Discussion Paper No. 14

Does Partnering Pay Off? - Stock Market Reactions to Inter-Firm Collaboration Announcements in Germany

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December 2004

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DOES PARTNERING PAY OFF?—STOCK MARKET REACTIONS TO INTER-FIRM COLLABORATION ANNOUNCEMENTS IN GERMANY

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ABSTRACT: The dramatic increase in interorganizational partnering in the last two decades raises questions for scholars and managers regarding the value impact of inter-firm collaborations. Using event study methodology, this paper tests whether stock market reactions differ when a collaboration formation or termination is announced. In addition, the study provides an in-depth analysis of potential determinants of stock market reactions to collaboration formation announcements. The sample consists of 1037 announcements in German stock markets from 1997 to 2002. The results show that an unexpected termination announcement decreases firm valuation, and a formation announcement increases firm valuation. Further, certain collaborations are more favorable than others, depending on firm industry, age, size, collaboration constellations, and equity versus non-equity investment in partner firm. The results open avenues for further research on partnering strategies.

KEYWORDS: Firm valuation, inter-firm collaboration, expectations, stock market reactions

JEL CLASSIFICATION: G 14, L 22, D 23

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1 Introduction and motivation

Inter-firm collaboration activity increased dramatically within the last two decades (Hergert & Morris, 1988; Hagedoorn, 1990; Badaracco, 1991; Gulati, 1995; Harbison & Pekar, 1998; Audretsch, 2001). According to Deering et al. (2003), firm collaborations account for 25% of turnover in 2002 of the largest US companies. By 2004, an increase of up to 40% is expected. Whereas for decades, management literature mainly concentrated on hierarchical and market organization, the cooperative interorganization as an intermediate hybrid form (Williamson, 1985) is attracting more and more interest. Drucker (1995) considers this the greatest change in the way corporate structure and business is conducted. Teece (1992, 24) evaluates collaborative organizational forms as a "new and dramatic organizational innovation".

The popularity of partnering suggests that entering inter-firm collaborations enhances the competitive position of the respective partners and thus increases their firms' values. Theories like resource-based view, transaction cost theory and signaling theory provide arguments for the attractiveness of collaborations. However, despite the last 20 years of research on collaborations, little is known about the value firms receive from such collaborations.

This paper focuses on stock market reactions to inter-firm collaboration announcements. It is assumed that the price change of a stock to published information on a firm's collaboration is directly attributable to the change in firm value as perceived by market participants. Using event study methodology,[1] I analyze collaboration announcements from firms listed at German stock markets, which were published in the years 1997 to 2002. The study provides an in-depth analysis of potential determinants of stock market reactions to collaboration formation announcements. While most other studies have used samples with a few hundred observations, this paper uses a far more comprehensive database of 1037 announcements. The German stock market is particularly well suited for this kind of study because issuers must immediately publish stock

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[1] Some scholars have expressed concerns about the validity of stock market reactions as a measure of the success of a strategic event (e.g. Porter 1987; Ravenscraft & Scherer, 1987). However, Koh & Venkatraman (1991) tested for convergent validity between a stock market reaction following a joint venture announcement and managerial assessment. Their results suggest that stock market signals and managerial assessments are convergent measures of success.

price relevant information and 99% of this information is published over electronic systems. Finally, the paper differs from previous work in analyzing both a period of a more bullish market from 1997 until March 2000 and a period of a more bearish market from April 2000 to the end of 2002.

The paper examines stock market reactions to inter-firm collaboration announcements pursuant to section 15 of the German Securities and Trading Act (WpHG). For the purpose of this study, inter-firm collaborations are defined as a voluntary, formal, cooperative agreement between two or more organizations involving either a pooling or trading of resources, linked with or without shared equity.[2]

The paper is organized as follows. Section 2 describes the overall value-creating mechanisms of inter-firm collaborations and discusses the hypotheses. Section 3 presents the research design. In section 4, the empirical results of the event study and of the multivariate analysis are reported. Section 5 concludes.

2 Inter-firm collaborations as value-creating mechanisms

2.1 Previous studies

Previous studies have used different approaches to examine the importance of inter-firm collaborations for firm success. These studies provide mixed results. Some scholars explore the impact of collaborations on firm survival. Whereas Baum & Oliver (1991), Uzzi (1996), and Miner et al. (1990) find that interorganizational linkages are positively related to firm survival, Schoonhoven & Lyman (2000) find no survival benefits for new semiconductor firms.

Recently, studies looked at the influence of (prominent) partnerships on IPO success by analyzing venture-capital-backed biotechnology firms. In their study of 301 firms, Stuart et al. (1999) report that firms with prominent collaboration partners go faster to IPO and earn greater valuations. However, in their sample of 858 biotechnol-

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[2] The definition is consistent with the large majority of papers in this field (see Parkhe, 1993; Gulati, 1995; Schoonhoven & Lyman, 2000). Joint ventures are excluded as a special form of cooperation in which partners form a new corporate entity separate from the parent organizations (Kogut, 1988; Hauswald & Hege, 2002).

ogy firms, Gulati & Higgins (2003) find no relation between partnerships and IPO success.

Another stream of studies used event study methodology to examine stock price responses to collaboration announcements. Chan et al. (1997) discover a significant positive stock price response in their sample of 345 non-equity collaborations announced in the USA from 1983 to 1992. The finding is consistent with Neill et al. (2001) analyzing 89 non-equity collaborations in the information and technology sector published in the USA from 1987 to 1994. Das et al. (1998) report no significant market reactions to marketing cooperaton announcements, but a positive significant reaction to technology collaborations in their sample of 119 announcements in the USA from 1987 to 1991. As a point of departure from these studies, this paper uses event study methodology to explore the impact of inter-firm collaboration on firm value.

2.2 Theoretical framework

Theory provides several explanations why collaboration occur and in what way they influence firm value. The most common theories are the resource-based view, transaction cost theory, and signaling theory in the form of interorganizational endorsement. The resource-based view posits that inter-firm collaborations can be seen as a source of new resources (Pfeffer & Salancik, 1978; Wernerfeldt, 1984). The resource basis of a firm as an indicator of its rent-generating capability (Penrose, 1959) may be enhanced by resources acquired through collaborations. Hence, collaborations serve as a source of access to resources of various kinds, resulting in an increase in firm value (Gulati, 1995; Gulati et al., 2000).

From the perspective of transaction cost theory, collaboration may be the least costly form of governance (Coase, 1937; 1960; Williamson, 1985) and therefore the most favourable coordination mechanism.[3] Researchers also argue that collaborations provide organizational flexibility and allow rapid repositioning to changing demands

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[3] Arguments of resource-based view and transaction cost economics have most often been used independently to understand inter-firm collaborations. Recently, efforts have been made toward an integrative perspective combining elements of transaction cost theory and the resource-based view (e.g. Madhok & Tallman, 1998; Madhok, 2000).

and industry structure (Badaracco, 1991; Porter & Fuller, 1986; Mody, 1993; Das et al., 1998), which helps to reduce future transaction costs.[4] With collaborations, a hybrid form between markets and hierarchies (Williamson, 1985; Hennart, 1988; Gulati, 1995), becoming increasingly popular, the well-known "make or buy decision" has been turned into a "make or buy or cooperate decision."

Finally, interorganizational relationships can act as a positive signal of endorsement to third parties (Podolny, 1994; Podolny et al., 1996; Stuart et al., 1999), especially for young and small companies (Carter & Manaster, 1990; Baum, 1996; Gulati & Higgings, 2003; Stuart et al., 1999). Market participants evaluate firms based on their own experience with the focal company or its observable quality. If the market actor has not dealt with the firm before, and/or the quality cannot be observed directly, other "references" have to be taken into account. One relevant signal is the firm's network and its evaluation through the attributes of exchange partners. The three presented theories shape the following hypotheses.

2.3 Hypotheses

Overall reaction to formation and termination announcements

These three theories – resource-based view, transaction cost view, and signaling theory – suggest that there should be a positive relation between the announcement of collaboration and the perception of the value of firms. This line of reasoning leads to the first proposition:

H1: The formation of an inter-firm collaboration results in a positive stock market reaction, indicating an increase in firm value.

Correspondingly, if the unexpected termination of a partnership is announced, a decrease in firm value would be anticipated. Even when potential synergies of an inter-firm collaboration are present, changing competitive environments or management failures can lead to inefficiencies and the breakdown of the collaboration. Presumably, not all information about negative developments is captured by the stock market, and there-

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[4] Transaction costs are the costs of negotiating, planning, monitoring and controlling exchange transactions under the assumption of contractual inefficiencies (Jensen & Meckling, 1991; Picot, 1991; Milgrom & Roberts, 1992).

fore the announcement of a collaboration termination contains negative news which then lead to a reduction of the stock price.

H2: The unexpected termination of an inter-firm collaboration results in a negative stock market reaction, indicating a decrease in firm value.

The effect of partnering by industry type

As emphasized by several researchers, the importance of cooperation depends on the industry structure in which the focal firm operates (e.g. Harrigan, 1985; Hagedoorn, 1993). Technology-intensive firms (e.g., computers, software, semiconductors, biotechnology) tend to be more collaborative than low-technology firms (Harrigan, 1985; Mody, 1993). In the fast-changing and knowledge-intensive high-technology industry, collaborations are often the fastest and least cost-intensive way to acquire the resources necessary for keeping pace with competitors (Mowery et al., 1996).

Moreover, since the assessment of technologies can be complex and resource-consuming, evaluating firm quality is very difficult for market players. Therefore, they will pay more attention to favorable evaluations, as signaled by a cooperation announcement. These considerations comply with the findings of Chan et al. (1997) who detect a significant average abnormal return for high-technology firms on the collaboration announcement day, whereas low-technology firms do not experience significant abnormal returns. Based on this line of reasoning, the third hypothesis follows:

H3: Inter-firm collaboration announcements of firms operating in the high-technology sector result in a higher positive stock market reaction than among low-technology firms.

Particularities of young and small firms

Consistent with the theoretical underpinnings of the resource-based view and signaling theory, collaborations are very important for a young company's ability to attract necessary resources and overcome the legitimacy liability of having a short track record (Schoonhoven & Lyman, 2000; Stuart et al., 1999; Baum & Silverman, 1999). Whereas established companies are often well known and have various possibilities of acquiring necessary resources, young firms' inter-firm collaborations may be crucial to survival. Although, the transaction cost approach offers differing arguments whether the effect of age on the value of collaboration for firms is positively or negatively. On the one side it can be argued that older firms have more experience with collaborations and

might be able to less costly accomplish the transaction, on the other side older firms have established organizational routines and are embedded in various contractual arrangements that might make it more complex and costly to incorporate a new collaboration into the administrative machinery. I presume that the proposition of the resource-based view and signaling theory preponderate the conflicting arguments of the transaction cost approach and therefore hypothesize that collaboration announcements of young firms are more stock-price–relevant than collaboration announcements of established firms.

H4: The age of the announcing firm is negatively correlated with the extent of positive stock market reactions to collaboration formation announcements.

Size is another empirically robust indicator for uncertainty about the quality of a firm (Beatty and Ritter, 1986; Gertler & Gilchrist, 1994). Economic agents have to rely heavily on signals because little public information on a small firm's history and strategy tends to be available. This leads to the conclusion that market agents react more on signals of small firms than they do of large firms. Empirical studies show that, measured on both a risk-adjusted and an unadjusted basis, small firms tend to have higher and more volatile stock returns than large firms (Banz, 1981; Reinganum, 1981; Zarowin, 1989; Fama & French, 1992). In a 1988 event study, Fama & French find that returns are less sensitive to variations in dividend yields on a portfolio that puts more weight on large firms than on an equal-weighted portfolio.

The literature offers conflicting arguments when the effects of collaboration announcements on small and large companies are compared. According to Hagedoorn & Schakenraad (1994), potential profit from partnering is higher for large companies because successful partnering requires effective organization, which is usually only available to large firms. Similarly, Simonin (1997) suggests that to gain value from inter-firm collaborations, disposable resources, expertise, and market power are required. Other researchers emphasize that small firms are characterized by high flexibility, which enables them to better leverage collaboration potential (Das et al., 1998). Teece (1992, 4) states that "cooperative agreements can enable smaller firms to emulate many of the functional aspects of large integrated enterprises, without suffering possible dysfunctions associated with large size." Further, large firms often experience greater iner-

tia due to their often exorbitant administrative machinery, which leads to inefficiencies (Van de Ven et al., 2000).[5]

A negative correlation between size and value effects of partnering is presumed, leading to the following hypothesis:

H5: Firm size of the announcing firm is negatively correlated with the extent of positive stock market reactions to inter-firm collaboration formation announcements.

Collaboration constellations

In addition to the size of the announcing firms, partner attributes are also influencing the value mark-up of collaboration formation announcements. It is expected that a small firm announcing a partnership experiences a different stock market reaction if the partner is also a small firm than if the partner is a large firm. The last constellation is power unbalanced and therefore "asymmetrical". Some researchers argue that this asymmetrical relationship is a very complex and risky endeavor for the small partner (Doz, 1998; Schoonhoven & Lyman, 2000).[6] However, a relationship with a large partner may convey that a firm has earned a positive evaluation from an influential market player. In addition, a large firm possesses a large resource pool to which the small firm may get access to. Therefore a higher positive reaction on the stock market is predicted compared to the other constellation, which leads to hypothesis 6:[7]

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[5] Indeed, Aldrich & Auster (1986, 183) emphasize: "The obstacles faced by new, small organizations can be easily overcome by larger, more established organizations, whereas the constraints faced by larger, more established organizations can often be easily surmounted by new, small organizations."

[6] Power asymmetry exacerbates relevancy differences in the strategies of weaker and stronger partners in inter-firm collaborations (Harrigan, 1985; Borys & Jemison, 1989). Most often, the weaker firm is more dependent on the success of the collaboration. Weak firms face serious difficulties, i.e., when the collaboration needs unplanned, additional resources or the project plan is in delay. In addition, the weaker firm risks exploitation because the control over major decisions and property rights is often in the hands of the empowered firm (Lerner & Merges, 1998).

[7] In this paper, I do not test if a small firm that enters a partnership with a large firm experiences a higher positive stock market reaction than the large firm. Chan et al. (1997) collected pairwise stock market data and found that the smaller partner firm shows a significant positive stock market reaction, whereas the larger partner shows no significant positive reaction. However, Neill et al. (2001) reported that the extent of positive stock market reaction does not differ between the larger and smaller partner.

H6: A small firm announcing an inter-firm collaboration with a large partner experiences a higher positive stock market reaction than a small firm announcing an inter-firm collaboration with another small firm.

Collaboration attributes

Hypothesis 7 suggests that a different effect is anticipated when a collaborative agreement between partners is combined with equity ties of one or both partners as compared to a collaboration without equity ties. Equity ties may signal a higher commitment and an "additional level of confidence" in the partnership (Stuart et al. 1999, 320).

Another reason for combining partnering and ownership may be that this configuration is better equipped to deal with contractual inefficiencies. It is not possible to contractually specify all the terms of a relationship. However, firms may refrain from opportunistic action when the partner is a shareholder. Aghion and Tirole (1994) show in several models with relationship-specific investments by both parties that the optimal solution is one with partial ownership of an upstream firm by a downstream firm. Allen and Phillips (2000) demonstrate that abnormal returns are largest when an inter-firm collaboration announcement is combined with one partner taking an equity stake in the other.

Based on this line of reasoning, the hypothesis is as follows:

H7: Inter-firm collaboration announcements linked with an equity investment result in higher stock market reactions than collaborations without an equity investment.

3 Research design

3.1 Sample and data

This study is based on *ad hoc* notifications of inter-firm collaborations pursuant to section 15 German Securities Trading Act (WpHG) in German stock markets from 1997 to 2002.[8] Since 1995, issuers must immediately publish any information that (1) comes within their sphere of activity and (2) is not publicly known, if such information is likely to exert influence on the stock exchange price of the admitted securities be-

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[8] Compliance with this act is monitored by the Federal Financial Supervisory Authority (BAFIN).

cause of the effect on the assets, financial position, or general trading position of the issuer. In Germany, electronic systems publish 99% of notifications fast and efficiently.[9]

One thousand one hundred and fifty-seven collaboration notifications were published in the relevant time period.[10] Thompson Financial Datastream data were used to obtain stock prices of firms that announced a partnership within the observation period. Ten *ad hoc* announcement items were excluded because of data unavailability. Another 109 news items were excluded because the common stock returns of the announcing firm were not available on the daily returns file for a period beginning 64 trading days prior to the announcement of the collaboration.[11] Hence, the sample consists of 1037 *ad hoc* news items.

3.2 Method of analysis

3.2.1 Calculating abnormal returns

The market value of a firm is the expected sum of discounted value of future cash flows (Brealey & Myers, 1988). The firm value adjusts when stock market receives information that changes the market expectations on the amount of future cash flow.

Using event study methodology, I analyze whether there is an "abnormal" stock reaction associated with unanticipated *ad hoc* news items concerning inter-firm collaborations (for the procedure see Brown & Warner, 1985; Watts, 1973). Three conditions must be satisfied in order to apply this methodology. First, the efficient market hypothesis which claims that "(…) prices always 'fully' reflect available information (…)" must hold (Fama 1970, 383; see also Fama et al., 1969). Thus, stock prices should adjust instantaneously to the announcement of an event. Second, the event must be unanticipated, i.e., the market must not have any information on the event before the an-

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[9] Once the ad hoc announcement is issued, it takes on average only 30 minutes for the public to receive the information via electronic services. Announcements in US stock markets are subject to more heterogeneous timing. Hence, the German ad hoc announcements provide an interesting empirical lens for studying the impact of new information. See also footnote 13.

[10] The appendix contains table A.1 which compares the overall incidence of ad hoc announcements to the incidence of announcements which inform about an inter-firm collaboration agreement.

[11] The study uses daily stock prices from Thompson Financial Datastream that are adjusted for subsequent capital actions, dividend payment, and stock splits. The estimation period (60 days prior to the announcement day) is important for calculating the abnormal stock returns. See chapter 3.2.1.

nouncement. Finally, it must be possible to eliminate other effects in order to calculate how specific information influences firm value, i.e., confounding news must be eliminated (McWilliams & Siegel, 1997).

The impact of an event on the value of a firm's stock is assessed by calculating the difference between the actual and expected returns on the stock during a relevant period surrounding the event, which is called the event period. To obtain the expected return as defined by McWilliams & Siegel (1997), the rate of return on the share of firm i on day t (R_{it}) is regressed against the rate of return on a market portfolio of (R_{mt}) on day t:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \qquad (1)$$

where

R_{it} = the rate of return on the share price of firm i on day t,

R_{mt} = the rate of return on a market portfolio of stocks on day t,

ε_{it} = the error term, with $E(\varepsilon_{it} \mid R_{mt}) = 0$.

The estimated coefficients $\hat{a}_i$ and $\hat{b}_i$ from the OLS-regression of R_{it} on R_{mt} over a given estimation period are used to calculate the daily abnormal return *(AR)* of firm i using the equation:

$$AR_{it} = R_{it} - (\hat{a}_i + \hat{b}_i R_{Mt}) \qquad (2)$$

In this study, the event day is the day on which the announcement is published, unless the announcement is released after the stock exchange closing time. In that case, the following day is classified as event day.[12] The selection of the event period is one of the most critical issues in using event studies. In the literature, the length of the event period varies enormously, e.g. from 9 months (e.g. Davidson & Worrell, 1992) to 2 days (e.g. Koh & Venkatraman, 1991). Several researchers recommend using a small window, because (1) a long event window severely reduces the power of the test statistic (Brown & Warner, 1985); (2) the market efficiency hypothesis states instantaneous stock price reactions to events; and (3) the assumption of stationary parameters becomes

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[12] The stock exchange closing time changed twice during the observation period.

less plausible by use of a long event window (McWilliams & Siegel, 1997). Moreover, Mitchell & Netter (1989) report a stock market reaction within 90 minutes, and Dann et al. (1977) within 15 minutes following the announcement of information. In the case of collaboration announcements, I expect that the stock price adjusts within the announcement day.[13]

The event period as the period to capture the excess return must be differentiated from the estimation period that is used to estimate the parameters. To estimate the daily market model parameters for each firm, an estimation period of 60 trading days beginning with 64 days prior to the event and ending 5 days prior to the event is used. The relevant market index for each firm follows from the stock index affiliation; for firms

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[13] Publication of significant events differs between Germany and the USA. In Germany, the announcement of *ad hoc* news is nationwide regulated since 1995 (see section 15 German Securities and Trading Act). Stock listed companies are required to *immediately* disclose "private" information that is likely to have a material effect on the valuation of the issuer. The vast majority of *ad hoc* news items are published immediately over the electronic system of DGAP (Deutsche Gesellschaft für Ad-hoc-Publizität mbH), which enters the news directly in the editorial systems of Reuters, vwd (Vereinigte Wirtschaftsdienste GmbH) and Bloomberg. In the USA "material" information is differently published between the Self-Regulatory Organizations (e.g. NYSE). For instance the NYSE claims that many "NYSE rules" are more stringent than those of other Self-Regulatory-Organizations (NYSE, 2004). In the USA events are often made public through electronic systems (Edgar, Reuters, Bloomberg) or The Wall Street Journal. The majority of previous event studies use data from the USA. Most researchers collected news items based on an announcement in The Wall Street Journal. Several studies use an event period that includes the event day and the preceding trading day, because the first documented announcement occurs often on the day before the event appears in the journal (e.g., McConnell & Nantell, 1985, Woolridge & Snow (1990)). Within the last few years the U.S. Securities of Exchange Commission (SEC) introduced two significant changes regarding publication behavior. Until October 2000 many US stock listed firms practiced "selective disclosure", in which firms give material information only to a few selected analysts and institutional investors prior to disclosing it publicly. This behavior was widely criticized and finally stopped by the SEC taking effect in October 23, 2000 with the "Regulation Fair Disclosure Rule". From now on "material information" has to be made publish within *five business days*, whereby the mechanism of publishing has not been standardized (SEC, August 15, 2000, File No.: S7-31-99: "the required public disclosure may be made by filing or furnishing a Form 8-K, or by another method or combination of methods that is reasonably designed to effect broad, non-exclusionary distribution of the information to the public." Taking effect on August 24, 2004 the SEC expands the list of reportable events and shortens the deadline for most items from five to *four business days* within the news have to be widely published (SEC, March 16, 2004 File No.: S7-22-02).

belonging to the DAX, the DAX index is used; for firms listed at the Neuer Markt, the NEMAX ALL Share-index is used; and for the remaining firms, the CDAX index is adopted.

Multivariate analysis

To address the research questions concerning the influence of size, age, and collaboration characteristics on the extent of abnormal returns to collaboration announcements, I conduct a multivariate analysis. The power of this method is that it allows ceteris paribus interpretations (e.g. Wooldridge, 1999).

After estimating the model with all control variables, I check for over fitting. Controlling for too many variables does not mean that the calculated coefficients of such a specification are biased, but that they are less precise than without the inclusion of statistically irrelevant variables. Dependent variables or control variables that satisfy all of the following criteria are therefore excluded in the optimized model:

a) the coefficients of the variables are individually insignificant,

b) the Wald test for joint significance of all variables of the same type is insignificant.

Measures

In the following sections, I briefly describe the variables used in the multivariate analysis.

Dependent Variable

The dependent variable is the abnormal return at the event day. The variable results from the event study. The sample excludes termination announcements and announcements with confounding news.

Independent Variables

Testing the hypothesis, the following independent variables are used:

High-technology versus non-high–technology

The variable high-technology is coded 1 if the observation relates to high-technology firms, 0 otherwise. Firms are classified as high-technology if they belong to the following groups as classified by the Federal Financial Supervisory Authority

(BAFIN) industry classes: biotechnology, internet, IT services, software, technology, and telecommunication.[14]

Age

Since the founding date was not available in all cases, the days since the firm is listed at the stock market is used as a proxy variable for the age of the announcing firm. The variable is calculated by taking the logarithm of the number of days between the first day the firm is listed on the stock market and the announcement day.[15]

Size

In this study, size is measured as the logarithm of the market value of stocks on the third trading day preceding the announcement.

Collaboration constellations

Five dummy variables are constructed to show differences among collaboration constellations. A firm is classified as small when its market capitalization on the event day is ranked below the median of the market capitalization of all other firms in the sample. I use this approach to exclude the effects of cold and hot markets on the market value of stocks. A ranking is more stable than the volatile market capitalization. The relative partner size was extracted from the full text of the *ad hoc* news items published by the announcing firm pursuant to section 15 of the German Securities Trading Act (WpHG). In cases where less information was provided, a website search was conducted for information about firms' annual accounts. Collaborations that cannot be clearly assigned to one group are classified in the subgroup "others."

- "Small - small" = 1 if a small firm announces an inter-firm collaboration with another small firm, 0 otherwise. This group will serve as the reference case.

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[14] Firms are classified as low-technology if they belong to the following groups: automobile/transportation and logistics; banking; construction; basic resources; financial services; industrial; retail/consumer cyclical/food and beverages; machinery; entertainment; utilities; others. The classification corresponds with the Business Week's and the Federal Financial Supervisory Authority's industry classification system.

[15] This proxy variable needs to be considered with caution, since the mean time from incorporation to public offering decreased within the last decades. Therefore, the proxy is expected to underestimate the age of older firms compared to younger ones.

- "Small - large" = 1 if a small firm announces an inter-firm collaboration with a large firm, 0 otherwise,

- "Large - large" = 1 if a large firm announces an inter-firm collaboration with another large firm, 0 otherwise,

- "Large - small" = 1 if a large firm announces an inter-firm collaboration with a small firm, 0 otherwise,

- "Others" = 1 if a clear assignment to the other groups was not possible, 0 otherwise.

Equity investment

The model includes three dummy variables for inter-firm collaborations that are associated with equity investments:

- "Investment of focal firm" = 1 if the announcing firm invests in the partner firm, 0 otherwise,

- "Investment of partner firm" = 1 if the partner firm invests in the announcing firm, 0 otherwise,

- "two-way investment" = 1 if the equity investment is two-way, 0 otherwise.

The reference case is an observation without equity investment.

Control variables

A number of variables known or expected to affect the value mark-up of an inter-firm collaboration announcement but not contained in the discussion of the hypotheses are added as controls. I include a dummy variable for partner location. Some scholars argue that non-domestic collaborations are in more danger of failure stemming from cultural distances (Schoonhoven & Lyman, 2000). However, entering collaborations with a non-German firm shows that the interest in the focal firm spans nations. Moreover, such international partnerships signal a higher growth potential for the announcing firm.

To control for the effect of being listed in a relatively new market segment, I include a dummy variable to separate firms listed at the Neue Markt from firms listed in other market segments. The Neue Markt, founded in March 1997, was a market segment for high growth and technology firms with more stringent governance principles

for market participants.[16] Severe loss of confidence in high-technology stocks after the global slump and a string of corporate scandals resulted in the early dissolution of this stock segment on March 21, 2003.

According to Gulati & Higgins (2003), investors observe signals during bullish markets differently from signals during bearish markets. In their recent study, Pástor & Veronesi (2003) report that IPO waves are preceded by an increased disparity between new and established firms in terms of their valuations and return volatilities. During the observation period, stock market conditions changed enormously. To capture the effects of temporal trends, a dummy variable is added for each half year of the time period.

Additionally, I control for different types of collaborations. Each collaboration is classified according to whether it can be described as horizontal or vertical.[17] Horizontal collaborations increase market power, whereas with vertical collaborations, firms may attract complementary assets or know-how. Koh & Venkatraman (1991) find that horizontal joint ventures are more productive for the parents than vertical collaborations. Chan et al. (1997) report similar findings looking at collaboration announcements.

Four additional dummies are integrated to differentiate between marketing collaborations, R&D collaborations, licensing collaborations, and announcements that either failed to report the objective or did not clearly specify the purpose for forming the collaboration. Das et al. (1998) report significant differences in the stock market's reaction to technology versus marketing collaborations. Whereas the stock market's reaction to technology collaborations is positive, its reaction to marketing collaborations is statistically indistinguishable from zero in their study.

4 Empirical tests and results

4.1 Abnormal returns due to inter-firm collaboration announcements

Table 1 presents the abnormal returns to collaboration announcements and the standard errors over a time period from two days before to two days after the announcements. The first column identifies the trading day relative to event day zero. The

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[16] Regulation required that all firms listed at the Neuer Markt submit their annual reports either under IAS or US-GAAP.

[17] A dummy variable is integrated for announcements that are not clearly specified as vertical or horizontal.

second column displays the abnormal returns of formation announcements that include confounding news. Column three contains the abnormal returns of pure collaboration formation announcements, and column four reports the abnormal returns of collaboration termination announcements.

The average abnormal return of collaboration announcements with confounding news at the day of the event is 3.8%. In column three it is shown that collaboration announcements without multiples news display a slightly higher excess return of 3.9% at the day of the event.[18] Hence, confounding news items have a small reducing effect on abnormal returns. Possible explanations are: first, collaboration announcements may experience a higher positive effect than announcements of other events which being combined have a smaller effect than the collaboration announcement alone; and second, collaboration announcements as positive information about a firm are likely combined with negative news to dilute the expected negative stock market reaction.

The results show that the formation of an inter-firm collaboration results in positive abnormal stock returns, indicating an increase in firm value.[19] The abnormal returns on the announcement day are highly significant in both samples. Other studies find a lower effect of collaboration announcements on stock market prices. In their study of 345 collaboration announcements of US firms from 1983 to 1992, Chan et al. (1997) report an abnormal stock market return of 0.64% at the event day. In their study of 119 collaboration announcements in the USA from 1987 to 1991, Das et al. (1998) discover only a significant (10% level) positive abnormal return of 0.5% at the day of the announcement and the following day together.

Column 4 sheds light on the abnormal return following a collaboration termination announcement. On the announcement day, a significant negative abnormal return of

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[18] Conspicuously, significant negative abnormal rents occur in the days following the event day. Whereas this phenomenon is seen in several event studies, a rational explanation is not found, yet (see for similar market anomalies Kaserer & Ahlers, 2000; Ikenberry et al., 1995). In this study, I find that the results regarding the hypothesis are robust when I use a longer event window (day of the event plus following trading day).

[19] The cross-sectional average (median) of market value increases by about € 6.9 millions in the case of pure collaboration announcements.

4.2% is displayed. The results indicate that the market punishes an unforeseen break-down of an inter-firm collaboration with a decrease in firm value that is on the same order as the gain from the announcement of such collaboration.

Table 1: Abnormal returns

Day index (relative to event day)	Inter-firm collaboration formation (events with confounding news included) Mean abnormal return (n=1011)		Inter-firm collaboration formation (events with confounding news excluded) Mean abnormal return (n=891)		Inter-firm collaboration termination Mean abnormal return (n=26)	
-2	0.005**	(0.002)	0.004*	(0.002)	-0.004	(0.010)
-1	0.001	(0.002)	0.001	(0.002)	-0.033*	(0.023)
0	**0.038**	**(0.004)**	**0.039***	**(0.003)**	**-0.042****	**(0.017)**
1	-0.009***	(0.002)	-0.008***	(0.002)	-0.005	(0.012)
2	-0.004**	(0.002)	-0.004**	(0.002)	0.004	(0.008)
Numbers in parentheses represent associated standard errors. *significant at 10%; ** significant at 5%; *** significant at 1%.						

Industry effects

To get a first impression of industry effects—whether there are differences in excess returns to collaboration formation announcements of high-technology versus non-high–technology firms—the sample without confounding news is divided in two groups. The calculations show a highly significant abnormal return at the event day of 4.7% for high-technology firms (n = 603; standard error = 0.004) and of 2.2% for non-high–technology firms (n = 288; standard error = 0.005). The abnormal return of high-technology firms is 2.5 percentage points higher than for non-high–technology firms. The difference of means test shows statistical significance. Table 2 summarizes the event study outcomes on industry effects. In comparison, in their study of 345 collabo-ration announcements in the US stock market in the years 1983 to 1992, Chan et al. (1997) report a significant average abnormal return of 1.12% for high-technology firms and an insignificant abnormal return of 0.10% for low-technology firms at the event day. Analyzing a sample of 89 US non-equity collaborations in the information and technology sector published in the years 1987 to 1994, Neill et al. (2001) find an ab-normal return of 5.7% at the announcement day.

Table 2: Industry specific abnormal returns and difference of means test

Abnormal returns at announcement day to formation of strategic collaborations	
High-technology firms	**Non-high–technology firms**
Mean abnormal return (n=603)	Mean abnormal return (n=288)
0.047*** (0.004)	0.022*** (0.005)
Difference of means test: t=3.529*** (0.007)	
Numbers in parentheses represent associated standard errors.	
*significant at 10%; ** significant at 5%; *** significant at 1%.	

4.2 Multivariate analysis

Table 3 presents descriptive statistics of the dependent variable and the independent variables.[20] The cross-sectional average abnormal return at the announcement day is 3.9% with a relatively high standard deviation of 10%. The majority of firms operate in the high-technology sector (68%). At the announcement day, the average firm is since 434 days listed at the stock market. The average market capitalization of the firms in the sample is € 166 millions at the third trading day preceding the announcement. The most frequent collaboration constellation is the one in which a large firm publishes collaboration with another large firm (36%). Followed by the constellations in which a small firm announces an inter-firm collaboration with a large firm (20%) or with another small firm (16%). Only 5% of collaboration formation notifications are from large firms that announce an inter-firm collaboration with a small firm. Presumably, this constellation is rarely seen as stock price relevant. The bulk of announced collaborations are without equity ties (93%). Only 1.3% of the collaborations in the sample go along with a two-way investment, 3.5% are combined with an investment of the announcing firm in the partner firm, and 2.6% are combined with an investment of the partner in the announcing firm. The Pearson product moment correlation matrix and the descriptive statistic of control variables are presented in the appendix.

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[20] I restrict the multivariate analysis to explore the determinants of the value mark-up of collaboration formation announcements, because of the small number of termination announcements that appeared in the observation period.

Table 3: Descriptive statistics of dependent and independent variables

Variable	Mean	Std. dev.	Min	Max
Abnormal return	0.039	0.101	-0.930	0.760
High-technology firm	0.677	0.468	0	1
Log (age)	6.072	1.018	4.127	9.299
Log (size)	5.112	1.701	-0.511	12.477
Small firm – small firm	0.163	0.369	0	1
Small firm – large firm	0.201	0.401	0	1
Large firm – small firm	0.054	0.226	0	1
Large firm – large firm	0.362	0.481	0	1
Relative size unclear	0.220	0.414	0	1
No investment	0.926	0.262	0	1
Investment of focal firm	0.035	0.183	0	1
Investment of partner firm	0.026	0.159	0	1
Two-way investment	0.013	0.115	0	1

The full model and the reduced model are reported in table 4. The first column identifies the independent variable. The second column lists the results of the full model. In column three and four the test results for over fitting are reported. The fifth column contains the results of the reduced model. Both models are estimated by a regression with heteroscedastic standard errors.[21]

Table 4: Regression for the effects on abnormal returns

Independent variables	Full Model Coefficient	Wald test	Coefficients jointly signifi-cant?	Reduced Model Coefficient
Non high-tech	Reference case			Reference case
High-tech	0.023***			0.021***
	(0.007)			(0.006)
Log (age)	0.011**			0.010**
	(0.005)			(0.005)
Log (size)	-0.008***			-0.008***
	(0.002)			(0.002)
Relative partner size				
Small firm – small firm	Reference case			Reference case
Large firm – large firm	0.003			0.006
	(0.011)			(0.010)
Small firm – large firm	0.028**			0.032***
	(0.013)			(0.012)

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[21] The Cook-Weisberg test reports indication of heteroscedastic distribution of residuals after OLS regression. Therefore, a regression with robust standard errors was conducted.

Large firm – small firm	0.000			0.001
	(0.013)			(0.012)
Relative size unclear	-0.006			-0.001
	(0.011)			(0.010)
Equity ties				
No investment	Reference case			Reference case
Investment of focal firm	-0.022*			-0.023**
	(0.012)			(0.011)
Investment of partner firm	0.002			-0.002
	(0.023)			(0.023)
Two-way investment	0.026			0.023
	(0.022)			(0.022)
Control variables				
Partner location in Germany	Reference case			
Partner location not Germany	0.003	F=0.17	No	
	(0.007)	p(F)=0.683		
Not Neuer Markt firm	Reference case			Reference case
Neuer Markt firm	0.016*			0.017**
	(0.008)			(0.008)
Type (relatedness)				
Horizontal	Reference case			
Vertical	0.007	F=0.77		
	(0.007)	p(F)=0.464	No	
Neither vertical nor horizontal	0.017			
	(0.020)			
Type of collaboration				
- Marketing collaboration	Reference case			
- R&D collaboration	0.008	F=0.83		
	(0.015)	p(F)=0.479		
- Licensing	0.018		No	
	(0.014)			
- others	-0.006			
	(0.011)			
Half year dummies				
- 1st half of 1997	0.009	F=23.84		0.009
	(0.032)	p(F)=0.000		(0.032)
- 2nd half of 1997	-0.022			-0.025
	(0.023)			(0.021)
- 1st half of 1998	0.187***[22]			0.177***
	(0.013)			(0.011)
- 2nd half of 1998	0.019			0.021
	(0.019)			(0.019)
- 1st half of 1999	-0.011			-0.012
	(0.009)			(0.009)
- 2nd half of 1999	0.014		Yes	0.013
	(0.010)			(0.010)

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[22] Only one collaboration notification was published in the first half of 1998. The announcing firm, EM.TV & Merchandising AG, experienced an abnormal return of 22% at the day of the event.

- 1st half of 2000	0.008	0.007
	(0.009)	(0.009)
- 1st half of 2000	Reference case	Reference case
- 1st half of 2001	-0.003	-0.004
	(0.011)	(0.011)
- 2nd half of 2001	0.005	0.004
	(0.016)	(0.016)
- 1st half of 2002	-0.008	-0.006
	(0.016)	(0.015)
- 2nd half of 2002	0.015	0.015
	(0.030)	(0.030)
Constant	-0.031	-0.020
	(0.030)	(0.031)
R-squared	0.082	0.077
RMSE	0.098	0.098

* significant at 10%; ** significant at 5%; *** significant at 1%; Standard error in parentheses; Total of 891 events.

I first comment briefly on the control variables included in the full model and explain whether they will be omitted in the reduced model before the results of the reduced model are presented and discussed. The control variable Neuer Markt, which distinguishes firms listed at the Neuer Markt from those listed at other market segments, shows a p-value of 0.054 and indicates that abnormal returns of Neuer Markt firms are 1.6 percentage points higher than abnormal returns of other market segments. The variable partner location measuring whether there is a different effect on abnormal returns when the partner is located outside Germany shows a positive but insignificant effect. In contrast to the outcome of Chan et al. (1997) the results suggest that a vertical collaboration causes higher abnormal stock returns than a horizontal collaboration. But again, the coefficient is not significant. R&D and licensing collaborations tend to have higher abnormal returns than marketing collaborations, although not significantly so.

The full model controls for effects of changes in market conditions by including dummies for each half year of the time period. The coefficients measure time effects in comparison to the second half of the year 2000 in which the stock market faced a continuous downturn. The estimated coefficients are insignificant, except for the coefficient for the first half of 1998. In a further analysis I test whether the results are differing between collaboration announcements in cold and hot stock market. Therefore the sample is divided in two groups. The "hot stock-market" group consists of announcements from January 1, 1997 to March 31, 2000 with a favorable stock market climate; the "cold

market" group consists of announcements from April 1, 2000 to the end of 2002 when the stock market faced a period of downturn. I test whether the coefficients estimated over one group of the data are equal to the coefficients estimated over the other group. The Chow test indicates no differences between the two groups (F=0.84; Prob>F=0.6487).

I also control for over fitting of the estimated model. A Wald test is conducted to check for joint insignificance of a group of variables. Column 3 of table 4 shows that the coefficients of several variables are jointly insignificant. The Wald test affirms joint significance of the included half-year dummies. The result suggests the importance of including them in the reduced model.

The reduced model in column 5 shows that there is a significant difference between high-technology firms and non-high–technology firms (hypothesis 3). Collaboration announcements by high-technology firms lead to an abnormal return that is 2.1 percentage points higher than by non-high–technology firms. collaborations entered by a firm operating in the fast changing and knowledge-intensive high-technology sector are considered more favorable than collaborations by non-high–technology firms.

Hypothesis 4 proposes that firm age is negatively related to the abnormal returns to collaboration announcements. Surprisingly, firm age is highly significant positive related to abnormal returns. Indeed, the estimated coefficients imply that a 1% increase in age results in a 0.010 percentage point higher abnormal return. An explanation for this finding might be that young firms face severe difficulties in attaining the potential increase in firm value from collaborations. Higher uncertainty results from the typically fewer experience of young firms' managers in managing collaborations, and the fewer resources that are available to redirect an inter-firm collaboration if the partnership undergoes an unfavorable development.

According to hypothesis 5, firm size is negatively correlated with the percentage of abnormal returns to collaboration announcements. The highly significant coefficient of firm size suggests that a 1% increase of size leads to a 0.008 percentage points lower abnormal return on the event day. From the results, it is clear that an inter-firm collaboration announcement by a smaller firm is more rewarded than by a larger firm, presumably because market players react more on small firms' signals.

Hypothesis 6 puts different collaboration constellations to the test. The reference

group is an announcement from a small firm that enters an inter-firm cooperation with another small firm. The constellation in which a small firm announces the formation with a large firm is clearly the one that leads to the highest abnormal return. According to the estimated model, these collaborations exhibit an abnormal return that is 3.2 percentage points higher than that in the reference case. Similarly, the other two possible constellations show a positive coefficient, indicating that they add more value than the reference case. However, the coefficients are not significant.

Hypothesis 7 proposes that collaboration announcements linked with an equity investment result in higher abnormal returns than collaborations without an equity investment. Contrary to the expectation, an investment of the announcing firm in the partner firm significantly diminishes the extent of abnormal returns by 2.3 percentage points. Similarly, the coefficient of the variable partner investment is negative but insignificant. Reciprocal equity ties show a positive but insignificant coefficient. The significant negative effect of an equity tie of the focal company on the value of the collaboration raises questions about the value of a strong commitment. On the one hand, an equity investment in the partner signals an additional level of confidence in the partner. On the other hand, an equity investment constitutes a strong commitment by making irreversible and specialized investments that render alternative options relatively more costly (Williamson, 1985). The results suggest that the market evaluates a weak commitment to be more favorable than a strong commitment. Presumably because in the case of a weak commitment the announcing firm can less expensively and more easily deviate from the announced action than with a strong commitment.

5 Conclusion and limitations

The paper sets out to explore, by analyzing stock market returns, whether partnering pays off. The results show that whereas a formation of an inter-firm collaboration increases firm valuation, an unexpected termination notification decreases firm valuation. The study further explores the determinants that influence the value mark-up of entering collaborations. I find that with regard to firm industry, firm characteristics, and collaboration attributes, certain collaborations are more favorable than others. Regarding high-technology versus non-high–technology firms, the results suggest that high-technology firms profit more from entering collaborations than non-high–technology firms. Contrary to expectations, the age of the announcing firm is positively correlated to the extent of positive abnormal returns. Presumably, investors rely more

on the experience of older firms than on younger firms in attaining synergies from collaborations. The hypothesis that smaller firms gain more from collaborations than larger ones is backed by the findings. Moreover, the empirical analysis demonstrates that the highest positive stock returns are experienced when a small firm announces a partnership with a large firm. The results also indicate that an inter-firm collaboration announcement in which the announcing firms invest in the partner is punished by significantly lower abnormal returns than in collaborations without partner investment.

The results have important implications for future research as well as for management. Regarding academic research, I find that the value impact of inter-firm coordination as a governance form varies systematically between industry, firm characteristics, collaboration partners and collaboration types. Consequently, investors should look closely at collaboration announcements and evaluate the different types and firm situations. Firm managers should be aware that firm characteristics, collaboration characteristics and by with whom a firm is associated drive the impact of inter-firm collaborations

The current study faces limitations that open avenues for future research. Several researchers emphasize that entering an inter-firm collaboration with a prominent collaboration partner may act as an endorsement for the focal firm (see, i.e., Saxton, 1997; Stuart et al., 1999), thus influences firm value. This study does not take the prominence of the collaboration partner into consideration. The dataset consists of announcements from firms operating in diverse industries. It is a complex undertaking to find a uniform valid measure for prominence over all these industries. Whereas in the field of biotechnology, patent citations may be an acceptable measure for prominence of the collaboration partner, the measure would not be useful for a firm that operates in media entertainment. Future research is suggested to supplement this study by including a valid measure for the prominence of the collaboration partners.

This study analyzes what drives the impact of collaboration on firm value. However, the study does not comprehensively elaborate on the upcoming questions regarding explanations for the detected differences, i.e.: Why do older firms profit more from entering collaborations than younger ones? Why is firm value influenced by an investment of the announcing firm in the partner firm but not by an investment of the partner firm in the announcing firm? It would greatly improve our knowledge of inter-firm collaborations to understand the reasons for these differences. An in-depth survey study

may shed light on the raised issues.

The present study sets out to investigate the impact of collaborations on firm value. Industry structure, firm characteristics, collaboration constellations and partner attributes are identified as value determinants. The study will hopefully be a useful contribution to further the understanding of inter-firm collaborations and to improve partnering strategies.

A Appendix

A.1: Number of ad hoc news in the German market (1997-2002)

	Total 1997-2002	By years
Total number of ad hoc news	21978	1997: 1312 1998: 1832 1999: 3443 2000: 5583 2001: 5421 2002: 4387
Ad hoc news concerning inter-firm collaborations	1157 (5.3% of total number)	1997: 16 (1,38%) 1998: 42 (3.63%) 1999: 209 (18.06%) 2000: 552 (47.71%) 2001: 238 (20.57%) 2002: 100 (8.64%)

A.2: Correlation matrix of dependent and metric independent variables

Variable	Abnormal return	log (age)	log (size)
Abnormal return	1.000		
log(age)	0.050	1.000	
log(size)	-0.175	0.038	1.000

A.3: Descriptive statistics of control variables

Variable	Mean	Std. Dev.	Min	Max
Partner location Germany	0.512	0.500	0	1
Partner location not Germany	0.474	0.500	0	1
Neuer Markt firm	0.746	0.435	0	1
Not Neuer Markt firm	0.254	0.435	0	1
1st half of 1997	0.007	0.082	0	1
2nd half of 1997	0.007	0.082	0	1
1st half of 1998	0.001	0.034	0	1
2nd half of 1998	0.027	0.162	0	1
1st half of 1999	0.039	0.194	0	1
2nd half of 1999	0.111	0.314	0	1
1st half of 2000	0.262	0.440	0	1
2nd half of 2000	0.241	0.428	0	1
1st half of 2001	0.121	0.327	0	1
2nd half of 2001	0.091	0.288	0	1
1st half of 2002	0.057	0.232	0	1
2nd half of 2002	0.034	0.180	0	1

Horizontal collaboration	0.343	0.475	0	1
Vertical collaboration	0.603	0.490	0	1
Neither horiz. nor vertic.	0.049	0.217	0	1
R&D collaboration	0.047	0.212	0	1
Marketing collaboration	0.770	0.487	0	1
Licensing	0.079	0.269	0	1
Others	0.100	0.300	0	1

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