	0.74	3.02	2.73
-3	-0.68	0.33	-0.76	-1.41	2.40	-1.37	3.58	7.64	-1.90	0.42	-2.52	0.21
-2	0.00	0.86	-0.19	-1.60	-0.47	0.72	-0.81	6.84	0.48	0.95	-0.63	-0.42
-1	0.34	-0.39	0.41	-1.19	0.24	0.49	0.06	6.90	-0.96	0.93	-2.06	-2.48
0	-0.34	-0.37	-0.28	-1.47	-3.29	-0.75	-2.57	4.33	2.91	0.38	2.32	-0.16
1	0.39	-0.16	0.41	-1.07	-0.73	-0.49	-0.19	4.14	8.96	-0.41	9.11	8.95
2	-0.77	0.49	-0.88	-1.95	1.23	0.94	0.73	4.87	-2.60	0.88	-3.65	5.30
3	-1.36	-0.62	-1.25	-3.19	-0.48	1.00	-1.03	3.84	0.44	0.76	-0.50	4.80
4	-0.98	0.01	-1.00	-4.19	-0.73	-0.78	0.02	3.86	0.00	0.56	-0.75	4.05
5	-1.59	0.21	-1.64	-5.83	-2.70	-0.26	-2.33	1.54	-1.33	0.94	-2.44	1.61

The table shows the abnormal returns and the cumulative abnormal returns for the stocks liked to three representative announcements in the sample over an event window of 11 days of length. The first row denotes the announcement being analysed according to the reference number used for this study. Rows 3 to 11 show the parent company's stock returns, the market returns, the abnormal returns and the cumulative abnormal returns, respectively, for each of the three announcements listed in the table.

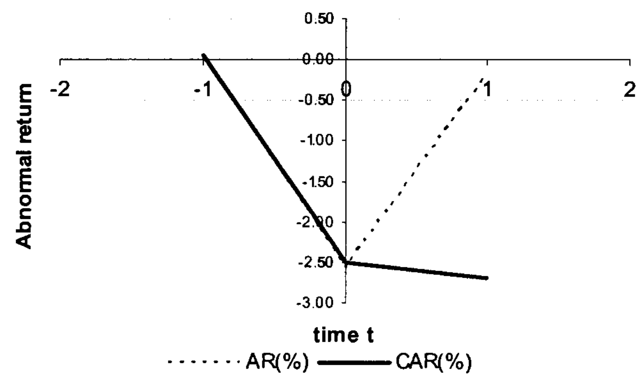
Figure 4.1 Abnormal returns and CARs over different event windows for a representative announcement in the sample (Announcement 70).



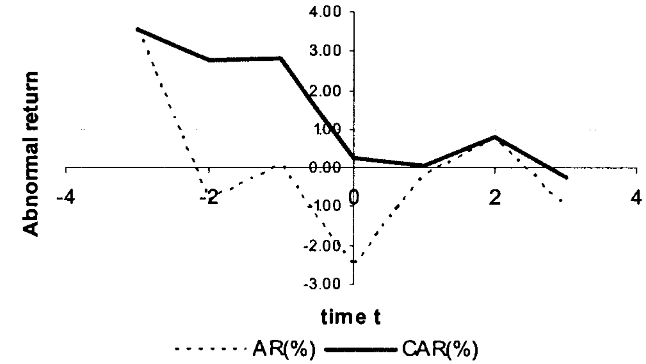
The figure shows the abnormal returns and the cumulative abnormal returns for the common stock relevant to announcement 70 in the sample when different event windows are considered. The graph on the top left-hand side of the page illustrates the case in which an event window of 3 days of length is considered. Similarly, the graphs on the top right-hand side and at the bottom of the page illustrate the cases in which event windows of 7 and 11 days of length are considered, respectively. In each graph, the dotted and the solid lines denote the abnormal return and the cumulative abnormal return, respectively.

Figure 4.2 Abnormal returns and CARs over different event windows for a representative announcement in the sample (Announcement 83).

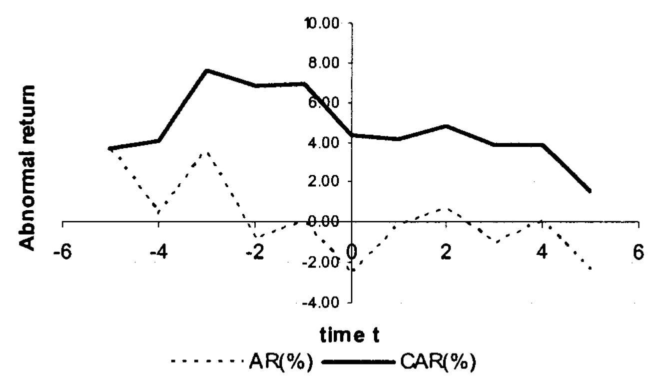
Announcement 83 (L_{EW} = 3)



Announcement 83 (L_{EW} = 7)

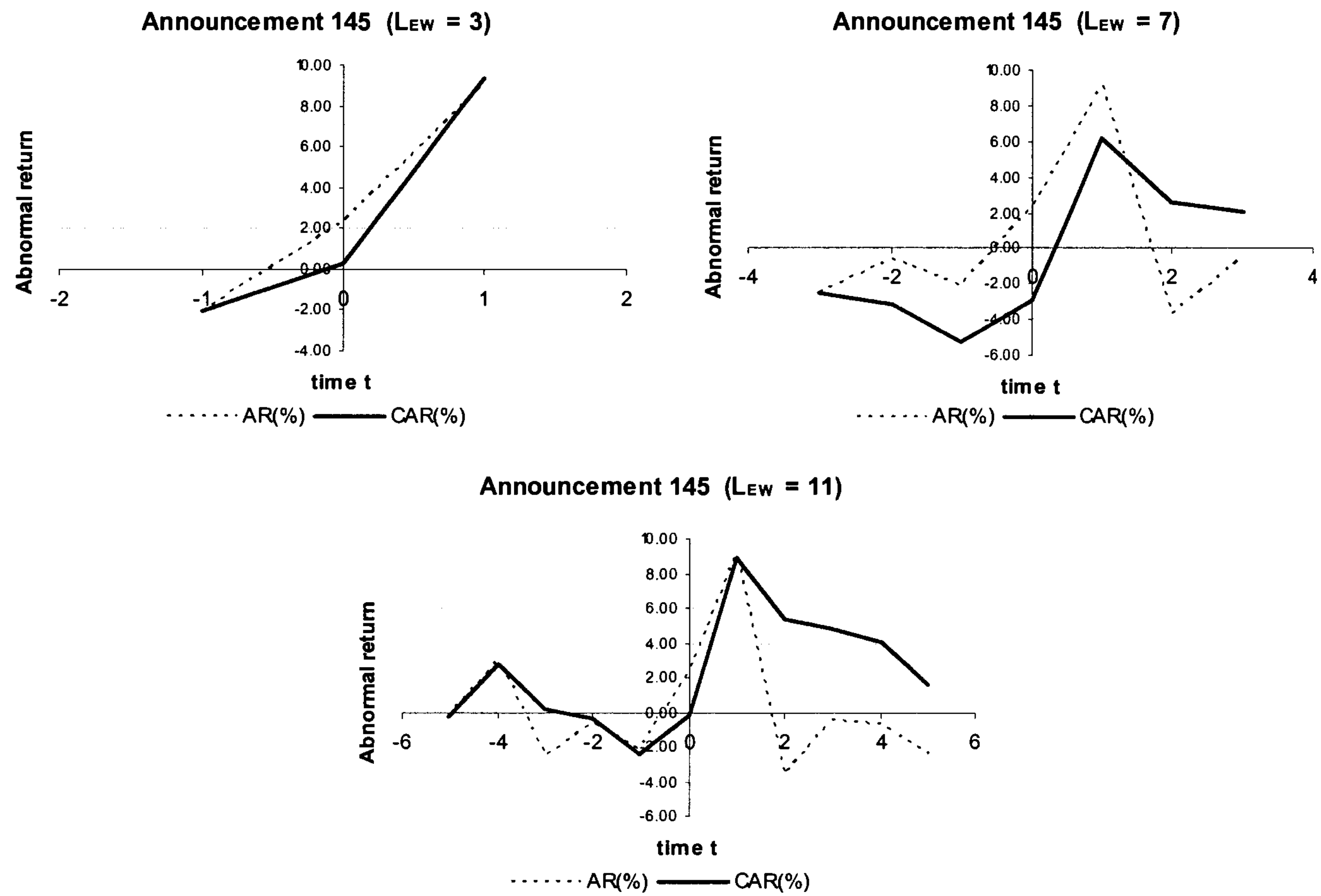


Announcement 83 (L_{EW} = 11)



The figure shows the abnormal returns and the cumulative abnormal returns for the common stock relevant to announcement 83 in the sample when different event windows are considered. The graph on the top left-hand side of the page illustrates the case in which an event window of 3 days of length is considered. Similarly, the graphs on the top right-hand side and at the bottom of the page illustrate the cases in which event windows of 7 and 11 days of length are considered, respectively. In each graph, the dotted and the solid lines denote the abnormal return and the cumulative abnormal return, respectively.

Figure 4.3 Abnormal returns and CARs over different event windows for a representative announcement in the sample (Announcement 145).



The figure shows the abnormal returns and the cumulative abnormal returns for the common stock relevant to announcement 145 in the sample when different event windows are considered. The graph on the top left-hand side of the page illustrates the case in which an event window of 3 days of length is considered. Similarly, the graphs on the top right-hand side and at the bottom of the page illustrate the cases in which event windows of 7 and 11 days of length are considered, respectively. In each graph, the dotted and the solid lines denote the abnormal return and the cumulative abnormal return, respectively.

Table 4.4 below shows the results of the correlation test between the abnormal returns of different announcements in the sample. The test is conducted under the null hypothesis of no presence of correlation and it is implemented for the three different event windows being considered for this study. The row named p-value<0.05, shows the number of times that an announcement's set of abnormal returns were significantly correlated to that of another announcement when the test was conducted at the 5% level. The same structure applies to all other rows. The row named (p-value < 0.05) / (corr. estimates) divides the number obtained in the corresponding p-value cell by the number of correlation estimates in the correlation matrix of the 92 announcements (there are $92^2 - 92 = 8372$ correlation estimates). As it can be seen from the table, the abnormal returns are not significantly correlated for any of the event windows being considered. This result holds even when the correlation test is carried out at the 10% level. Therefore, the assumption that was made in the previous section of no correlation across the abnormal returns of different announcements seems to hold for the sample used in this study.

Table 4.4 Correlation test for the abnormal returns of different announcements in the sample.

	Abnormal Returns		
	L_{EW}=3	L_{EW}=7	L_{EW}=11
Announcements	92	92	92
Correlation estimates	8372	8372	8372
p-value < 0.05	218	243	217
(p-value < 0.05) / (corr. estimates)	0.026	0.029	0.026
p-value < 0.10	413	449	439
(p-value < 0.10) / (corr. estimates)	0.049	0.054	0.052
p-value < 0.15	598	679	658
(p-value < 0.15) / (corr. estimates)	0.071	0.081	0.079

The table shows the results of the correlation test between the abnormal returns of different equity carve-out announcements. The test is conducted under the null hypothesis of no presence of correlation and it is implemented for the three different event windows being considered for this study. The row named p-value<0.05, shows the number of times that the abnormal returns of an announcement were correlated to those of another announcement in the sample when the test was performed at the 5% level. The same structure applies to all other rows. Finally, the row named (p-value < 0.05) / (corr. estimates) divides the number obtained in the corresponding p-value row by the number of correlation estimates in the correlation matrix of the 92 announcements (i.e. $92^2 - 92 = 8372$).

In terms of aggregate results, the average market model parameters in the sample consist of an α of 0.00083664 and a β of 0.83472. These values are consistent with the fact that the sample is sufficiently large so that the average α approaches zero and the average β approaches 1. Table 4.5 below, shows the average abnormal returns and the average cumulative abnormal returns after aggregating the data across observations. The table shows the results for the three event windows being considered with their values centred on the announcement day, $t=0$. For each event window and for each day in it, the first three columns of the table show the average abnormal return, its median and the percentage of positive abnormal returns in the sample, respectively. The last three columns show similar data but for the average CAR. Notice that both, the average abnormal returns and the average CARs are all positive for the announcement day $(t=0)$ and the day after it $(t=1)$ for all of the event windows being considered. This is consistent with some announcements happening at the end of the trading day, in which case, the market incorporates the new information over the next trading session. Also notice from the table that the percentage of observations with positive abnormal returns and positive cumulative abnormal returns increases significantly on the announcement day and it remains high over the following trading session. After 2 days (i.e. at *t=2*), however, this percentage tends to decline. Similarly, starting at *t=2* all average abnormal returns turn negative; thus, the terminal average CAR tends to dissipate as the length of the event window is increased. This issue will be explored in more detail in the next section. Finally, Figure 4.4 plots the relationship between the average abnormal returns and the average CARs depicted in Table 4.5. Notice from the figure that for the three event windows being considered, the average CAR line shows a positive market reaction shortly after the carve-outs are filed (i.e. from *t=0* to *t=1*). However, this trend tends to be reversed on *t*=2 and on the days after it. Therefore, there seems to be an initial positive overreaction to carve-out announcements which is likely to be corrected over the trading sessions following the announcement day. Nevertheless, the initial market reaction to an equity-carve out, at least for the companies included in the sample, is consistently positive and in the order of 1.66 % and 2.42% on the day of the announcement and the trading day immediately following it, respectively.

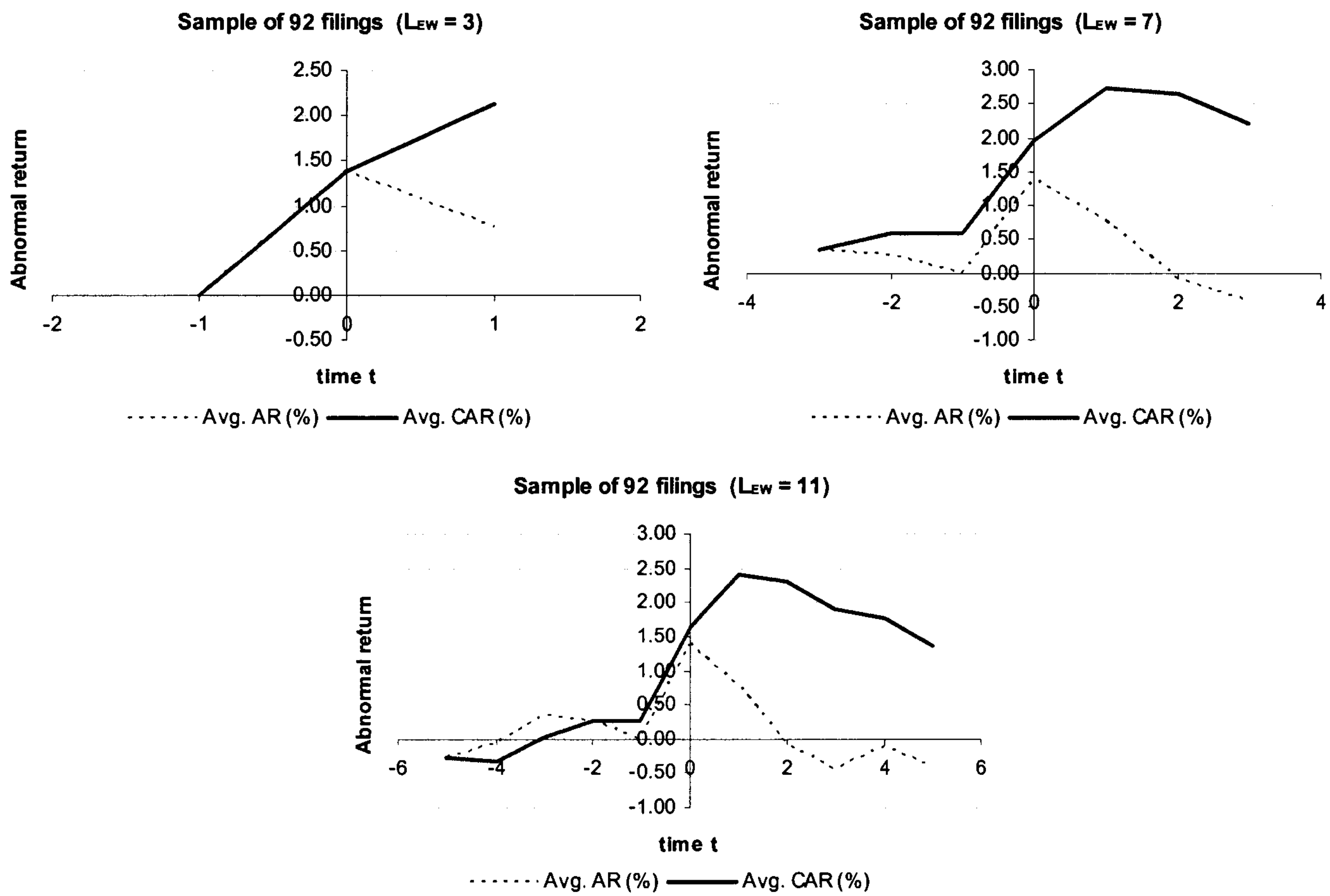
Table 4.5 Average abnormal returns and average cumulative abnormal returns.

(Values expressed as percentages)

	L_{EW}=3						L_{EW}=7						L_{EW}=11					
t	$\bar{\varepsilon}^*$	Med	Pos	$\overline{CAR(t)}$	Med	Pos	$\bar{\varepsilon}^*$	Med	Pos	$\overline{CAR(t)}$	Med	Pos	$\bar{\varepsilon}^*$	Med	Pos	$\overline{CAR(t)}$	Med	Pos
-5													-0.27	-0.18	43.48	-0.27	-0.18	43.48
-4													-0.06	0.10	54.35	-0.33	-0.23	48.91
-3							0.34	-0.06	47.83	0.34	-0.06	47.83	0.34	-0.06	47.83	0.01	-0.50	44.57
-2							0.25	-0.03	47.83	0.60	-0.33	47.83	0.25	-0.03	47.83	0.27	-0.44	44.57
-1	-0.01	-0.37	44.57	-0.01	-0.37	44.57	-0.01	-0.37	44.57	0.59	-0.27	46.74	-0.01	-0.37	44.57	0.26	-0.57	44.57
0	**1.38**	0.58	59.78	**1.37**	0.56	60.87	**1.38**	0.58	59.78	**1.97**	0.48	56.52	**1.38**	0.58	59.78	**1.64**	0.42	53.26
1	**0.76**	0.09	52.17	**2.13**	0.52	58.70	**0.76**	0.09	52.17	**2.73**	0.91	55.44	**0.76**	0.09	52.17	**2.40**	0.66	54.35
2							-0.09	-0.24	42.39	2.64	0.11	52.17	-0.09	-0.24	42.39	2.31	0.29	53.26
3							-0.42	-0.33	43.48	2.22	-0.12	48.91	-0.42	-0.33	43.48	1.89	0.64	53.26
4													-0.12	-0.30	48.91	1.77	0.55	54.35
5													-0.40	-0.47	42.39	1.36	0.51	54.35

The table shows the average abnormal returns and the average cumulative abnormal returns for each day in the three event windows being considered. For each event window and for each day in it, the first three columns in the table show the average abnormal return, its median and the percentage of positive abnormal returns in the sample, respectively. The next three columns show the same information but for the average CAR. The average abnormal returns and the average cumulative abnormal returns on the filing day and the day after it have been highlighted.

Figure 4.4 Comparison of average abnormal returns and average CARs over different event windows.



The figure shows the average abnormal returns and the average CARs over different event windows. The graph on the top left-hand side illustrates the case in which an event window of 3 days of length is considered. Similarly, the graphs on the top right-hand side and at the bottom of the page show the cases in which event windows of 7 and 11 days of length are considered, respectively. In each graph, the dotted and the solid lines denote the average abnormal return and the average cumulative abnormal return, respectively.

4.2 Results from Hypothesis Testing

From the data presented in Table 4.5 and the testing procedure outlined in Section 3.2 test statistics for hypothesis HA0 and HB0 can now be estimated. Table 4.6 shows the relevant test statistics for each one of the average cumulative abnormal returns during the three different event windows. All of the values that are statistically significant at the 5% level have been highlighted, and those which are significant at the 1% level have also been identified with an asterisk. Notice that both z-statistics reflect results that are very similar. However, Z_{CMM} generally tends to be smaller than Z_l on the announcement date and the two days after it. This pattern is reversed on the days preceding the announcement and after $t=3$. This situation is consistent with the variance of the distribution increasing on the announcement day since Z_l, which is sensitive to mean and variance changes, increases by more than Z_{CMM}, which is sensitive to mean variations only, on this day. The reverse applies for the days preceding the announcement. In other words, because both the mean and the variance of the distribution change during the announcement, Z_l exhibits values that are more statistically significant around the announcement day.

Also notice from the table that the highest terminal average CAR (2.133%), is obtained with the smallest event window $L_{EW}=3$. However, as it was mentioned before, average CARs up to $t=2$ are similar across event windows and, as Table 4.7 illustrates[9], their differences are not statistically significant even at the 10% level. Thus, the results seem to be consistent across event windows and robust with respect to the initial point used to measure the CARs for different companies. Nevertheless, notice that for $L_{EW}=5$, the average CARs

[9] This test is constructed by noticing that the average CARs follow a $N(0,\sigma^2)$ distribution (with σ depending on the null hypothesis being tested). Therefore, the difference between the average CARs also follows a normal distribution with a variance that is a function of the variances and the covariances of the average CARs being tested. Given these variance estimates of the average CAR differences, the normal test for mean divergences is applied.

seems to dissipate as we look farther away from the announcement date; yet, they remain positive and significant at the 10% level. As it was stated before, this dissipation could be the result of market over-reactions or other events affecting the companies' prospects.

It is equally interesting to notice that all of the average CARs before the announcement date are not significantly different from zero, regardless of the z-statistic being considered. However, this pattern changes on the announcement date, when all of the average CARs become strongly positive and significant for both z-statistics. This pattern continues up to $t=3$ when the last statistically significant values are observed for both, $L_{EW}=7$ and $L_{EW}=11$. Once again, this situation seems to be somehow consistent with moderate market efficiency since all of the significant market reactions start taking place on the announcement day. However, as it was discussed before, the data also shows an initial positive overreaction that tends to be corrected during the days following the announcement.

Finally, the results just described in this and in the previous section are consistent with those documented by Schipper and Smith (1986), Slovin *et al.* (1995), Allen and McConnell (1998), Hulburt *et al.* (2002), and Boone *et al.* (2003), who report short term average cumulative abnormal returns ranging from 2% to 2.8% around equity-carve out announcements. Also, the results presented in this study confirm the direction of the effects suggested by the theoretical model of Nanda (1991).

Table 4.6 Average cumulative abnormal returns and z-statistics under the null hypotheses of equity carve-out neutrality.

	L_{EW}=3			L_{EW}=7			L_{EW}=11		
t	$\overline{CAR(t)}$ (%)	Z_1 (HA_0)	Z_{CMM} (HB_0)	$\overline{CAR(t)}$ (%)	Z_1 (HA_0)	Z_{CMM} (HB_0)	$\overline{CAR(t)}$ (%)	Z_1 (HA_0)	Z_{CMM} (HB_0)
-5							-0.27	-0.73	-0.84
-4							-0.33	-0.63	-0.81
-3				0.34	0.93	1.08	0.01	0.02	0.02
-2				0.60	1.14	1.14	0.27	0.36	0.41
-1	-0.01	-0.03	-0.03	0.59	0.91	0.93	0.26	0.31	0.36
0	**1.37***	2.62	2.10	**1.97***	2.64	2.20	**1.64**	1.79	1.74
1	**2.13***	3.31	2.59	**2.73***	3.27	2.68	**2.40***	2.42	2.29
2				**2.64***	2.88	2.78	**2.31***	2.17	2.37
3				**2.22**	2.24	2.31	**1.89**	1.67	1.92
4							**1.77**	1.48	1.69
5							1.36	1.09	1.24

The table shows the average cumulative abnormal returns and their z-statistics for all of the days included in the three different event windows being considered for this study. Z_1 tests the null hypothesis that equity carve-out announcements have no impact on the distribution (i.e. mean and variance) of the returns of the parent companies' common stock. Z_{CMM} tests the null hypothesis that equity carve-out announcements have no impact on the mean of the distribution of the returns of the parent companies' common stock (i.e. that average CARs are zero). Values that are statistically significant at the 5% level under either z-statistic have been highlighted, and those which are significant at the 1% level have also been identified with an asterisk.

Table 4.7 Z-statistics for testing the difference between the average CARs of different event windows.

	L_{EW} $\overline{CAR(t)}$ difference using $\hat{\bar{\sigma}}^2(t)$			L_{EW} $\overline{CAR(t)}$ difference using $\hat{\bar{\sigma}}^2_{CMM}(t)$		
L_{EW}/t	**3 - 7**	**3 - 11**	**7 - 11**	**3 - 7**	**3 - 11**	**7 - 11**
-3			0.45			0.58
-2			0.36			0.40
-1	-0.81	-0.29	0.32	-0.81	-0.33	0.35
0	-0.66	-0.25	0.28	-0.54	-0.23	0.26
1	-0.57	-0.22	0.26	-0.46	-0.20	0.23
2			0.24			0.24
3			0.22			0.24

The table shows the z-statistics for the (asymptotic) test of the difference between the average CARs of the event windows being considered for this study (see Table 4.6). The test is conducted under the null hypothesis of no difference between the average CAR estimates. The first set of values shows the z-statistics that are obtained by using the consistent variance estimator given in equation (23). The second set shows those obtained by using the unconditional variance estimator given in (26). The second row in the table indicates which event windows are being evaluated. First, the z-statistic for the difference between the average CARs of the event windows with lengths of 3 and 7 days is shown. Similarly, the next two columns show the z-statistics for the average CAR differences between event windows with lengths of 3 and 11 days, and those with lengths of 7 and 11 days, respectively.

5 INTERPRETATION AND CONCLUSIONS

This paper explored the short term effects of equity carve-outs on the value of the common stock of the originating company. The most significant sources of value derived from equity carve-outs were discussed and an empirical assessment of the value of these transactions was undertaken. Employing a sample of 92 equity carve-out announcements, occurring form January 1995 to May 2000, an event study methodology was implemented for assessing the effects of equity carve-out announcements on the distribution of the returns of the parent companies' common stock. The study considered both mean and mean-variance disturbances, under the null hypothesis of equity carve-out neutrality.

Given the sample on hand, it was found that equity carve-outs convey an average cumulative abnormal return in the order of 1.66, 2.42, 2.48 and 2.05% on the day of the announcement and on the three days after it, respectively. As a consequence, both hypotheses of equity carve-out neutrality were rejected at the 5% level. Therefore, it can be concluded that equity carve-outs have significant short term distributional effects (i.e. mean and variance effects) on the returns of the parent company's common stock, and that these effects persist even if mean disturbances are considered in isolation. Furthermore, these findings are consistent regardless of the event window being considered for their calculation. However, since the average cumulative abnormal returns tended to dissipate over the fourth and the fifth trading day following the announcement, it is possible that the positive returns captured by the tests are the consequence of initial market overreactions. Nevertheless, the average cumulative abnormal returns were found to remain positive and significant at the 10% level even after five days from the announcement day.

Finally, further expansions of this paper would include an empirical assessment of the relative importance of the value factors discussed in Section 2 on the CARs of individual companies, as well as, an assessment of long term performance of the parent companies undertaking an equity carve-out.

APPENDIX

Ref. no.	Filing date	Subsidiary	Parent Company	% owned before	% owned after	Proceeds ($ mil)
10	03/15/1995	Red Lions Hotels(Red Lion Inn)	Red Lion Inns LP	100.0	69.7	133.0
11	08/27/1999	Next Level Communications	General Instrument Corp	91.6	81.7	170.0
12	08/27/1997	Priority Healthcare Corp	Bindley Western Industries Inc	100.0	83.6	29.0
15	10/11/1996	BA Merchant Svcs(BankAmerica)	BankAmerica Corp	100.0	68.3	173.6
16	11/06/1997	Dollar Thrifty Automotive	Chrysler Corp	100.0	NA	461.3
25	07/16/1999	Homeservices Com Inc	MidAmerican Energy Holdings Co	95.2	65.0	48.8
26	01/20/2000	America Online Latin America	America Online Inc	53.8	42.8	200.0
29	04/12/1996	DuPont Photomasks Inc	EI du Pont de Nemours and Co	100.0	72.0	68.0
30	07/29/1998	Conoco(EI du Pont de Nemours)	EI du Pont de Nemours and Co	100.0	69.5	3963.1
37	12/20/1995	Sterling Commerce	Sterling Software Inc	100.0	84.0	240.0
40	09/18/1998	Infinity Broadcasting Corp	Columbia Broadcasting System	100.0	83.3	2439.5
41	07/24/1996	XLConnect Solutions Inc	Intelligent Electronics Inc	100.0	82.1	43.5
42	06/22/1995	ThermoSpectra(Thermo Instr)	Thermo Instrument Systems Inc	85.7	75.0	21.0
43	01/16/1996	ThermoQuest Corp	Thermo Instrument Systems Inc	100.0	93.7	45.0
44	04/15/1997	Metrika Systems Corp	Thermo Instrument Systems Inc	84.0	63.0	31.0
45	01/30/1998	ONIX Systems Inc	Thermo Instrument Systems Inc	87.0	68.0	47.9
54	10/17/1997	Thermo Vision(Thermo Inst)	Thermo Optek Corp	93.0	80.0	8.1

Ref. no.	Filing date	Subsidiary	Parent Company	% owned before	% owned after	Proceeds ($ mil)
57	01/04/1995	HCIA Inc(AMBAC Inc)	AMBAC Inc(Citibank/Citicorp)	95.9	72.5	24.5
61	01/17/1995	PMI Group Inc	Allstate Corp	100.0	38.6	654.5
63	08/08/1996	Sabre Group Holdings(AMR Corp)	AMR Corp	100.0	82.2	436.3
64	07/16/1997	NewCom Inc(Aura Systems Inc)	Aura Systems Inc	94.0	75.0	19.0
65	04/15/1996	Aviation Sales Co	Aviall Services Inc(Aviall)	100.0	NA	61.8
67	09/24/1998	barnesandnoble.com Inc	Barnes & Noble Inc	100.0	82.2	450.0
69	07/02/1998	uBID Inc	Creative Computers Inc	100.0	82.3	23.7
70	05/26/1998	Convergys(Cincinnati Bell)	Cincinnati Bell Inc	100.0	91.3	156.0
71	01/20/2000	Cabot Microelectronics Corp	Cabot Corp	100.0	82.6	80.0
72	11/13/1996	CarMax Group(Circuit City)	Circuit City Stores Inc	100.0	77.5	361.8
73	09/25/1998	Prodigy Communications Corp	Carso Global Telecom	65.3	49.6	120.0
74	05/07/1999	Engage Technologies Inc	CMGI Inc	93.5	81.6	90.0
76	09/12/1996	Commodore Separation Tech	Commodore Environmental Svcs	100.0	87.0	7.7
77	12/13/1999	Palm Inc(3Com Corp)	3Com Corp	100.0	94.3	874.0
78	10/23/1995	Ascent Entertainment Group Inc	COMSAT Corp	100.0	82.8	75.0
79	09/09/1997	Electric Lightwave Inc	Citizens Communications Co	100.0	82.8	102.4
83	04/04/2000	eFunds Corp	Deluxe Corp	100.0	87.9	71.5
84	03/19/1998	Unigraphics Solutions Inc	Electronic Data Systems Corp	100.0	98.4	56.0
85	03/15/1999	Azurix Corp	Enron Corp	NA	NA	556.3
86	05/04/2000	Axcelis Technologies Inc	Eaton Corp	NA	NA	341.0
87	08/18/1995	Investors Financial Services	Eaton Vance Corp	100.0	NA	33.0
88	02/09/1996	Associates First Capital Corp	Ford Motor Co	100.0	80.7	1651.6

Ref. no.	Filing date	Subsidiary	Parent Company	% owned before	% owned after	Proceeds ($ mil)
89	02/28/1997	Hertz Corp(Ford Motor Co)	Ford Motor Co	100.0	49.4	438.5
90	08/26/1996	Metris Companies Inc	Fingerhut Cos Inc	100.0	83.0	45.3
92	01/12/1996	First USA Paymentech Inc	First USA Inc	94.6	79.0	85.7
93	11/16/1998	Delphi Automotive Systems Corp	General Motors Corp	100.0	82.3	1445.0
94	07/14/1999	Golden Telecom Inc	Global TeleSystems Group Inc	100.0	66.0	55.8
95	12/20/1995	Suburban Propane Partners LP	Hanson PLC	62.0		384.4
96	06/06/1997	Avis Rent A Car Inc	Avis Inc(HFS Inc)	100.0	30.0	265.2
98	09/10/1999	Retek Inc(HNC Software Inc)	HNC Software Inc	100.0	87.9	82.5
99	02/20/1996	CompuServe Inc(H&R Block)	H&R Block Inc	100.0	82.3	384.0
100	08/16/1999	Agilent Technologies Inc	Hewlett-Packard Co	100.0	84.1	1818.0
102	05/07/1996	Ryerson Tull Inc	Inland Steel Industries Inc	100.0	86.7	66.8
103	02/05/1999	NetObjects Inc	IBM Corp	76.0	57.6	72.0
104	04/05/1996	Southern Pacific Funding,OR	Imperial Credit Industries Inc	100.0	62.6	85.0
105	04/27/1999	Digex Inc	Intermedia Communications Inc	100.0	98.0	170.0
106	06/13/1996	Integrated Living Communities	Integrated Health Services Inc	100.0	37.3	33.6
107	12/08/1995	Intercardia Inc(Interneuron)	Interneuron Pharmaceuticals	88.3	63.7	33.0
110	04/12/1999	US Search Corp.com	Kushner-Locke Co	86.0	55.2	54.0
111	08/01/1995	Midwest Express Holdings Inc	Kimberly-Clark Corp	100.0	30.0	81.0
112	04/04/1995	Borders Group Inc	K Mart Corp	100.0	13.0	416.5
113	09/01/1995	DST Systems Inc	Kansas City Southern Inds Inc	100.0	47.0	369.6
114	03/15/1996	American States Financial Corp	Lincoln National Corp	100.0	83.0	184.0
115	05/23/1995	Intimate Brands Inc(Limited)	Limited Inc	100.0	84.0	578.0

Ref. no.	Filing date	Subsidiary	Parent Company	% owned before	% owned after	Proceeds ($ mil)
116	07/17/1996	Abercrombie & Fitch Co	Limited Inc	100.0	86.0	89.6
117	08/08/1995	Diamond Offshore Drilling Inc	Loews Corp	100.0	74.0	249.6
118	12/22/1995	Dialysis Corp of America	Medicore Inc	99.1	67.0	3.8
119	04/14/2000	Stratos Lightwave Inc	Methode Electronics Inc	100.0	86.1	183.8
120	10/18/1999	Xpedior Inc	Metamor Worldwide Inc	99.6	82.6	162.2
121	09/23/1999	Expedia Inc	Microsoft Corp	100.0	84.7	58.2
122	09/23/1999	McAfee.com Corp	Network Associates Inc	100.0	85.2	75.0
123	08/14/1998	Fox Entertainment Group Inc	News Corp Ltd	37.5	31.2	2386.8
124	03/20/1995	HealthPlan Services Corp	Noel Group Inc	59.7	43.5	49.0
125	03/21/1996	Cerion Technologies Inc	Nashua Corp	100.0	45.3	49.9
126	09/09/1996	Genetic Vectors Inc	Nyer Medical Group Inc	74.9	33.9	5.0
128	12/23/1996	ATL Products Inc(Odetics)	Odetics Inc	100.0	82.9	18.2
131	04/21/1999	American National Can Group	Pechiney SA	100.0	45.5	510.0
133	01/08/1999	Pepsi Bottling Group Inc	PepsiCo Inc	100.0	35.4	1955.0
134	12/20/1996	Nexar Technologies Inc	Palomar Medical Technologies	87.4	67.7	22.5
135	12/17/1996	Chicago Bridge and Iron Co NV	Praxair Inc	100.0	8.7	151.2
137	03/07/1996	Metromail Corp	RR Donnelley & Sons Co	100.0	41.7	196.8
138	08/14/1996	Donnelley Enterprise Solutions	RR Donnelley & Sons Co	100.0	42.8	71.5
139	06/02/1997	Eagle Geophysical Inc	Seitel Inc	100.0	18.9	100.0
141	04/21/1998	MIPS Technologies Inc	Silicon Graphics Inc	100.0	85.2	77.0
143	02/05/1996	Lucent Technologies Inc(AT&T)	AT&T Corp	100.0	82.4	2647.0
144	02/20/1996	American Portable Telecom Inc	Telephone and Data Systems Inc	100.0	82.8	166.6

Ref. no.	Filing date	Subsidiary	Parent Company	% owned before	% owned after	Proceeds ($ mil)
145	02/01/1996	Thermo Sentron Inc(Thermedics)	Thermedics(Thermo Electron)	100.0	74.0	40.0
146	01/02/1998	Waddell & Reed Financial Inc	Torchmark Corp	100.0	66.0	399.3
147	03/29/1996	Trex Medical Corp(ThermoTrex)	Thermo Electron Technologies	92.3	80.0	35.0
148	06/26/1996	TransAct Technologies Inc	Tridex Corp	100.0	82.4	9.8
150	08/04/1995	Union Pacific Resources Group	Union Pacific Corp	100.0	84.5	621.6
153	04/06/1995	US Order Inc	WorldCorp Inc	88.0	65.0	56.8
154	04/09/1999	Williams Communications Group	Williams Cos Inc	100.0	86.0	544.6
155	09/13/1996	Midway Games Inc(WMS Indus)	WMS Industries Inc	100.0	86.8	102.0
157	01/27/1998	Omega Protein Corporation	Zapata Corp	100.0	64.1	136.0

Data source: Lexis-Nexis (2005).

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