Research Joint Ventures and Collusion - What can we learn from European Commission Decisions?

ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Department of Economics

Supervisor: Dr. Martin Bog

Name: Nora Barbi

Exam number:

E-mail address: norabarbi@hotmail.it

Keywords: Research Joint Ventures, Collusion, Event study Methodology

Abstract

This paper offers an indirect approach to test for possible anticompetitive behaviour of firms engaged in European Research Joint Ventures. I analyze the cumulated abnormal returns of the partner firms for the days surrounding the announcement of the RJV. The sample contains firms that "can be suspected of collusion" and firms that "are not suspected of collusion". I assume that Shareholders are aware of this difference at the moment of the announcement. I construct a categorical variable that distinguish between the two groups of firms and using a simple empirical specification I test for the effect of this variable on the abnormal returns of the participant firms. At the end of the analysis, however, I find not enough evidence to affirm that RJVs facilitate collusion behaviours.

Acknowledgements

I would like to thank my mother and my family all for their love and support. I also would like to thank Dr. M. Bog, Prof J. van Sinderen and Prof. R. Zwinkels at the Erasmus School of Economics for their thoughtful comments. I would like to thank Prof. Schinkel at the Amsterdam Center for Law&Economics for making available the review of the Commission Decisions. I would like to thank K.Felleitner for her precious suggestions and the laughter. Special thanks go to T. Bezemer for sharing with me the bad and the good moments of the past year. I also would like to thank all the people that supported me during the period of the collection and the analysis of the data: A. Bonfatti, R. de Luca, M. Talarico, M. Mariani, A. Pecora, M. Grosso, N. Daudì and W. Pier. A final thanks goes to I. Bassi and G.dalla Torre, for always being there.

Table of contents:

Abstract 2

1.Introduction 4

2.European antitrust law 6

2.1.European Commission Decisions 7

3.Literature review 8

3.1RJVs and Collusion, indirect approaches 8

3.2Event studies on alliance formation 12

4.Methodology 16

4.1.Sample and Data 16

4.2.The Empirical Specification 18

5.Results and Discussion 24

6.Conclusions 32

7.References 33

8.Appendix 36

1.Introduction

A Research Joint Venture (RJV) is an entity formed by two or more participant firms where knowledge and resources are shared in order to joint cooperate for the research and development of new products and/or new processes. RJV started to became a popular way to share the R&D efforts in the 80's. Nowadays they are a common instrument used especially in those sectors for which R&D requires high fixed cost. Moreover, RJV agreements are enhanced by governments for their positive effects on welfare through the reduction of R&D costs. The US National Cooperative Research Act (NCRA) of 1984 was issued to promote R&D cooperation among US firms. In Europe, there exist two large networks created in order to enhance European R&D alliances: the EU Framework Programme for Science and Technology (EU-FP) and the Eureka Programme[1]. These two networks together saw the formation of over 25,000 R&D alliances in the last twenty years. The benefits for the firms that form RJVs are several. Trough this kind of cooperation it is possible to avoid the duplication of R&D costs and take advantage of assets complementarities. Firms learn new skills and gain access to new information, processes and specialized resources. RJVs also allow for the internalization of the spillovers and help to overcome possible free-rider problems. Moreover, RJVs give the participants the possibility to share the risks related to the R&D activity. Some or all of these benefits are desirables when firms decide to cooperate in R&D (Marìn et al .(2000) and Roller at al. (2007)).

Another important benefit that firms could take into consideration is the possibility to soften market competition through the RJV. It is therefore possible that some RJVs are formed with intentions of collusion.

This paper aims to discover possible anticompetitive behaviours of firms participating in European RJVs. I test for this hypothesis using an indirect approach. I collect a sub-sample of RJVs for which the European Commission adopted a formal decision concerning possible anticompetitive behaviour[2] and I define these RJVs as "those that can be suspected of collusion". I then collect a random sub-sample of RJVs from a population of European RJVs and I define these RJVs as "those not suspected of collusion". I then combine the two sub-samples and analyze the cumulated abnormal

[1] For further information please refer to the official web pages of these networks: http://cordis.europa.eu/fp7/ for the EU Framework Program and www.eureka.be for the Eureka Program.
[2] See next section for a basic review of the European antitrust legislation.

returns of the participant firms around the day of the announcement of the RJV. I introduce a simple empirical specification that tries to capture the effect of the "expected collusion" information included in the event "RJV announcement" looking at the determinants of the abnormal returns. The focal point of my empirical specification is the categorical variable *ECdecision*[3] that distinguish between the two sub-samples of RJVs. If the RJVs suspected of collusion were indeed formed for this purpose, then this variable should have a role in explaining the abnormal returns of the shares in the days surrounding the announcement. This claim rests on the assumption that the shareholders knew, at the moment of the announcement, that the RJV had such characteristics that made it fall into the scope of the antitrust legislation. I therefore assume that they were fully aware of the collusive potential of the RJV. The other variables I included in the specification have been used in literature to explain the determinants of RJV formation. The interaction of these variables with *ECdecision* should reveal different impacts on the abnormal returns of the firms in the hypothesis a RJV is formed to enhance collusion behaviours.

There are only few papers in the empirical literature that try to assess whether RJVs facilitate collusive behaviours. Moreover, the existing literature is based exclusively on US data. Oxeley at al. (2009) also offer an event study methodology approach to detect possible collusion behaviour through RJV. Instead of analyzing the determinants of the abnormal returns of participant firms, they analyze those of rival firms. They find that the abnormal returns of rivals move in the same direction of the abnormal returns of participants and argue therefore that RJVs soften competition for the whole sector. Goeree and Helland (2008) try to detect a shift in the probability for US firms of joining a RJV after the introduction of a revised leniency program. Duso et al. (2008) investigate on the determinants of the stability of a RJV, arguing that stable RJVs are more suspected of collusion. Duso et al. (2009) study instead the shifts in market share due to RJV participation. They argue that if no increase in market share is achieved thorough RJV participation, then the firms might have formed the RJV to collude. All of these works provide some evidence of anticompetitive behaviour enhanced by RJV formation.

My approach starts with the general claim that some RJV are formed with collusive intentions. If this is true, shareholders should be informed of that, or at least they should

[3] See the methodology section for a detailed explanation of the independent variables.

suspect it. To find out if indeed some RJVs are formed with collusive intentions I therefore analyze the reactions of the shareholders. I observe whether shareholders behave differently for "firms with potential for collusion" and "firms without potential for collusion". If they behave differently this imply that they had collusive expectations from the RJV formation. If shareholders had collusive expectations this most probably imply that at least some RJVs are indeed formed to enhance collusion.

On the other hand, if the "collusive potential of a firm" add no significant information for the shareholders, they should behave the same way for both groups of firms. This means that all the variables included in my specification should have the same effect for both groups of firms, i.e. those "with potential for collusion" and "those without potential for collusion". This in turn means that the interaction terms of these variables with the variable *ECdecision* should be all equal to zero. This is indeed what I find. However, the variable *ECdecision* seem to have a positive effect but only when it is not accompanied by interaction terms. A possible explanation is that shareholders indeed attach a positive value to the "collusive potential" of a firm, but they believe at the same time that the RJV will produce gains besides the collusive activity. If this is the case, the other variables do not have a different impact whether there is potential for collusion or not, i.e. the interaction terms are not significant.

At the end of my analysis, I can only conclude that shareholders attach a positive value to the collusive potential of firms but I have not enough evidence to assess that RJVs in Europe are indeed formed with the intention of collusion.

The reminder of the paper is as follow. Next section includes a brief introduction of the European Antitrust legislation and a review of the European Commission decisions. Section 3 includes the literature review. In section 4 I present the Methodology. Section 5 discusses the results. Finally, section 5 offers the conclusions.

2. European antitrust law

The foundations of the European antitrust legislation are included in the articles 81., 82., 83., 84., 85., and 86. of the Treaty of the European Union. Articles 81 and 82 are of major relevance. Art. 81. directly forbids agreements direct to prevent, restrict or distort competition. Paragraph 3 of Art. 81 lists the cases in which the article may be inapplicable. Art. 82. refers to the cases of abuse of a dominant position. Other than in

the Treaty, antitrust rules are contained in a series of regulations, notices and guidelines adopted by either the Commission or the Council of the European Union.

Relevant to the R&D joint ventures are the block exemptions to the Article 81 of the EC Treaty. The block exemptions are a series of exceptions for which the Article 81(1) might not be applicable. They contain a series of special cases for which the European Commission might tolerate a certain degree of infraction of Art 81(1). The block exemptions are divided into vertical agreements, horizontal agreements and licensing agreements. Two regulations included in the horizontal agreements, Commission Regulation (EC) No 2658/2000 and Commission Regulation (EC) No 2659/2000, are of particular relevance for R&D joint ventures. The latter, in particular, declares that Art 81(1) might not applicable in the case of joint research and development, even when these agreements are indeed restrictive of competition as prescribed by Art. 81(1).

2.1. European Commission Decisions

Carree, Günster and Schinkel (2008) propose a review of all the 538 formal decisions on antitrust published on the Official Journal of the European Communities that the European Commission adopted from the Treaty of Rome in 1957 until 2004. 62 of the 538 Commission decisions regard the formation of joint ventures. To notice is that they exclude from their work all the cases in which an investigation has been dropped by the Commission for lack of evidences, and include consequently only the cases for which a formal decision has been adopted. The decisions made by the Commission can take three forms: negative clearance, exemption or infringement[4]. In the case of infringement, remedies and sanctions may follow. The paper presents a statistic analysis on the type of decisions, on the sector of the parties, on the economic motivation of the parties, on the investigation duration and on the amount of imposed fines. Regarding the 62 formal decisions on joint ventures 11 received negative clearance, 49 received exemption and only 2 were declared as infringements. Is interesting to notice the difference with the "horizontal constraints" category for which in 130 out of 219 decisions, the Commission declared infringement. Another interesting

[4] Negative clearance is declared when, based on the available information, the practice object of the investigation does not infringe Art 81. Exemption means that the practice under investigation does enter in the scope of Art 81 but that block exemptions apply. Exemptions are only valid for limited and specified periods. Finally, infringement is declared when the practice violates Art 81 and no exemption is applicable.

analysis is the subdivision by Economic sector. Carree at al. find that the majority of the decisions concern the manufacturing, communication and transport industry. Distinguishing instead between the three types of possible decisions, they find that infringement increases over time with respect to exemption and negative clearance.

A forthcoming book by Carree, Russo, Schinkel and Guenster focuses on the economical analysis of the Commission decisions above mentioned. A chapter is fully dedicated on the joint ventures decisions and it includes the list of the 62 decisions accompanied by the details of the joint ventures involved. The decisions are divided in three categories: the ones regarding R&D joint ventures, the ones regarding Marketing, Selling and Production joint ventures and the ones regarding Strategic and Technological Alliances. The 34 decisions regarding R&D joint ventures constitute the starting point of my dataset.

3.Literature review

3.1. RJVs and Collusion, indirect approaches

The empirical literature on RJVs and Collusion is rather scarce for two main reasons. First, collusion is not easy to detect and therefore to prove it with an empirical exercise is always necessary to use indirect ways that imply somewhat subjective assumptions. Second, data on RJVs are private information and consequently not easy to obtain. At this regard, most of the empirical literature on the topic is based on US data as US firms, prior forming a RJV are requested to fill in with the US National Cooperative Research Act that render the data collection easier. Five recent works attempt to prove indirectly that collusion is one of the reasons for RJVs formation, or at least that RJVs facilitate tacit collusion in the product market.

Goeree and Helland (2008) build up a model to test whether there is a variation in RJVs formation after the introduction of a new leniency program. They construct two samples, an across industry and a telecommunication one, including US RJVs over the period 1986-2001. The idea at the base of their research is that if RJVs are formed with absolute no intention of collusion then the introduction of the new policy should not influence the formation of RJVs. This approach is particularly valid as the new leniency policy has no influence on the formation of RJVs per sè but it does affect RJVs

formation with collusive intentions. Goeree and Helland study RJVs formations in the US in 1993, the year in which the leniency program has been revised. The main novelty of the policy was that amnesty was granted only to the firm that first filled in with the Antitrust Division of the Department of Justice. They used the year 1993 as a dummy in a regression model that has as a dependent variable the probability of forming a RJV. Together with the dummy year, Goeree and Helland include in their model other variables that according to the existing literature[5] are likely to influence the probability of forming an RJV. Their results suggest that the revision of the leniency policy leads indeed to a significant reduction of the probability of forming a RJV. Moreover, when restricting their test to the sole telecommunication industry they find a reduction of around 25% of the probability for a firm to join a RJV in that industry. Their overall findings are supportive of the idea of RJVs as a mean of collusion. One of the limitations of their work, however, lies in the fact that they do not directly observe some of the variables included in their model. The probability for a firm to join a RJV is determined by the difference between the value for the firm of joining that specific venture and the value for the firm of not joining that specific venture. If the difference is positive the firm has a higher probability of join. The value for a firm of joining/not joining is influenced by a number of different variables like the change in R&D intensity, the market share and other firm-specific variables. However it is only possible to observe the value of these variables when the firm actually joins the RJV. Goeree and Helland use expected values of these variables to predict the value for the firm of not joining that specific RJV. Given that they use expected values instead of observed values, their results are affected by a certain degree of subjectivity. In my research I face a similar problem. I do not observe the returns of a firm in the case of "no announcement" of a RJV; instead, I only observe the returns of a firm when it does announce a RJV. Like Goeree and Helland I have to use expectations instead of true values and therefore my results, like theirs, are affected by a certain degree of subjectivity.

[5] Marín, Siotis and Hernán. (2000) find that R&D intensity, industry concentration, firm size and past experience are all factors that positively influence RJV formation. Roller, Siebert and Tombak. (2007) find similar results. They extensively examine incentive and disincentives for RJV formation. Incentives for RJV formations are cost-sharing opportunities, reduction of free-rider problems created by R&D spillovers and the fact that firms produce complementary products. They find that the factors that have the major impact on the choice for two firms to participate together in a RJV are firm-size asymmetry, number of participants in the RJV, industry of the participants, the impact on R&D investments and the fact that firms have previously participated in other RJVs.

Another approach is proposed by Duso, Pennings and Seldeslachts (2008). Their sample includes 785 US RJVs over the period 1985-1999. They test the hypothesis of RJVs as a mean of collusion through the analysis of the stability of a RJV. They argue that firms may delay research and development and hence remain in the joint venture longer than necessary with the sole scope of collude. Stability is positively influenced by a large number of participants, as larger RJVs are found to be more stable, and negatively influenced by the exit or entry of members. Duso et al. use for their model a dummy "stable" as a dependent variable verifying whether variables like industry concentration, size of RJV, R&D intensity and presence of non-profit institutions can explain the stability of a RJV. They find that large RJVs in highly concentrated markets are more stable and therefore more prone to collusion. The limitation of these results however lies on the fact that the only thing that is explained and proved in this work is the positive relation between the stability of a RJV and a number of firm and industry-specific variables that influence it. The link between the stability of a RJV and its use as a mean of collusion remains a mere assumption for which they do not provide further proof. In my research, on the contrary, I try to establish a direct link between the intent to collude and the abnormal returns of firms. The link is depicted by the dummy *ECdecision*[6] .This dummy variable separates my sample in two parts, on one side I have the firms for which the European Commission adopted a formal decision regarding Article 81 of the European Treaty and that therefore can be suspected of collusion from the shareholders point of view. On the other side, I have a random draw of firms for which the European Commission never adopted a decision on the matter of antitrust. However, my hypotheses have to rely on one assumptions as well: the shareholders of the first group of firms foresee the possibility of collusion, which is later investigated by the Commission. In other terms I assume that if a RJV can be restrictive of competition, the shareholders know (or can suspect) it from the moment it is announced.

A different approach to detect collusion is tried by Duso, Roller and Seldeslachts (2009) who try to support the hypothesis of collusion, this time looking at the market share of the participant firms. In this paper, they use the same sample of 785 US RJVs over the period 1985-1999 used by Duso, Pennings and Seldeslachts (2008). The main idea underlying their model is that a loss of market share due to RJV participation is a sufficient condition to assume intention of collusion. They assume two possible

[6] The variable is explained in detail in the Methodology section.

explanations for RJV formation, one is the realization of efficiency gains, and the other is the realization of benefit through collusion. In the case of efficiency gains the participating firms also realize an increase in market share. They argue that if no increase in market share is achieved through the RJV then the firms must have form it with the sole intent of colluding. They analyze the relationship between market share and size of RJVs networks. They find that participation in medium size RJVs networks operating in the Chemicals, Petroleum, Industrial and Commercial machinery, Electronic and Transportation Equipment industries lead to a decrease of a firm market share and it is therefore supportive of collusion behaviour. .

Gugler and Siebert (2007) . They study whether the efficiency gains from horizontal mergers and RJVs are significant enough to justify anticompetitive effects. They find evidence of anticompetitive effects through mergers, but not through RJVs formation. Still their research is limited to the semiconductor industry only.

Oxley, Sampson and Silverman (2009) aim to detect possible anticompetitive behaviours in RJVs using event study methodology. They use a pretty singular approach that focuses on the abnormal stock returns of rival firms during the days surrounding the announcement of a RJV. In the event study literature[7] researchers find, in the majority of the cases, that the announcement of a new partnership leads to positive abnormal stock returns of the participant firms. This evidence, however, can be explained by two different and contrasting hypotheses. Participant firms are supposed to gain access to new information, technology and resources and therefore to improve their performance through learning process and efficiency gains, otherwise impossible without the R&D cooperation. Shareholders therefore react positively to the announcement a new partnership. This first explanation is coherent with the view that RJVs are pro-competition. On the other hand, however, if RJVs were a mean of collusion, and shareholders expected possible anticompetitive behaviour, they would also react positively, generating positive abnormal stock returns. Is therefore difficult to distinguish which of the two effects prevail when studying positive abnormal stock returns. To solve the problem, Oxley at al. decide to look at the correlation between the abnormal returns of the partners and those of rival firms. They argue that if RJVs are formed to enhance innovation and progress among the participants, then the partners and the rivals' abnormal returns should be negatively correlated. On the other hand, if

[7] For the event study literature see following section.

the RJVs are formed with the intent of softening product market competition, then the abnormal return of the participants and those of the rival firms should be positively correlated. This idea follows from the assumption that all the firms in the industry will benefit from the reduced competition enhanced by the RJV. In their study, Oxley at al. indeed find positive correlation between the abnormal stock returns of participants and those of the rival firms. They conclude therefore that some RJVs are expected to soften competition. In their study they analyze 705 alliances announcements over the period 1996-2004 in the telecommunications and electronics industry and use as a definition of rival firms those that have the same primary 4-digit SIC code as the participants. Having the same 4-digit SIC code however does not necessarily imply that two firms are direct rivals in the final product market. Even though they belong to the same 4-digit SIC classification, two firms could manufacture and sell products that are not directly competing with each other. The problem, however is that in most cases databases only offer the 4-digit SIC code as a primary code for firms. For researchers this is still the link more easily available between different firms' primary sectors. Moreover this analysis use the US market as "the final market" without taking into consideration possible differences among regions. For example two firms with the same primary 4-digit SIC code might not direct compete in the same geographical area.

The work of Oxeley at al. together with that of Schut and Frederikslust (2004)[8] represent the starting point of my analysis.

3.2. Event studies on alliance formation

Researchers use event study methodology to examine how the stock market reacts to a specific "event". To do so they look at the abnormal stock returns of a firm in the day of the "event". The "event" is related to the subject under study and it can be literally anything that is able to influence the behaviour of investors in the stock market like a political election or the announcement of a merger. For the purpose of my research, I limit my literature review to the studies that analyze the stock market reaction to the event "announcement of an alliance".

Fama et al. (1969) give one of the first contributions to the event study literature. Their paper aims to study how the firm market value reacts to the information brought

[8] For a description of Schut and Frederikslust's research see following section.

about by the announcement of a stock split[9]. They include in their study 940 stock split announcements in the US over the period 1927-1959. In the majority of the cases, a stock split is followed by the announcement of a dividend increase. As in general directors of firms are unwilling to decrease dividends, it is reasonable to assume that they will increase the dividends if and only if they expect a future and constant positive performance of the firm that will allow them to maintain the dividends at the increased level. Fama et al. assume therefore that the announcement of a stock split is a signal of future positive performance by the firm. Their assumption is confirmed by their findings. They found evidence of positive abnormal returns in the months preceding the announcement of the stock splits and evidence of negative abnormal returns in the month following the announcement of the stock splits for those firms for which the announcements are not followed by an increase in dividends. Hence their main conclusion is that the market is efficient, in the sense that it reacts to the dividend information included in the announcement of a stock split. My study builds on the same idea: the market, in my case, should react to the "expected benefits from collusion" information included in the announcement of a RJV.

McConnell and Nantell (1985) make use of the market model to test similarities between the market reactions at the announcements of mergers and JVs. Their aim is to separate two possible different causes of wealth gains in mergers: synergy and management displacement. To do so they isolate the synergy effect trough the analysis of the market reactions to joint ventures, for which there is no management displacement. Their idea stands on the assumption that mergers and joint ventures are characterized by similar synergy patterns. Their study includes 136 joint ventures announced during the period 1972-1979. They analyze the abnormal stock returns of participant firms for the days around the announcement of the JV. They find that like in mergers, the participants of a joint venture gain positive abnormal returns. When testing for size they find that the smaller firms benefit from larger excess rates of return than lager firms. When converting the excess gains in dollars, though, they find that in general the gains are equally distributed. They can conclude that synergy is the prevalent explanation for wealth gains in mergers.

[9] A stock split is the decision to increase the number of outstanding share of a firm by issuing new shares and offering them to the current shareholders. As the number of shares increase, their price decrease, given that the firm maintain the same capitalization.

Woolridg and Snow (1990) study the cumulative abnormal return for 767 announcements made by 248 companies and reported on the Wall Street Journal in the period 1972-1987. They test three different hypothesis regarding strategic decisions adopted by firms' managers. The first one is what they call the Shareholder Value Maximization hypothesis. This hypothesis states that shareholders rewards managers for taking strategic decisions that will improve the long-run performance of the firm, like for example the announcement of a RJV. If this hypothesis is true, then market reactions should be positive. The second hypothesis is what the authors call the Institutional Investors one. They argue that in US large and influential groups of investors like pension and investments funds or bank trust departments prefer short-run profits to long-run ones. If this second hypothesis is true, then the market will react negatively to the announcement of a long-run strategic decision like a RJV formation. Finally, what they call the Rational Expectation hypothesis predicts no reaction by the market as the shareholders expect the managers to take periodic strategic decisions in order to maintain (and not to enhance) the firm competitiveness. They take into consideration announcements of joint ventures, R&D alliances, product and market diversification and capital expenditures. They also test for the size of the investment and the duration of the project. Their evidences, in line with the rest of the literature, are supportive of the Shareholder Value Maximization hypothesis. They found stronger positive return for longer projects, but not substantial differences between small and large investments. With respect to the different types of announcements, they find that JVs and R&D alliances report stronger positive returns than product and market diversification and capital expenditures.

Koh and Venkatraman (1991) use event study methodology to test the impact of different JVs formation strategies on parents' market value for the IT sector. Their sample includes 175 JVs and 239 firms over the period 1972-1986. They test for relatedness among the primary category of the parents and between the category of the parents and the primary category of the JV. They also test the impact of market shares asymmetries and more in general the impact of the size of the participants in an equally owned JV. In line with the literature, they find that JV announcements results in positive abnormal returns. To test for their different hypothesis they simply divide the firms in their sample into different categories. Then they analyze the average abnormal returns of the categories. They first divide the parents in four categories depending on the JV role, i.e. depending on weather the JV will manufacture a totally new product, a

new product that is related with the parents' business or whether it will enter a new geographical market or it will enter new sectors in the same geographical market of the parents. They find that different JV roles have a different impact on the firms' abnormal returns. More specifically their results indicate that the parents of RJVs that produce related products or that operated in related markets earn higher average abnormal returns. Furthermore, they divide the parents depending on whether their activities are related to the activity of the joint venture or not. They also divide the sample into related parents and unrelated parents. They arrive to the conclusion that both, the relatedness among the activities of the parents and between the activity of the parent and the activity of the JV, leads to higher average abnormal returns. Finally, they divide their sample for size, separating larger and smaller parents. They find that smaller partners report on average higher gains than larger ones.

Das, Sen and Sengupta (1998) use a similar event study methodology to test different hypothesis regarding abnormal share returns of companies participating in 119 strategic alliances over the period 1987-1991. Their focus is on the nature of the alliance, distinguishing between technological and marketing alliances; on the formation process, individuating which firm is the first mover; on the size and on the relative dependence of the partners. They find that the announcement of a technological alliance produces larger positive returns than the announcement of a marketing alliance. Moreover, they find that the profitability of the partners and their abnormal share returns are negatively correlated. Finally, they find evidence that smaller partners enjoy greater abnormal returns than larger partners.

Anand and Khanna (2000) use a similar model to assess whether cumulated experience in managing joint ventures and licence agreements can explain the abnormal return of the stocks around the day of the announcement of successive agreements. Their sample includes 1976 JV and licenses by 147 firms over the period 1990-1993. They find that learning process are important in the case of joint ventures only and not in the case of licensing agreements. Moreover, in line with previous empirical studies, they find that these learning effects are greater for R&D and manufacturing joint ventures than for Marketing or other forms of joint ventures.

Reuer and. Koza. (2000) study two different explanations for joint ventures: the "indigestibility" hypothesis and asymmetry of information hypothesis. Their dataset includes 297 European and US joint ventures, terminated in the period between 1985 and 1995. They divide their sample into four group based on the degree of asymmetry

information between the partners. They find stronger positive abnormal returns for the group with the largest degree of information asymmetry (when the primary 3-digits SIC codes of both partners and that of the JV all differs). They conclude in favour of the asymmetry of information hypothesis.

A paper by Schut and Frederikslust (2004) builds on the model developed by Fama at al. and study the shareholders wealth effects of 233 RJVs announcements in the Netherlands over the period 1987-1998. Schut and Frederikslust aim at establishing the strategy factors that have an impact on the stock prices of the participants companies. They divide these factors into three categories: Strategic Content, Strategic Context and Strategic Control. The first group includes variables that discern between the motives of a RJV: market, technology, and efficiency. The variable diversification also belongs to the Strategic Content. This variable measures the relatedness between the primary sector of the RJV and the primary sector of the participants. To the Strategic Context belong the variables Individualism, Related Size, and Partner Relatedness. In the group Strategic Control Schut and Frederikslust include the dummies Minority, Majority and Equality, with the intent to capture the effects of the ownership structure. They find that the 75% of the RJV announcements included in their research produce positive abnormal returns. All the variables they included are significant and have the expected sign. In my study I included many of the factors individuated by Schut and Frederikslust in this research.

4. Methodology

4.1. Sample and Data

My dataset is constituted by two distinct sub-samples. The first sub-sample contains data on 27 RJVs for which the European Commission adopted a formal decision relative to Article 81 of the Treaty of the European Union. The second sub-sample represents a random draw of equal size from a population of European RJVs.

Obtain the true population of RJVs formed in Europe for the period under study is very difficult. However, a good approximation can be obtained through the database Securities Data Company, Joint Ventures and Alliances (SDC). I therefore retrieved

from SDC the 3729 RJVs formed in the EU 27 countries from 1984 until today. As the first sub-sample only covers the period 1977-1997, I limited the SDC sample until the year 2000. Moreover, not all the observations in SDC include data regarding the ownership structure of the RJVs. For this reason, I had to restrict further the sample to 728 RJVs, including only those observations for which the information on ownership was available. Using the program Eviews I extracted a random sample of 27 observations, matching the size of the first sub-sample.

To establish the date of the announcement of the RJVs I used, for the first sub-sample, the reports of the European Commission published in the Official Journal of the European Communities together with the database LexisNexis News. I was not able to determine the dates for 7 RJVs and I therefore excluded them from the sample. As the dates reported in SDC are not always accurate[10], I followed the same procedure for the second sub-sample. The process leadl to the modification of 5 dates. Other observations have been excluded during the curse of the analysis because of the peculiar behaviour of the asset prices under study.

The final dataset is a combination of the two sub-samples and consist of 70 firm-observations related to 42 RJVs over the period 1977-1999. For lack of data, this first dataset does not allow to control for the size of the firms. To collect firm-specific data I used the database Thomson One Banker; this source, however, did not contain data on the number of employees, on the total assets and on the sales for some of the firms included in my sample. I therefore restricted it to 535 firm-observations complete of size data. The model is tested on both, the 70 firm-observations sample and the 55 firm-observations sample.

RJV specific data like nation, name and number of participant firms, ownership structure and deal description come from the reports of the European Commission for the first sub-sample and from SDC for the second sub-sample. SDC also contains data on the primary 4-digit SIC code of the participant firms and of the venture itself. The primary 4-digit SIC codes of the firms in the first sub-sample come instead form Thomson One Banker. No information was provided regarding the primary 4-digit SIC code of the RJVs in the reports of the European Commission nor elsewhere. However, following the accurate description of the deal that the Commission made for every single case, I was able to attribute a rather accurate 4-digit SIC code to every venture in

[10] Other researchers find inaccuracy in the dates reported by SDC. See for example Anand and Khanna (2000); and McGahan and Villalonga. (2005).

the first sub-sample. This attribution however, remains subjective. The same apply for the classification of the RJVs into two categories depending on whether the activity of the RJV is only limited to R&D or whether the participant firms also decide to manufacture and/or market the products together. To classify the RJVs into the two groups I paid careful attention to the descriptions of the deals included in the reports of the Commission and in SDC.

Firm specific data like number of employees, total assets and sales come from Thomson One Banker. The stock market data all come from DataStream. I collected daily share prices for each firm included in the sample for a period of 170 days prior the announcement of the RJV. For the same periods, I collected the daily price of the Morgan Stanley Capital International Index (MSCI) World that I used as a benchmark. For the free risk rate, I collected the daily yield on 3 month US Treasury Bill.

4.2. The Empirical Specification

The empirical specification I use for my research tries to capture the effect of the "expected collusion" information included in the event "RJV announcement" using event study methodology. If shareholders react positively to the announcement of a RJV because they expect some benefit from a possible anticompetitive behaviour, then all of the included variables should have a role in explaining the abnormal return of the shares in the days surrounding the announcement. The variable *ECdecision* is meant to capture the shareholders' expectations of collusion. The variable divides the sample in two groups of firms: those that have been investigated by the European Commission in relation to Art 81 of the Treaty of the European Union and those for which a formal decision has not been adopted. I define the first group of firms as "those that can be suspected of collusion" and the second group of firms as "those not suspected of collusion". My hypothesis rests on the assumption that the same facts and circumstances regarding the state of competition between the undertakings that brought the European Commission to adopt a formal decision were known to the shareholders at the moment of the announcement.

All of these cases have been brought to the attention of the European Commission by notification of the parties themselves, as required by Council regulation 17, effective until May 2004. Until that date the undertakings had the obligation to notify to the

Commission any arrangements that could, even only potentially, fall within the scope of Article 81. The variable *ECdecision* try then to capture in a backward looking fashion, the shareholders' expectations of a possible anticompetitive behaviour given the fact that they knew, at the moment of the announcement, that the RJV had such characteristics that made it fall into the scope of Art 81. The other variables I included in the specification have been used previously in literature either to try to detect collusion trough RJV formation or either to try to depict the determinants of RJV formation.

The variable *OtherActivity* try to capture to which extent the firms involved in the RJV are working together. The role of a RJV can be confined to sole R&D activity but it can go further and include the manufacturing phase, the marketing phase as well as the supplying phase. Each of these steps requires a higher degree of involvement of the firms and the disclosure of firm-sensitive information. The more firms work together sharing technology, processes, best practices, supply channels, etc. the better their coordination become. The rationale of this variable lies on the assumption that if the parties set up the RJV with the intent of softening the competition, a joint collaboration in the manufacture and/or market and/or supply phases can only improve their coordination. Therefore, if the RJV are indeed a mean of collusion the variable *OtherActivity* is expected to appear with positive sign. In the empirical literature[11] however, R&D and Technological agreements in general are considered more benefit enhancing than marketing ones. If the motives underlying the RJV are not those of anticompetitive behaviour, then one should expect a negative sign instead.

To capture the different expected impact of this variable on the abnormal returns of the shares depending whether the reasons underlying RJV formation are those of collusion or not, I include an interaction term between the variable *ECdecision* and *OtherActivity*. The combination of these two variables is therefore excepted to carry a positive sign.

[11] For example, Das, Sen and Sengupta (1998) argue that Technological alliances are characteristic of emerging markets, while marketing agreements occur most often in mature market. The stock returns in case of a marketing announcement are lower simply because shareholders expect benefits to last for a shorter time. Moreover, they argue, marketing alliances can be a signal of weakness. Koh and Venkatraman (1991) also find stronger returns in case of Technological agreements with respect to Marketing, Licensing and Supply ones. Oxley, Sampson and Silverman. (2009) argue for the two different and contrasting effects of JV that combine R&D and other activities, although, in line with the literature, they find a negative impact for Market alliances.

The variable *Bilateral* divides the RJV in the sample into two categories: those formed by two members and those formed by more than two members. This variable is meant to capture the stability and therefore the "easiness" of coordination in a RJV. When RJVs are formed by more than two members, elusion of competition is more difficult to achieve as all the members have to effectively coordinate to achieve collusion. The stability of the venture in general decrease with the number of participants (Duso et al. 2008) and effective coordination and cooperation toward collusion becomes more difficult. On the other hand, the higher the number of participants, the larger the benefits due to costs sharing. To control for the different influence that this variable should have for firm "with intentions of collusion" and firms "without intentions of collusion" I construct an interaction term for the variables *Biltilateral* and *ECdecision.* The variable is therefore expected to appear with a positive sign.

The variable *Participants* is defined as the number of participants in a RJV and it is subject to the same considerations of the variable *Bilateral.* The higher the number of participants, the more difficult the coordination. Even for this variable, I construct an interaction term with *ECdecision* in order to capture its different impact. The higher the value of this interaction variable the lower the expected impact on the share returns of the participant firms. A negative sign is therefore expected.

The variable *Horizontal* distinguishes between agreements in which two or more participants operate in the same sector and agreements in which none of the participants operates in the same sector. The rationale for this variable is easy to understand: the more related are the partners' sectors, the easier the coordination toward market collusion.[12] More important, the joint market share reached trough the joint venture increases the market power of the participant firms. It is interesting to verify whether the interaction of the variables *Horizontal* and *ECdecision* produces the positive effect that is expected. The interaction term is therefore expected to carry a positive sign.

Another factor of interest for the shareholders is the magnitude of the benefits the firm will achieve through collusion. The bigger the market share of the firm and that of its partners, the higher their gains. Unfortunately, I was not in possession of the data regarding the market shares of the participants. I therefore use the size of the firms, measured by annual sales, total assets and number of employees as a proxy for market

[12] Oxley et al. (2009) draw a similar conclusion arguing that horizontal agreements in concentrated sectors facilitate market coordination.

share. Yet, for the purpose of my research, studying the relative size of a firm with respect to its partners other than the size of the firm itself would be of interest. Again, I was not in possession of the size data for all the partners and therefore I could not construct a variable for the relative size. Even for the variable size there exist different and competing hypothesis[13] in literature. To assess the different effects of *Size* for the two groups of firms I construct an interaction term with the variable *ECdecision*. The term is expected to carry positive sign, as the size of a firm can be directly linked to the magnitude of its gains in case of collusive behaviour. The larger the size, the higher the gains.

The ownership structure of the joint venture says whether the firm has a majority, a minority or an equal interest in the venture. When the control is equally divided between the participants it is possible to reach a higher coordination. A disparity of control in fact, could not result in the same degree of coordination as the firm with the lower participation might not be eager to engage in a collusive behaviour when it has to submit to the other firm's decisions. At this regard, it is interesting to analyze the interaction effect of the variable *Equality* with the variable *Size*. If a large firm engages in an equally owned RJV this could be a signal for the other participants and for the shareholders that it is favourable to a fruitful coordination. As argued before, this effect would be better captured from the relative size of the firm's partners. Again, I was not in possession of this data. When the ownership structure allows for a firm to have a majority interest, effective coordination might not be achieved therefore rending collusion more difficult. If this is the case, the variable *Majority* should appear with a negative sign. However, in case a majority interest is present, and if in spite of the coordination problems the firms indeed achieve effective collusion, the gains will be most probably higher for the firm that owns the majority interest. In this case the reaction of the shareholders should be positive. Which one of the effects will prevail remains therefore uncertain. Even for the ownership structure I include the interaction term. The coefficient is expected to carry a positive sign for the interaction *ECdecision*Equality*, while the sign of the interaction *ECdecision*Majority* remains uncertain.

[13] Koh and Venkatraman (1991) find that smaller firms earn positive abnormal returns, while the returns of the larger partners are insignificant. Roller et al. (2007) argue a similar hypothesis. Marìn at al. (2000) argue that the absolute size of a firm in terms of number of employees and total assets, also capture the capability of the firm to cope with possible large fixed costs related with the RJV. The size of a firm can be a signal for the shareholders that the firm is indeed able to sustain the costs related with the new venture. Goeree at al. (2008) infer that firm with larger assets are more likely to engage in RJV.

The variable *Diversification* depicts the degree of relatedness between the primary sector of the participant firms and the primary sector of the RJV[14]. The higher the value of this variable, the greater the distance between the activities of the RJV and those of its parent firms. If firms form RJVs to enhance anticompetitive behaviour, the gains will be higher if the RJV is able to soften the competition in the primary market of the firm. It follows that this variable should appear with a negative sign. To distinguish this effect for those firms more suspected of collusion I include the interaction term *ECdecision*Diversification*, which is expected to carry a negative sign.

The model is specified as follow:

$$CAR_i = \alpha + \beta_0 ECdecision_i + \beta_1 OtherActivity_i + \beta_2 Bilateral_i + \beta_3 Participants_i + \beta_4 Horizontal_i$$
$$+ \beta_5 Size_i + \beta_6 Equality_i + \beta_7 Majority_i + \beta_8 Diversification_i + \beta_9 ECdecision_i * OtherActivity_i$$
$$+ \beta_{10} ECdecision_i * Bilteral_i + \beta_{10} Equality_i * Sales_i + \beta_{11} ECdecision_i * Participants_i$$
$$+ \beta_{12} ECdecision_i * Horizontal_i + \beta_{13} ECdecision_i * Size_i + \beta_{15} Ecdecision_i * Equality_i$$
$$+ \beta_{16} ECdecision_i * Majority_i + \beta_{17} ECdecision_i * Diversification_i + \varepsilon_i \quad (1)$$

The dependent variable

The dependent variable represents the cumulate abnormal returns of a firm's share price over the days surrounding the announcement of a RJV. The abnormal returns have been calculated using the simple version of the Capital Asset-Pricing Model[15] (CAPM) as follows:

$$E(eR_{it}) = \alpha_i + \beta_i (eMR_t) + \varepsilon_{it} \quad (2)$$

where:

[14] Balakrishnan and Koza (1993) constructed this variable to depict the relatedness of to partner firms. Schut and Frederikslust (2004) included it in their research as measure of the relatedness between the activities of the participant firms and those of the RJV.
[15] See e.g. Levy and Post. (2005).

$E(eR_{it})$ represents the expected excess return over the free risk rate of the asset *i* at time *t*

eMR_t represents the excess market return over the free risk rate at time *t*

α_i is the constant term of asset *i*

β_i represents the systematic risk of asset *i*

ε_{it} is the error term

Following the literature in event study methodology[16] regression (2) is estimated for a period that goes from 50 until 170 days prior the announcement of the RJV. The estimated excess return is then subtracted from the effective excess return to obtain the abnormal return of share *i* at time *t*:

$$AR_{it} = eR_{it} - E(eR_{it}) \quad (3)$$

Abnormal returns are calculated for the day of the announcement i.e. day 0 and for the preceding and the following day i.e. day -1 and day +1. I then calculated two cumulated abnormal returns, one including the three days and one including only day 0 and day +1:

$$\mathrm{CAR}_1 = AR_{i-1} + AR_{i0} + AR_{i+1} \quad (4)$$

$$\mathrm{CAR}_2 = AR_{i0} + AR_{i+1} \quad (5)$$

[16] McConnel and Nantell (1985) estimate their model for the period that goes from 180 until 61 days before the announcement; Das et al (1998) use a larger span, from 200 until 10 days before the announcement; Reuer and Koza. (2000) estimate their model from 250 until 50 days before the announcement; Schut and Frederikslust (2004) for the period starting 200 until 51 days before the announcement, finally Oxeley et al. (2009) use the span from 170 until 21 days before the announcement.

Table 1 shows the description of the independent variables included in the regression. Table 2 and 3 contain the descriptive statistics for the independent variables divided in sub-samples for the 55 and the 70 firm-observations samples.

5. Results and Discussion

Table 4 illustrates the statistics relative to the Cumulative Abnormal Returns. The full sample shows an average CAR for 3 days span, i.e. day 0, day +1 and day -1 of 1.07%, while the average CAR for day 0 and day +1 is slightly lower, 0.8%. These results indicate indeed that RJVs announcements trigger positive reactions in the stock market. The magnitude of both CARs is in line with the findings in previous event studies[17]. I then analyzed the two average CARs separately for the first and the second sub-sample. The first sub-sample is the one that includes the RJVs for which the Commission adopted a formal decision in relation to Article 81 of the European Treaty i.e. the firms that "can be suspected of collusion". Surprisingly, this sub-sample reports the lowest average CARs. The average CAR_1 is 0.73% while the average CAR_2 is only 0.16%. The second sub-sample reports an average CAR_1 of 1.59% and an average CAR_2 of 1.77%. This result is not surprising as the second sub-sample contains few firms that have rather large CARs. The magnitude of their CARs however is not large enough to consider these observations as outliers.

Table 5. Estimated regression on CAR_1 and on CAR_2 -53 firm-observations sample

	CAR 1		CAR 2	
	Coefficient	Std. Error	Coefficient	Std. Error
Ecdecision	0.022783*	0.011048	0.014804	0.010822
Diversification	0.008455*	0.003275	0.007192*	0.003208
Horizontal	-0.019189**	0.010608	-0.014482	0.010391
lnSales	0.017234*	0.008047	0.009071	0.007882
lnEmployees	-0.022658*	0.008538	-0.014456**	0.008363
	R-squared	0.289986	R-squared	0.220977
	Adj R-squared	0.217535	Adj R-squared	0.141485
	F-statistic	4.002538*	F-statistic	2.779859*
	Obs	55	Obs	55

[17] Koh and Venkatraman (1991) find an average 2 days CAR of 0.87%. Das, Sen and Sengupta (1998) when studying Thechnological Alliances find a 3 days CAR of 1.2% and a 2 days CAR of 1.1%. Anand and Khanna. (2000) find a 3 days CAR of 1.61% and 0.81 for a 2 days CAR. Schut and Frederikslust (2004) find a 2 days CAR of 0.4%. Oxley, Sampson and Silverman. (2009) find 2 days average CARs of 1.64% and 1.28%.

The first column of Table 5 reports the OLS estimates of the econometrical specification that has as a dependent variable CAR_1 i.e. the cumulated abnormal returns over three days span. This specification is a reduced version of the one I proposed in the previous section. The inclusion of all the variables gives no significant results indicating that an appropriate selection of the variables to include is necessary. I applied a step-wise regression, starting from the full model and dropping, one at a time, the variables that seems to have a negative impact on the specification. For each step, I examined the significance of the coefficients, the adjusted R-squared, and the F-test, that test the null hypothesis that all the coefficients are equal to zero. I dropped a variable when it was not significant and when its inclusion penalized the adjusted R-squared. At the end I obtain the restricted specification reported in Table 5.

The variable *ECdecision* appears with a positive sign as expected. It also carries a relatively high coefficient i.e. the fact that a firm has a higher potential for collusion can explain a 2.27% increase in the abnormal returns. This result is in line with the hypostasis that shareholders react more positively for those firms with an higher potential for collusion. However, when I add the interaction terms between *ECdecision* and the other variables the explanatory power of the specification drastically reduces. Results of this second specification are shown in the first column of Table 6. An interpretation for this result is that shareholders do attach a positive value to the "collusive potential" of a firm, but they believe at the same time that the RJV will produce gains besides the collusive activity. If this is the case, the other variables do not have a different impact whether there is potential for collusion or not, i.e. the interaction terms are not significant. I can conclude that shareholders attach a positive value to the collusive potential of a firm, but they do not think that this is the main (or at least the sole) source of gains of the RJV. This can also indicate that shareholders are uncertain whether the firm will actually collude or not.

The variable *Diversification* depicts the distance between the primary sector of activity of the RJV and the primary sector of activity of its parent firms. The higher the value of this variable, the less related the activities of the parents with those of the RJV. I was therefore expecting the variable to appear with negative sign, as the more the activities are related, the higher are the expected gains from collusion. Surprisingly the variable appears with positive sign. A possible explanation for this result can be found in the work of Reuer and Koza (2000). They find that RJV that are formed in sectors of activity that differ from the sector of activity of one or both parents lead to higher

abnormal returns. They conclude that RJV are therefore used as a mean of diversification. One limitation, however, is that for the case the primary activity of the RJV differs from that of only one parent, they do not specify whether the share returns under study belong to the parent with the same sector or the other. They examine bilateral RJVs and take into consideration only the movements of the shares of one of the parents without specifying which one. Other works in the RJV literature find instead higher returns for those firms that form the RJV in their same primary sector. Koh and Venkatraman (1991) finds that firms that engage in a RJV that is related to its primary sector gain on average higher abnormal returns than firms that form RJV for diversification purposes. Schut and Frederikslust (2004) find that shareholders react less positively the higher is the distance between the primary activity of the parents and that of the RJV. They argue that a RJV that does not utilize the core competence of the firm is less likely to create value. In my case it seems that shareholders attaches a positive value to the fact that the RJV offers the firm the possibility to expand in a new sector of activity. This however is hard to conciliate with collusive intentions.

The variable *Horizontal* corroborates the previous result. This variable, in fact, depicts the relatedness between the primary sector of activity of the parents. The variable appears with a negative sign indicating that shareholders react negatively when the activities of the parents are related. This result is in contrast with my hypothesis of collusion. However, Oxley at al (2009) find that is not the variable Horizontal itself that affects the abnormal returns, but this variable combined with a measure of market concentration. They find that horizontal RJVs in concentrated sectors produce positive abnormal returns and conclude in favour of collusive hypothesis. Unfortunately, I am not in possession of a measure of market concentration to test the same hypothesis.

In the RJV literature there are mixed evidences regarding the relatedness of the parent firms. Balakrishnan and Koza (1993) find that shareholders react positively to the announcement of RJVs when the parents operates in different sectors. The RJVs enhance efficiency gains through asset complementarities and shareholders attach a positive value to it. On the contrary, Koh and Venkatraman (1991) find higher positive returns for related parents arguing that shareholders do not value positively ventures with high asymmetries among partners.

Analyzing together the results for both, *Diversification* and *Horizontal*, I can conclude that my results are in line with the part of the literature that favours asymmetric RJVs. Shareholders attach a positive value to the possibility to enhance

efficiency gains through asset complementarities and to the possibility to gain insights into different sectors. These results are however not supportive of collusion hypothesis.

The variable *lnEmployees* appears with negative sign. It seems that shareholders of large companies react negatively to the announcement of a RJV. This result is in line with the majority of the event study literature that finds lower abnormal returns for larger firms with respect to smaller partners (McConnel and Nantell (1985); Koh and Venkatraman (1991); Das et al. (1998)). On the contrary, in the RJV formation literature, Marìn at al (2000) finds that larger firms have a higher incentive to form a RJV than smaller firms. Goeree and Helland (2008) corroborate their result. For the purpose of my research, the negative coefficient of this variable does not indicate evidence of collusive intentions.

The variable *lnSales*, on the contrary, appears with positive sign. These two results are however contrasting. Of course, the fact that I am analyzing the impact of a firm size instead of its relative size with respect to the partners is a big limitation. Moreover, the market share of a firm, in relation to the market share of its partners would have a greater explanatory power. Sales can only be a far proxy for a firm market share.

When I analyze the impact of these variables on CAR_2 i.e. the cumulated returns on day 0 and day +1, I do not find robust results. In this regressions the only variables that appear to have a role in explaining the abnormal return are *Diversification* and *lnEmployees.*

The first column of Table 6 reports the OLS estimates of the econometrical specification that has as a dependent variable CAR_1 i.e. the cumulated abnormal returns over three days span. The regression includes all the variables that can have an influence on the abnormal returns of firms that forms a RJV with the intent of soften the competition in the product market. Together with these variables, I include their interaction with the categorical variable *ECdecision.* The role of the interaction terms is to reveal the different impacts of the variables on the cumulated returns for those firms that “can be suspected of collusion”. I start the analysis from the 53 firm-observations.

Table 6. Estimated regression on CAR_1 and on CAR_2 -53 firm-observations sample. Full regression

	CAR 1		CAR 2	
	Coefficient	Std. Error	Coefficient	Std. Error
ECdecision	-0.154591	0.172447	-0.244474	0.161282
OtherActivity	-0.018054	0.030569	-0.010269	0.028589
Bilateral	-0.015997	0.061154	-0.043822	0.057194
Participants	-0.026333	0.046893	-0.037676	0.043857
Horizontal	0.002065	0.029823	0.003911	0.027892
lnSales	0.040372*	0.017561	0.041085*	0.016424
lnEmployees	-0.040183*	0.016258	-0.038416*	0.015205
Majority	-0.000653	0.046976	-0.010180	0.043935
Equality	0.111264	0.065902	0.148263*	0.061635
Diversification	0.004141	0.005411	0.003920	0.005061
*Sales*Equality*	-0.010850	0.008889	-0.015612**	0.008313
*ECdecision*OtherActivity*	0.016268	0.040498	0.001698	0.037876
*ECdecision*Sales*	-0.014941	0.018726	-0.020575	0.017514
*ECdecision*Bilateral*	0.007386	0.064420	0.033634	0.060249
*ECdecision*Participants*	0.026501	0.046926	0.038912	0.043888
*ECdecision*Employees*	0.021821	0.019836	0.030375	0.018552
*ECdecision*Horizontal*	-0.028925	0.034114	-0.027690	0.031906
*ECdecision*Equality*	-0.004581	0.040461	0.001101	0.037841
*ECdecision*Diversification*	0.019646**	0.011068	0.016880	0.010351
*ECdecision*Majority*	-0.005449	0.051916	-0.021421	0.048555
R-squared	0.472515		R-squared	0.472396
Adj R-squared	0.162230		Adj R-squared	0.162041
F-statistic	1.522842		F-statistic	1.522116

The most striking result is that the variable *ECdecision* is not significantly different from zero. This result is in contrast with the findings of the previous specification. Other than the explanation I gave before, I here offer other possible interpretations of the results of this second specification. The first explanation is that shareholders, even though well informed of the potential for the RJV to be a mean of collusion, do not assign a "premium" to this information. This could happen for example because the shareholders believe that the collusion will not bring gains that are higher enough to justify the trade of the shares for this sole reason. A more plausible explanation is that perhaps shareholders fear that the European Commission will limit or keep under constant monitoring the activities of the RJV as it happens after a formal decision of exemption is adopted. In this case they would foresee no gains from collusion. Even worse shareholders can fear that the firm will be declared guilty of infringement of the Art 81 of the Treaty of the European Union and it will be subject to a high fine. This last hypothesis however is improbable as RJVs usually receive exemption from the

application of Art 81. Moreover, if this would be the case, the variable *ECdecision* should be significantly different from zero and appear with a negative sign. The third explanation for the failure of the variable *ECdecision* is that in reality shareholders are not well informed of the potential for collusion of the RJV. If this is the case they will have no reaction to the information "potential for collusion" included in the event "RJV formation" and the variable *ECdecision* is therefore unable to split the sample into firms "that can be suspected of collusion" and firms "not suspected of collusion" from the viewpoint of the shareholders. Finally, a fourth explanation is that the RJVs are not actually formed with the intention of collusion and that shareholders are well aware of it. In this case, even though the shareholders are aware of the "potential for collusion" they do not give this information any "premium" as they know that the firms are not forming the RJV to soften the market competition but to enhance efficiency gains through cost sharing or through the access to new information, processes and resources. Without the positive impact of this variable, is impossible to distinguish between the possible motives for the positive abnormal returns. In fact, there are not enough evidences to assess that the positive abnormal returns come from perspectives of collusion. More generally the whole econometric specification does not appear to be able to capture the determinants of the abnormal returns.

In the attempt of trying to detect possible multicollinearity in the specification, I estimated different variants of the model. No significantly different results are obtained when excluding possible correlated variables[18].

Only three variables, seems to have an impact on CAR_1: *lnEmployees, lnSales* and the interaction variable *ECdecision*Diversification.* The rest of the variables in the model are not significantly different from zero.

The variable *lnEmployees* appears with negative sign. This result is robust with that of the previous specification. However, if the RJVs are formed to perseverate anticompetitive behaviours the interaction term that capture the effect of this variable for firms that are more suspected of collusion, should have a positive sign. The interaction term is indeed positive but it is not significantly different from zero.

The variable *lnSales*, appears with a positive sign and again it is robust with the previous specification. The interaction term between the variables *lnSales* and *ECdecision* does not significantly differ from zero either. This means once again that

[18] Results of the estimates are not shown as no other variable appear to be significantly different from zero.

the size of the firm does not have a different impact whether the RJV is formed for collusion purposes or not.

The interaction variable *ECdecision*Diversification* is significant but it appears with the wrong sign. It seems from this result that the more the activities of the firm are unrelated with those of the RJV, the greater the expected benefits if the RJV is formed with anticompetitive purposes. Even this result is in contrast with my hypotheses. Moreover, the variable *Diversification* does not appear to be significantly different from zero. This would mean that *Diversification* has no effect for the firms that are not suspected of collusion while it has a positive impact for those suspected of collusion.

Finally, the overall explanatory power of the model is relatively high (R^2 is 47%) but this is most probably due to the inclusion of a large number of explanatory variables.

I conduct a robustness check testing the same specification for CAR_2, i.e. the cumulated abnormal returns over only day 0 and day +1. Results are reported in the third column of Table 6 There are few differences in the estimates of this second regression, perhaps showing lack of robustness of the overall results. The variable *Equality* is significantly different from zero and its impact on the abnormal returns is very strong (14%). This result is in favour of the hypothesis of better coordination. To know whether the impact of this variable is different for firms that are more suspected of collusion, however, the interaction term *ECdecision*Equality* should be significantly different from zero, but it is not. In this estimation I also find that the interaction term *Sales*Equality* is significantly different from zero and it appear with negative sign. The rational underlying this variable is that large firms that engage in equally owned RJVs signal their propensity to coordination. The term was therefore expected to carry a positive sign. The negative coefficient means that the effect of having large sales included in the positive coefficient of *lnSales*, is reduced when the firm engages in an equally owned RJV. This result is in contrast with my hypothesis. Finally, in this second specification the interaction term *ECdecision*Diversification* is no longer significant.

The estimates of the econometric specification for the 70 firm-observations sample are reported in Table 7. For this larger version of the sample, I was not in possession of the size data. The first column reports the estimates of the regression on CAR_1. Like in the previous specification, the variable *ECdecision* is not significantly different from

zero. Again, only few variables are in fact significantly different from zero: *Majority*, *Horizontal* and the interaction *ECdecision *Majority.*

Table 7. Estimated regression on CAR_1 and on CAR_2 -70 firm-observations sample

	CAR 1		CAR 2	
	Coefficient	Std. Error	Coefficient	Std. Error
ECdecision	-0.073109	0.190565	-0.114988	0.198367
OtherActivity	-0.009426	0.027789	-0.000529	0.028927
Bilateral	0.012765	0.069269	-0.007132	0.072105
Participants	-0.048722	0.054283	-0.059827	0.056506
Horizontal	-0.046975**	0.027909	-0.054301**	0.029052
Majority	0.073950*	0.032567	0.083874*	0.033901
Equality	0.026164	0.028315	0.029059	0.029474
Diversification	-0.002303	0.005677	-0.002108	0.005910
*ECdecision*OtherActivity*	0.024621	0.036915	0.004228	0.038427
*ECdecision*Bilateral*	-0.027212	0.072534	-0.004313	0.075504
*ECdecision*Participants*	0.047880	0.054332	0.060195	0.056557
*ECdecision*Horizontal*	0.026660	0.033550	0.038944	0.034924
*ECdecision*Equality*	-0.037233	0.039440	-0.034347	0.041055
*ECdecision*Diversification*	0.013754	0.011582	0.013345	0.012056
*ECdecision*Majority*	-0.088629**	0.046736	-0.113892*	0.048650
	R-squared	0.236335	R-squared	0.238207
	Adj R-squared	0.024205	Adj R-squared	0.026598
	F-statistic	1.114106	F-statistic	1.125696

The variable *Majority* appear with positive sign. As argued in the previous section, this can be conciliated with the hypothesis that shareholders expect a higher share of the gains that will derive from collusion in spite of coordination problems. However, the fact the interaction term *ECdecision*Majority* has a negative sign tells us that shareholders of firms with a majority interest in the venture react less positively for those firms "that can be suspected of collusion". This corroborates the hypothesis for which a majority interest renders effective coordination and hence collusion more difficult.

The variable *Horizontal* appears with the wrong sign. For the purpose of my research, I would expect that a Research Joint Venture in which two or more firms compete in the same market would be a more useful mean of collusion, and therefore its announcement would trigger positive reactions from the part of the shareholders. This result is robust with the findings of the 55 firm-observations samples reported in Table 5. It seems that shareholders attach a positive value to asymmetric RJVs.

As a robustness checks I test the same specification for the 70 firm-observations sample on the CAR_2. Results of the estimates are reported in the third column of Table 7 This second specification is robust with the previous one.

6. Conclusions

The aim of this paper was to detect possible anticompetitive behaviour of firms engaged in European Research Joint Ventures using an indirect approach. However, the categorical variable that constitutes the focal point of my specification is only significant in the 55 firm-observations sample when the regression does not include any interaction term. Moreover, interaction terms are in general not significant. An interpretation for this outcome is that shareholders do attach a positive value to the "collusive potential" of a firm, but they believe at the same time that the RJV will produce gains besides the collusive activity. This means that they expect that besides collusive benefits, the firm will realize efficiency gains and/or gain access to new information and specialized resources. If this is the case, the other variables should not have a different impact whether there is potential for collusion or not, i.e. the interaction terms should not be significant. I can conclude that even if shareholders attach a positive value to the collusive potential of a firm, they do not expect that the gains of the RJV will come exclusively from collusion activity.

However, this does not fully explain the discrepancy in the significance of the variable *ECdecision* for the two different specifications.

Another possible reason for my results can derive from the size of my sample. The number of observations is rather low and might not be enough to obtain robust results.

In conclusion, I have some evidence to affirm that shareholders attach a positive value to the collusive potential of firms. However, my specification does not provide enough evidence to assess that RJVs in Europe are indeed formed with the intention of collusion.

7.References

Anand, Bharat N., and Tarun Khanna. 2000. “Do Firms Learn to Create Value? The Case of Alliances”. Strategic Management Journal, Vol. 21, No. 3, Special Issue: Strategic Networks, pp. 295-315.

Balakrishnan, Srinivasan and Mitchell P. Koza. 1993. “Information asymmetry, adverse selection and joint-ventures, Theory and evidence”. 1993. Journal of Economic Behavior and Organization 20, 99-117.

Bartholdy, Jan, and Paula Peare. 2005. “Estimation of Expected Return: CAPM vs Fama and French”. International Review of Financial Analysis.Volume 14, Issue 4, 2005, Pages 407-427.
Bartholdy, Jan., and Paula Peare. 2003. “Unbiased Estimation of Expected Return using CAPM”. International Review of Financial Analysis.

Carree, M., and F. Russo, and M.P. Schinkel, and A.M. Guenster. 2009. “European Commission Decisions on Competition: Landmark Antitrust and Merger Cases from an Economic Viewpoint”. Cambridge: Cambridge University Press. Forthcoming.

Carree, Martin, and Andrea Günster, and Maarten Pieter Schinkel. 2008. “European Antitrust Policy 1957-2004: An Analysis of Commission Decisions”. 2008. Amsterdam Center for Law & Economics Working Paper No. 2008-06.

Das, Somnath, and Pradyot K. Sen, and Sanjit Sengupta. 1998. “Impact of Strategic Alliances on Firm Valuation”. Academy of Management Journal. Vol. 41, No. 1,27-41.

Duso, Tomaso, and Enrico Pennings, and Jo Seldeslachts. 2008. “ On the Stbility of Research Joint Ventures: Implications for Collusion”. Discussion paper 240, SFB/TR 15 Governance and the Efficiency of Economic Systems (GESY), Free University of Berlin, Humboldt University of Berlin, University of Bonn, University of Mannheim, University of Munich.

Duso, Tomaso, and Lars-Hendrik Roller and Jo Seldeslachts. 2009. “Do Research Joint Ventures Networks lead to product market Collusion?”. Presented at a seminar at the Norwegian School of Economics the 12th of February 2009.

Fama, Eugene F., and Michael C. Jensen, and , Lawrence Fisher, and Richard W. Roll. 1969. “The Adjustment of Stock Prices to New Information”. International Economic Review, Vol. 10, February 1969.

Goeree, Michelle S., and Eric Helland. 2008. “Do Research Joint Ventures Seve a Collusive Function?” Robert Day School of Economics and Finance Research Paper No. 2009-12.

Gugler, Klaus, and Ralph Siebert. 2007. “Market Power Versus Efficiency Effects of Mergers and Research Joint Ventures: Evidence from the Semiconductor Industry“. The Review of Economics and Statistics, November 2007, 89(4): 645–659.

Koh, Jeongsuk, and N. Venkatraman. 1991. “Joint Venture Formations and Stock Market Reactions: An Assessment in the Information Technology Sector”. The Academy of Management Journal, Vol. 34, No. 4, pp. 869-892.

Levy, Haim, and Thierry G. Post. Investments. 2005. USA: Prentice-Hall

Marín, Pedro L., and Georges Siotis, and Roberto Hernán. 2000.“An Empirical Evaluation of the Determinants of Research Joint Venture Formation”. CEPR Discussion Paper Series No. 2442.

McConnel, John J. and Timothy J. Nantell. 1985. “Corporate Combinations and Common Stock Returns: The Case of Joint Ventures,” The Journal of Finance, Vol. XL No. 2, June 1985, pp. 519-536.

McGahan, Anita M., and Belen Villalonga. (2005). “The Choice Among Acquisitions, Alliances, and Divestitures.”. Strategic Management Journal 26, no. 13, 1183–1208.

Oxley, Joanne E., and Rachelle C. Sampson, and Brian S. Silverman. 2009. "Arms Race or Détente? How Inter-firm Alliance Announcements Change the Stock Market Valuation of Rivals". Rotman School of Management Working Paper No. 1328965. Robert H. Smith School Research Paper No. RHS RHS 06-069.

Reuer, Jeffrey J. and Mitchell P. Koza. 2000 "Asymmetric Information and Joint Venture Performance: Theory and Evidence for Domestic and International Joint Ventures". Strategic Management Journal, Vol. 21, No. 1, pp. 81-88.

Roller, Lars-Hendrik, and Ralph Siebert, and Mihkel M. Tombak. 2007. "Why Firms Forms (or Do Not Form) RJVs". The Economic Journal, 117 (July), 1122–1144.

Schut, Gertjan, and Ruud van Frederikslust. 2004. "Shareholder Wealth Effects of Joint Venture Strategies". Multinational Finance Journal, vol. 8, no. 3 & 4, pp. 211–225).

Woolridg, J. Randall, and Charles C. Snow. 1990. "Stock Market Reaction to Strategic Investment Decisions". Strategic Management Journal, Vol. 11, No. 5, pp. 353-363.

Internet references:

EU Framework program. http://cordis.europa.eu/fp7/

Eureka Program. www.eureka.be

Official Journal of the European Union. http://eur-lex.europa.eu/en/index.htm

8.Appendix

Table 3. Independent Variables

Variables	Description
ECdecision	Is a dummy variable that take on the value of 1 if the European Commission adopted a formal decision on the RJV in relation to Article 81 of the Treaty of the European Union and 0 otherwise.
Bilateral	Is a dummy variable that take on the value 1 if the RJV is constituted by only two members and 0 otherwise.
Participants	Is defined as the number of participants in the RJV.
Horizontal	Is a dummy variable that take on the value 1 if at least two participants in the RJV share the same 4-digit primary SIC code.
Size	Depicts the size of the participant firms. As a measure of size I used alternatively and combined the natural logarithm of employees, the total assets and the annual sales.
Equality	Is a dummy variable that take on the value of 1 if the participants share the same interest in the RJV and 0 otherwise.
Majority	Is a dummy variable that take on value 1 either if the firm owns the absolute majority of the venture or either if the firm shares the majority with another firm.
Diversification	This variable depicts the distance between the primary sector of the participant firms and the primary sector of the RJV[19]. The variable is constructed in following way[20]: $$D_{ij,j} = \frac{\left\|SIC_{ij} - SIC_{j}\right\|}{899}$$ The higher the value of this variable, the greater the distance between the activities of the RJV and those of its parent firms.

[19] Balakrishnan and Koza (1993) constructed this variable to depict the relatedness of to partner firms. Schut and Frederikslust (2004) included it in their research as measure of the relatedness between the activities of the participant firms and those of the RJV.

Table 2. Descriptive Statistics – 55 firm-observations sample

	Full sample				First sub-sample				Second sub-sample		
	Mean	Max	Min	Std. Dev	Mean	Max	Min	Std. Dev	Mean	Max	Min
ECdecision	0.600000	1	0	0.494413	1	1	1	0	0	0	0
OtherActivity	0.836364	1	0	0.373355	0.909091	1	0	0.291937	0.727273	1	0
Bilateral	0.709091	1	0	0.458368	0.575758	1	0	0.501890	0.909091	1	0
Participants	3.890909	17	2	4.661397	5.060606	17	2	5.749671	2.136364	3	2
Horizontal	0.345455	1	0	0.479899	0.484848	1	0	0.507519	0.136364	1	0
Majority	0.127273	1	0	0.336350	0.090909	1	0	0.291937	0.181818	1	0
Equality	0.654545	1	0	0.479899	0.636364	1	0	0.488504	0.681818	1	0
Diversification	0.860997	7.377086	0	1.508245	0.579735	4.114572	0	0.899675	1.282890	7.377086	0
lnSales	8.560105	11.48914	1.029619	1.880977	9.047745	11.48914	5.875577	1.502639	7.828645	10.50383	1.029619
lnEmployees	10.37329	12.90421	4.025352	1.800823	10.90140	12.90421	7.600902	1.500661	9.581130	12.44127	4.025352
	Observations		55		Observations		33		Observations		22

Table 3. Descriptive Statistics – 70 firm-observations sample

	Full sample				First sub-sample				Second sub-sample			
	Mean	Max	Min	Std. Dev	Mean	Max	Min	Std. Dev	Mean	Max	Min	Std. Dev
ECdecision	0.600000	1	0	0.493435	1	1	1	0	0	0	0	0
OtherActivity	0.814286	1	0	0.391684	0.880952	1	0	0.327770	0.714286	1	0	0.460044
Bilateral	0.742857	1	0	0.440215	0.619048	1	0	0.491507	0.928571	1	0	0.262265
Participants	3.528571	17	2	4.190124	4.476190	17	2	5.213669	2.107143	3	2	0.314970
Horizontal	0.314286	1	0	0.467583	0.428571	1	0	0.500870	0.142857	1	0	0.356348
Majority	0.128571	1	0	0.337142	0.071429	1	0	0.260661	0.214286	1	0	0.417855
Equality	0.685714	1	0	0.467583	0.714286	1	0	0.457230	0.642857	1	0	0.487950
Diversification	0.871174	7.377086	0	1.527544	0.605037	4.114572	0	0.849541	1.270380	7.377086	0	2.142830
	Observations		70		Observations		42		Observations		28	

Table 4. Cumulated Abnormal Returns

	Full sample		First sub-sample		Second sub-sample	
	CAR 1	CAR 2	CAR 1	CAR 2	CAR 1	CAR 2
Mean	0.010781	0.008085	0.007319	0.001676	0.015974	0.017700
Maximum	0.258168	0.308841	0.106378	0.070939	0.258168	0.308841
Minimum	-0.106316	-0.100464	-0.076064	-0.071915	-0.106316	-0.100464
Std. Dev.	0.047583	0.049592	0.035716	0.030035	0.061665	0.068960
Obs.	70	70	42	42	28	28

[20] The value 899 represents the maximum possible relatedness between the SIC codes.

Table 8 **Estimated regression on CAR_1 and on CAR_2 -55 firm-observations sample**

First sub-sample vs Second sub-sample

	CAR 1				CAR 2			
	FIRST SUB-SAMPLE		SECOND SUB-SAMPLE		FIRST SUB-SAMPLE		SECOND SUB-SAMPLE	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
OtherActivity	-0.004694	0.024513	-0.017217	0.034905	-0.012756	0.021829	-0.009066	0.036476
Bilateral	-0.011368	0.018743	-0.016637	0.069844	-0.014154	0.016691	-0.044742	0.072987
Participants	-2.10E-05	0.001748	-0.028151	0.053531	0.000964	0.001556	-0.040293	0.055940
Horizontal	-0.027011**	0.015416	-0.003822	0.033614	-0.023995**	0.013728	-0.004559	0.035126
Majority	0.000459	0.024873	0.028607	0.046142	-0.022160	0.022149	0.031923	0.048219
Equality	0.008832	0.022578	0.037235	0.029456	0.008566	0.020106	0.041743	0.030781
Diversification	0.020655*	0.008587	0.004413	0.006175	0.016293*	0.007647	0.004311	0.006453
InSales	0.014038	0.011483	0.027443	0.015998	0.004117	0.010226	0.022482	0.016718
InEmployees	-0.015548	0.011027	-0.035645**	0.018077	-0.003991	0.009820	-0.031886	0.018890
	R-squared	0.403882	R-squared	0.497715	R-squared	0.379566	R-squared	0.446781
	Adj R-squared	0.170618	Adj R-squared	0.121001	Adj R-squared	0.136787	Adj R-squared	0.031866
	F-statistic	1.731439	F-statistic	1.321200	F-statistic	1.563423	F-statistic	1.076802
	Obs	33	Obs	22	Obs	33	Obs	22

Table 9 Estimated regression on CAR_1 and on CAR_2 -70 firm-observations sample

First sub-sample vs Second sub-sample

	CAR 1				CAR 2			
	FIRST SUB-SAMPLE		SECOND SUB-SAMPLE		FIRST SUB-SAMPLE		SECOND SUB-SAMPLE	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
OtherActivity	0.015195	0.017538	-0.009426	0.037433	0.003699	0.014439	-0.000529	0.042377
Bilateral	-0.014448	0.015530	0.012765	0.093309	-0.011445	0.012786	-0.007132	0.105631
Participants	-0.000842	0.001674	-0.048722	0.073122	0.000369	0.001378	-0.059827	0.082778
Horizontal	-0.020315	0.013437	-0.046975	0.037596	-0.015357	0.011063	-0.054301	0.042560
Majority	-0.014679	0.024192	0.073950	0.043870	-0.030018	0.019917	0.083874	0.049663
Equality	-0.011069	0.019814	0.026164	0.038141	-0.005288	0.016313	0.029059	0.043178
Diversification	0.011450	0.007285	-0.002303	0.007648	0.011237	0.005998**	-0.002108	0.008658
	R-squared	0.251916	R-squared	0.219036	R-squared	0.282965	R-squared	0.199722
	Adj R-squared	0.097899	Adj R-squared	-0.054302	Adj R-squared	0.135340	Adj R-squared	-0.080376
	F-statistic	1.635637	F-statistic	0.801339	F-statistic	1.916784**	F-statistic	0.713044
	Obs	42	Obs	28	Obs	42	Obs	28