

Trusting the others

A research study on the influence of economic sectors
on trust in R&D partnerships



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Finally, after four years of studying, this is the end product for my bachelor Sociology. Although this study combines some economic theories that were never investigated by me before with interesting sociological theories, I enjoyed researching it. It was a challenge for me because of I knew little about the subject on beforehand. Besides, I also had to deal with difficult statistic analyses.

Therefore, I want to thank Rense Corten for his ideas and helpful supervision. The time he has spent on helping me with difficult analyses, the English writing and with reflecting on my research and ideas, definitely has helped me to get a better result.

I also want to thank Ruud Knieriem for helping my with my academic writing in English.

Summary in Dutch

Dit onderzoek gaat over de invloed van economische sectoren op het vertrouwen tussen bedrijven bij een strategische onderzoeks- en ontwikkelingsovereenkomst. Het onderzoek is opgebouwd uit een theoretisch kader waaruit meerdere hypothesen zijn opgesteld. Deze hypothesen zijn vervolgens getoetst met behulp van de Thomson Financial SDC Platinum dataset.

Het is erg belangrijk dat als bedrijven een overeenkomst sluiten, zij beiden er geen misbruik van maken. Immers, de informatie die gedeeld wordt is vaak kostbaar. Daarom speelt vertrouwen een belangrijke rol. Echter, naar de invloed van sectoren op het vertrouwen tussen bedrijven is nog geen onderzoek gedaan en hierover bestaat dus ook nog geen specifieke theorie. Ondanks dat kunnen we wel uit de literatuur drie hypothesen opstellen.

Onze hypothesen zijn dat een overeenkomst tussen bedrijven het meeste vertrouwen krijgt als de bedrijven uit dezelfde regio komen, in dezelfde economische sector zitten en zij niet elkaars concurrent zijn.

Uit de resultaten van de toetsen blijkt dat als bedrijven in dezelfde economische sector zitten er meer kans is op vertrouwen in de overeenkomst. Daarom kunnen we alleen deze hypothese aannemen. Verder blijkt dat herkomst uit de regio's *Amerika* en *Azië*, ten opzichte van de overige landen behalve Europa, ook de kans laat toenemen op meer vertrouwen in een overeenkomst tussen bedrijven. Als laatste blijkt ook dat hoe hoger de flexibiliteit van de sector waar de overeenkomst is afgesloten, hoe meer kans er is op vertrouwen.

In de discussie merken we op dat onze dataset alleen uit Engelstalige literatuur is opgebouwd. Daarnaast blijkt dat maar tien procent van alle overeenkomsten ongelijkwaardig is. De vraag rijst dan of de vorm van overeenkomst wel een goede maat is voor vertrouwen. Tevens is het onduidelijk wat volgens de dataset een ongelijkwaardige overeenkomst precies inhoudt want dit wordt niet gespecificeerd. Ten derde zien we ook dat er maar erg weinig eerdere overeenkomsten zijn opgenomen in de dataset. Wij vinden dat er meer onderzoek moet worden gedaan naar de invloed van sectoren op overeenkomsten tussen bedrijven. Wat we hier vooral voor nodig hebben, zijn uitgebreidere datasets met meer informatie over de vorm van de contracten voor nodig. Een kwalitatief onderzoek zou hier ook aan bijdragen omdat we dan meer inzicht kunnen krijgen op hoe vertrouwen zich tussen bedrijven ontwikkeld in de loop van der tijd.

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Section 1 Introduction

If you have a secret and you want to share it, with who would it be? Most people would probably answer that they would only share their secrets with someone they trust. So, you do not trust everyone. In literature trust is defined by the assumption that actors are rational in the sense that trust is only possible if, for the person who gives trust, the expected outcome of placing trust is preferred over the expected outcome of not placing trust (Buskens et al. 2002). However, there is the problem that the person who is trusted can abuse this trust. Therefore, the person who receives trust has an opportunity to abuse trust and the person who gives trust has something to lose if the trust is abused (Buskens et al. 2002).

By knowing that, one of the least expected activities from companies would be the sharing of knowledge which is gathered through research and development (R&D) by the company itself (Hagedoorn 2002). After all, if they share information, every other company could use it for their own good and they can lose for example their leading position on the market. So, they would only share information and trust with another company if the expected outcome of placing trust would be preferred over the expected outcome of not placing trust, and when they expect that their trust will not be abused.

There are examples where placing trust in another company and the sharing of R&D between companies has led to a better position on the market or a totally new product. In the Netherlands we all are familiar with the Senseo coffee machine. This machine is an example of an R&D partnership between Sara Lee/Douwe Egberts and Philips and it improved their position on the market (Eisema 2007). One of the benefits of an R&D partnership between companies is that they can avoid the duplication of research investment and they can exploit similarities between the technology knowledge they have (Hagedoorn et al. 2000). This recent example shows us that partnerships can have positive effects.

There are different forms of R&D partnerships. Hagedoorn et al. (2000) shows us two: the formal agreement and the informal agreement. The formal agreement can be distinguished further into two different forms: equity based partnerships and non-equity based partnerships. In the informal part there is only the undefined arrangement. In section 2 these forms will be explained in more detail.

Something to question about R&D partnership is; in which situations will an R&D partnership more easily be made? In other words: in which situation of an R&D partnership will there be more trust? If companies decided they want to start an R&D partnership, trust is important.

This study will look at the influence of economic sectors on trust between companies. There are companies in different economic sectors that participate in R&D partnerships and could it be that companies in some economic sectors trust their R&D partners more than in other sectors? Are companies from the same economic sector more likely to trust their R&D partner because they are in the same sector and therefore know each other better? We think this is interesting to research because we combine our sociology knowledge about trust in networks with the economic knowledge about partnerships.

The scientific relevance of this research study is that there is not yet research done on the influence of economic sectors on trust in an R&D partnership. We use sociology theories about networks and trust to formulate hypotheses about the best situation for trust between companies. Furthermore, the hypotheses are tested by using the Thomson Financial SDC Platinum database and in this way we test if our theory also correspondent with our database.

The relevance of this study for companies is that they can make a better choice for a partner for a successful R&D partnership, based on which economic sector they are and which economic sector their future partner is.

The goal of the research study

The goal of this research study is to achieve more knowledge about the effect of economic sectors on trust in R&D partnerships. Could it be that between some sectors there is more trust then between others? Even more, what are the reasons for trusting certain sectors more than others? The added value of this study is that we test our hypotheses which are based on theory. In that way we test if the theory fits with the results from our dataset. Furthermore, the focus of this research study is unique, because there is no research ever done on the influence of economic sectors on trust in R&D partnerships.

Research questions

The main research question of this study is:

How does trust differ between economic sectors in an R&D partnership?

To answer this question there are two sub-questions:

- 1. What is the influence of trust in R&D partnerships?*
- 2. Does the influence of trust change over different economic sectors?*

The first sub-question gives us a better look at how trust influence an R&D partnership and what factors are important for trust in an R&D partnership. The second sub-question gives us a closer look

on how trust influences partnerships in different economic sectors and if there are difference between economic sectors. We try to answer these two questions by using literature. After that we reformulate our answers to hypotheses which we test by using our dataset.

Plan of research

This study is a research study, which means that the research will be done through the investigation of relevant literature and by testing our hypotheses through a dataset. Important research articles for this subject which are used, are articles written by for example: Coleman, Granovetter, Hagedoorn et al., Gulati, Buskens et al. and Bojanowski et al. These articles can be found in the references. Furthermore we use the Thomson Financial SDC Platinum database. The database gathers information on newly formed partnerships from press releases, specialized journal articles, and other business-oriented databases (Bojanowski et al 2009:9).

Thesis outline

In section 2 of this research study there first will be a closer look to the idea of trust, what forms of R&D partnerships exist and how trust works in R&D partnerships. We summarize previous findings about trust and trust in R&D partnerships. In section 3 we draw a conclusion about the previous findings and we theoretical answer the sub questions mentioned above. Furthermore, we formulate hypotheses which we later test in our dataset. In section 4 we describe our dataset and we operationalize our variables. Section 5 shows our test results. In section 6 we draw conclusions on our hypotheses and we discuss our results.

Section 2 Previous Findings

In this section we first state our definition of trust and look to important previous findings about trust. We look to theories and research which is already done. Furthermore, we do the same for R&D partnerships. We combine trust and R&D partnerships and look at research about this. At the end we look if there is previous research done about the influence of economic sectors on trust in R&D partnerships.

2.1 Theories on trust

In the introduction of this research study we learned that trust could be defined by the assumption that the actors are rational in the sense that trust is only possible if, for the person who gives trust, the expected outcome of placing trust is preferred over the expected outcome of not placing trust. Furthermore, the person who receives trust can choose to abuse it, which has negative consequences for the person who gives trust (Buskens et al. 2002). Coleman (1990) concludes that there are always, at minimum, two parties involved in a trust relation and calls them the trustor and trustee. The trustor gives trust and the trustee receives trust. He also presents us four elements that define a trust situation:

1. Placing trust gives the trustee the possibility to honour or abuse trust
2. When the trustee abuses trust, the trustor regrets placing trust, and if the trustee honours trust the trustor benefits from this
3. The trustor gives voluntary trust to the trustee without formal safeguards
4. There is a time-gap between placing trust and the action of the trustee

To illustrate this we put these elements in a model, which we call a Trust game, seen as in Figure 1 (Barrera 2008).

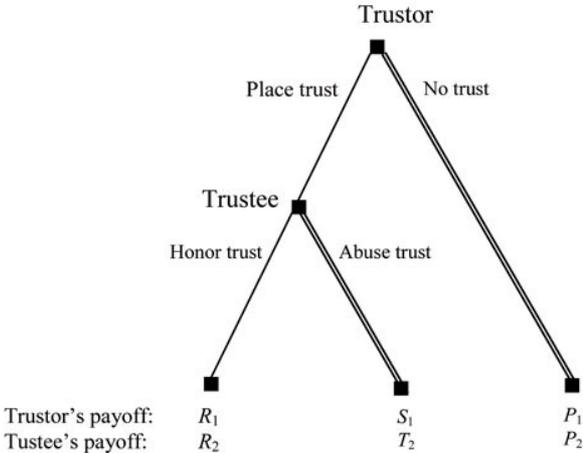


Figure 1 Trust Game ($T_i > R_i > P_i > S_i$)

In this game the first move is by the trustor who can choose to trust or not trust the trustee. If the trustor chooses to not trust the trustee, the game ends with a payoff of R_1 for the trustor and R_2 for the trustee. If the trustor chooses to trust the trustee, the trustee can choose to abuse trust or to honour trust. In the case that the trustee chooses to abuse trust, the payoffs for the trustor will be S_1 and for the trustee will be T_2 . However, if the trustee chooses to honour the trust, the payoffs will be P_1 for the trustor and P_2 for the trustee (Buskens et al. 2002:169).

It is important to notice that the value of the payoffs is: $T_i > R_i > P_i > S_i$. Assuming that the actors are rational, a trustor would never place trust in a trustee because a rational trustee would always abuse the trust and the payoff in that situation for the trustor is lower than the payoff by not placing trust. The trust game is also a social dilemma because both actors receive a lower payoff if trust is not placed than in the situation that trust is placed and honoured (Buskens et al. 2002:169). This placing of no trust is what we call a Nash equilibrium and it is Pareto-suboptimal. The motivation for the trust game is that if the trustee honours the trustor, the outcome for the trustor will be higher than if the trustor does not play the game.

Most trust situations occur in a social context where actors meet each other and each other's acquaintances more often over time (Buskens et al. 2002:170). This meeting in social context is also known in literature as 'embeddedness' (Granovetter 1985). Granovetter (1985) did a literature study about the problem of embeddedness. He writes in his article that he claims that both order and disorder, honesty and malfeasance have more to do with structures of personal relations and networks of relations, than with organizational forms (1985:503). Although the article from Granovetter only is a summary of earlier research and therefore only a literature study, his arguments are very good and give a good start for seeing how embeddedness influences trust.

Learning and control

Buskens et al. (2002) show us two mechanisms of how embeddedness in a social context may affect trust, which they label as *learning and control*.

Learning means that information from actions from the past, gives us information to make better choices in the future. In our case this means that if a trustor knows about a trustee that in the past he has not abused trust, or a third-party who has had an interaction with the trustee tells the trustor that the trustee did not abuse trust in earlier situations, the trustor will be more willingly to trust the trustee (Buskens et al. 2002). Granovetter (1985) said also that someone's own experiences from the past are even better to rely on and he also says that to rely on a third-party is even better than to rely on no experience at all. However it can also be the other way around. Coleman (1990) shows that learning not only happens in a positive way, but that it could also be that negative information from the past can decrease trust. An example of this theory could be that if my bike is broken and I

need it to be fixed, I first would consider going to the bike-mechanic I was the last time when my bike was broken. When I concluded that he fixed my bike well the last time, I would go back to him because I know trustworthy. However, if he did not fix my bike, I would go to another bike-repairer to get my bike really fixed.

Control in a trust situation means that even if there is a possibility for abusing trust by the trustee, this is only for a short-term period and that the trustor controls the long-term possibilities of abusing trust (Buskens et al. 2002:171). Thus, if the trustee wants to abuse the trust from the trustor, the benefits of this choice are only for a short-term, because the trustor will stop trusting the trustee after the trustee has abuse trust. After all, the outcome of not placing trust gives the trustee the outcome P_2 , which is lower than the outcome S_2 if he honours trust. So, for the long-term relation, the trustee needs to be trustworthy or else he loses the trust from the trustor and even more he can lose trust form other parties too. For example, if I would buy a new bike and after two months the bike would already been broken, I would not go back tot the same bike shop. Furthermore, I would buy a new bike somewhere else and I would tell it to my friends to prevent them from going there also.

Dyad and Network

We have now seen that the mechanisms of control and learning are important, but we also see that the social network is involved. Granovetter (1985) says that if two people both belong to the same network, they are together for a long time and they have developed the same standards from the same events, trust can also grow. So, if there are only two actors, trust can grow and we have seen that if there is a network trust can also grow through this network. Thus, the two mechanisms control and learning can both be used in a dyad (only two actors) or in a network (two actors and also third parties) as an embeddedness effect, seen as in table 1 (Buskens et al. 2002:172).

Mechanism	Dyad	Network
Learning	Information about the trustee from own past experiences	Information from third parties about their past experience with a trustee
Control	Possibilities to sanction a trustee oneself after abuse of trust	Possibilities to sanction a trustee through third parties after abuse of trust

Table 1 Four effects on trust

Competition

Trust can effect competition between actors because if an actor is trustworthy, third parties can later also decided to place trust in the actor which is positive because the actor can for example sell more products. So, if a trustee wants to win a competition with other trustees, he wants to be trustworthy. In a learning model we can see this in the fact that past experiences are important for the

trustworthiness of a trustee and if there are bad experiences these experiences have negative influences for winning a competition. In the control model we can see this in the fact that sanctions for a not longer trustworthy trustee in the future are negative for winning a competition.

Conclusion about theories about trust

From the above described theories we now have seen that there are number of conditions in which trust can grow:

- Control and Learning are two mechanisms for how embeddedness in a social network can affect trust.
- Control means that trust is more easily placed when the trustor has more possibility to sanction the trustee if he abuses trust.
- Learning means that trust is more easily placed if someone's own experiences from dealing with the trustee are positive and if there are no own past experiences a third-party has positive dealing experiences. Positive third-party experiences are better for placing trust than no experiences with the trustee at all.
- Trust also has a positive effect on competition between trustees.

2.2 Research on Trust

Now we take a look at research which is investigating trust. Buskens et al. (2002:179) start their research by saying that it is often acknowledged that embeddedness is important for trust, but still analysis of the mechanisms through which embeddedness works is often lacking. In their research they have done two vignette studies to find out how learning and control effects are produced. Vignette studies mean that respondents are presented with hypothetical transactions and that they are asked to imagine that these 'vignettes' are real transactions. In the first experiment the authors take a look at buyer-supplier relations for which purchase managers of Dutch companies are asked about a hypothetical transaction. The transaction incorporates information such as price and importance but also about the relationship of the buyer with the supplier. The participants had to answer questions about the extent to which they would negotiate about the terms of the transactions and about arrangements they would like to include in a formal contract (Buskens et al. 2002:186). The second vignette study was done with students. They were asked to compare pairs of situations for buying a used car, while properties of the relation between the buyer and the car dealer where varied (Buskens et al. 2002:186). A difference between the two experiments is that in the first experiment learning and control through third parties were not explicitly distinguished, while the second experiment provided a first attempt to make a proper distinction. Their conclusion is that both learning and control work at a dyadic as well as at a network level (Buskens et al. 2002:

195). The first experiment shows that learning from past experiences with the same buyer and control for future transactions facilitates trust. Furthermore, the second experiment shows that learning at the network level due to third-party information from common friends, as well as through control at the network level via common memberships of sport clubs, also facilitate trust (Buskens et al. 2002:196).

The weakness of this study is that it comprises only two vignette studies. We could say that in a real-life experience people might have reacted differently, because the buyer and seller have to interact and this can lead to different outcomes. If a seller is very persisting, a buyer can buy something because he feels intimidated or if they buyer and the seller don't speak the same language (for example if you buy something when you are on vacation) the outcome can be different. Furthermore the study is done under Dutch students and purchase managers. People who do not fall into these two categories, such as elderly people or managers from a different culture, can also react very differently in the experiment and in the real-life.

Camerer and Weigelt (1988), in Buskens et al. (2002), also conducted experiments to test the Trust game. In this experiment games are played that consist of eight or six times repeated Trust Games with incomplete information (Buskens et al. 2002:181). Incomplete means that the trustor does not know of for the trustee is it better to honour trust than to abuse trust. The experiment shows that trustors test whether the trustee is trustworthy, especially on earlier encounters (Buskens et al. 2002:182). The more positive experiences a trustor has, the more the trustor is convinced that he is playing with a trustee who does not have any reason to abuse trust. However, at the end of the game, trust does not increase. This is because the trustor realizes that at the end of the game the trustee can abuse his trust because the game is ending and there are not coming any more situations of placing trust from the trustor. In literature this situation is also known as the 'end-game' effect. In real-life this is not likely to happen, because neither the trustor nor the trustee knows when the last transaction is.

Conclusion about research about trust

If we look back to the theory about trust, we can see that both learning and control seems to work in experimental games. We are going to find out in the next part of this section if this also works in real-life R&D partnerships.

2.3 Theories on R&D partnerships

Forms of R&D partnerships

R&D partnerships exist in many forms (Hagedoorn 2002). Research partnerships can be formal or informal and if they are formal the can either be partnerships that are equity based and focus on

R&D or they can be non-equity based partnerships which are mainly contractual arrangements (Hagedoorn et al. 2000:569). By partnerships that are equity based Hagedoorn means that at least two firms combine their R&D through equity joint ownership of a separate firm, and mostly this firm only has R&D within the broader context of the research agenda of the two firms. By a partnership that is non-equity based Hagedoorn means that they are created so that firms and other organisations can pool resources in order to undertake joint R&D activities. This means that there is not a new firm created.

Reasons for R&D partnerships

Most articles that describe theories about the reasons for companies to start a formal R&D partnership use a lot of different reasons. Hagedoorn et al. (2000) shows that there are three broad categories in literature of addressing these reasons: transaction costs, strategic management and industrial organization theory. The last category is mostly a game-theoretic and mathematical model and therefore not interesting for the current study.

Among the category transaction costs an R&D partnership gives the companies an advantage of sharing the cost of a specific type of activity (Hagedoorn et al. 2000).

Among strategic management the most common reasons are competitive force and strategic network. The competitive force drives companies towards a research partnership. Partnerships are seen as a financial possibility of shaping competition by improving a firm's comparative competitive position (Hagedoorn et al. 2000:571). Porter (1986), in Hagedoorn et al. (2000), say that this is because every company wants to have a leading position in the market and to create this leading position, they benefit from a research partner in which they have access to a new scope of activities without spending expensive resources to enter a new market. Companies who start an R&D partnership and so start a strategic network, profit through this network from more efficiency, synergy and power (Hagedoorn et al. 2000).

2.4 Research on R&D partnerships

We now take a look at research done on R&D partnerships. Firstly, we only take a short look at the research done about reasons to start an R&D partnership, because the reasons to start an R&D partnership are not the main focus of this current study. After that we take a look at trust in R&D partnerships and we find of the theories we mentioned in section 2 are confirmed.

Reasons to start an R&D partnership

The empirical research about R&D partnerships has taken two approaches: research through analyses of existing datasets or surveys and research through case studies (Hagedoorn et al. 2000).

Examples of such datasets are the MERIT-CATI database, the CORE database and the NCRA-RJV database. These are all large datasets which are used in more studies.

We have seen that the two broad categories in literature for starting an R&D partnership are transaction costs and strategic management. In the research studies we found that these two categories were not as separated as theory told us. Nevertheless we do find research about why firms start an R&D partnership.

Link and Zmud (1984), in Hagedoorn et al. (2000), did perhaps the first broad-based empirical analysis for reasons to start an R&D partnership. In a research on the video display terminal industry they found that most companies start an R&D partnership to maintain and increase their market share (Hagedoorn 2000).

In a study by Link and Bauer (1989) and Link (1990), in Hagedoorn et al. (2000), they also tried to find the reasons for companies to start an R&D partnership. They found that companies who faced market threats from a foreign competition were using partnerships to gain horizontal diversification. Those who did not face such competition were using partnerships to increase vertical integration in the market (Hagedoorn et al. 2000:578). Hagedoorn et al. do not tell how they found these results.

Link (1998), in Hagedoorn et al. (2000), found that members of two sponsored research partnerships experienced profit in their R&D efficiency. These profits were found in reducing the duplication of research cost and cycle time.

As seen above, empirical evidence for the reasons to start an R&D partnership is mostly found through case studies. We see that the theory of transaction cost is confirmed. Also some elements of the strategic management we see confirmed in these case studies.

2.5 Theories on trust in R&D partnerships

Gulati (1995) describes very well in his article the role of trust in interfirm alliances. He says that interfirm trust is incrementally built as firms repeatedly interact (Gulati 1995:92). This is based upon the theory that if companies have an ongoing interaction, they learn to know each other and so they develop trust around norms of equity or 'knowledge-based' trust. Furthermore trust alters their choice of contract in an alliance. When there is more trust, it is more likely that there is a less detailed contract closed. This is because a detailed contract is one mechanism to predict the behaviour of the partner. Another mechanism is trust. So, if there is trust, a detailed contract is no longer necessary (Gulati 1995). Thirdly trust can arise when untrustworthy actions of a partner can lead to costly sanctions and has a bad prospect for the future. For example sanctions can be: loss of further transactions, loss of reputation or loss of other points of interaction between the two firms (Gulati 1995:93). These sanctions are even more important considering the network a firm is in, because in a dense social network, reputation plays an important role for future alliances. In this

situation the theory also says that partnerships between partners in the same country are less detailed contracted because the sanctions are higher for the partners if they show opportunistic behaviour. This higher sanction is because they are in a smaller network and this smaller network could damage their reputation more easily.

If we look back to the Trust Game in Figure 1, we see how this works for trust in an R&D partnership. There are two ways in which the Trust Game can be played. First, the game starts with the step to start a partnership or not. In this game the Trustor needs to decide that he trusts the trustee. If he does not trust the trustee the outcome of the game would be for both players P , which means no partnership for both players. If the trustor does trust the trustee, then the trustee needs to choose if he honours or abuses the trust. If the trustee abuses trust the outcome for the trustee will be T and for the trustor S . Then T means a partnership for the trustee in whom the trustee takes all the profit or information and does not return anything and S means for the trustor a partnership with no profits and loss of information. If the trustee starts to honour the trust the outcome will be R for both players. R means a partnership where both partners have a profit and both partners gain information.

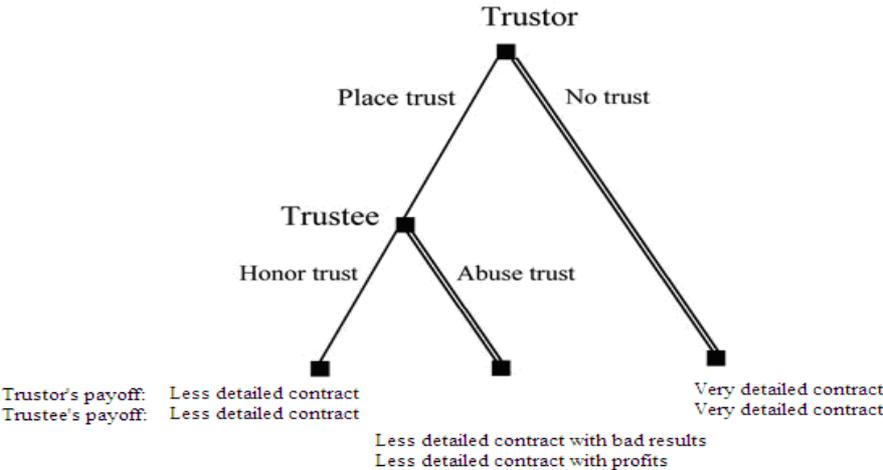


Figure 2 Trust game between two companies starting a partnership

If the partners already decided to start a partnership the Trust game can also be played on trusting or not trusting the other partner, seen as in figure 2. If company one starts with saying that it does not trust the other partner, the outcome would be P , which means in this case a very detailed contract (or a new form of cooperation which is also very detailed). If the first company does say it trust the other and the other company honours the trust, the outcome would be R for both players and then the partnership will start with a less detailed contract. If the other company wants to abuse trust by company one, the outcome will be S for company one and T for company two. S means a less-detailed contract, but with a bad result for company one and T will also be a less-detailed contract but with a profit for company two, because company two abuses the less-detailed contract.

2.6 Research on trust in R&D partnerships

In a case study about the factors for trust and distrust in partnerships Butler et al. (1996) look at two cases between companies who had an alliance and compare them with the theories they found about trust in partnerships. In their conclusions we can see that there are a number of factors which lead to trust or distrust. For example, they say that trust needs to operate at different levels between the joint-venture and the partners (Butler et al. 1996:87). Also trust is not only necessary at the level of senior managers, but also at the operating level there needs to be interaction embedded within a social network. This interaction becomes more important if there is interdependence and ambiguity. Butler et al. (1996) also say that the contract only makes a little contribution to the successful generation of trust. Once partners start to make the contract dominant for the cooperation between them, the partnership is doomed (Butler et al. 1996:88). This article is a good start to get a first impression about how trust works in a partnership, but the article only tested two cases and builds on these two cases their conclusions. Furthermore the authors do not investigate or explain how social interaction must be embedded. They only noticed that the key to develop personal trust derives from the network to which the various partners belong. Neither do they explain why contracts are only important at the start and later can lead to a failure of the partnership

Bojanowski et al. (2009) did research with the Thomson Financial SPC Platinum databases and compared this with the World Development Indicators from 2003. One of their findings was that even though America was by far the most homophile nation in R&D partnerships. This can be explained by the fact that America has more potential alliance partners than any other nation (Bojanowski et al. 2009:21). Although the dataset is made based upon the firms own publicity about the start of an R&D partnership, the article shows that the number of partnerships in a country has also something to do with the offer of companies available for partnerships.

Another case study, done by Larson (1992), is under seven inter-firm alliances where she tried to understand the process by which these alliances were made. She noticed three phases:

1. preconditions for exchange
2. conditions to build
3. integration and control

In the first phase the reputation of the partner, prior relations and personal reputations are important. If they are all good the step to the next phase can be made. In the second phase mutual economic advantage is important, and also that one firm is an initiator and that both firms start a trial period. When there is mutual economic advantage and the trial period is positive the third phase can be started. In this third phase the firms start with operation and strategic integration and have social control (Larson 1992:83). Thanks to these three phases, Larson concluded that the relation

between two firms start with small transactions and that the transactions become larger if trust grows and the transactions go well.

Lyons (1994), in Butler et al. (1996), did a research study on 72 inter-firm contracts relationships. He analyzed the contracts and found the same as Larson; that when partnerships exist longer, the amount of formal contracts decreases.

Buskens et al. (2000), in Buskens et al. (2002), used data from a study about relations between buyers and supplier of IT products. As a dependent variable they used the number of issues used in the contract that was written for a transaction. They found that fewer issues are used in the contract after positive transactions in the past, but found no effect of transactions expected in the future for this variable (Buskens et al. 2002:181). Furthermore, they also found that there are fewer issues addressed in the contract if the buyer and suppliers are located closer to each other in a network. As an explanation for these findings, they said that they are probably embedded in a denser network (Buskens et al. 2002:181). This means that the network they are in is more closed and therefore the sanctions of abusing trust are higher through control and learning.

Hagedoorn (2002) described trends in forms of research partnerships using also the MERIT-CATI database analyses. Hagedoorn shows that equity based partnerships have become less popular than other forms of partnering. He also says that non-equity contractual forms of R&D partnerships have become very important. Explanations for this change are probably due to the organization cost of equity based partnership in combination with their high failure rate (Hagedoorn 2002: 478). An explanation for the high failure rate of this form of partnership is not given in the article.

Gulati (1995) analysed a dataset with information on all publicly announced alliances in the period 1970-1989 and defined three economic sectors: the biopharmaceutical, the new materials and the automotive sector. His findings suggest that a company selects contractual forms for their alliances not only on the activities they include, but also on the relation with the partner and if they had earlier alliances (Gulati 1995). He also found that the larger the numbers of prior equity alliances across two firms, the less likely their subsequent alliances are based to be equity (Gulati 1995:105). A third important finding is that international alliances are more likely to be equity based than domestic alliances (Gulati 1995:105). Although the study is only done on three economic sectors, it provides good evidence for both learning and control in trust situations in an R&D partnership. Gulati also did a regression analysis on the sectors. He compared the biopharmaceutical with the new materials and the automotive sectors. The results show that there is a significant difference between the sectors on trust, but only comparing the biopharmaceutical with the new material and the automotive sectors. He did not test if there was also a significant difference between the new material and the automotives sector.

The research described above, gives us good evidence for the theory we found on trust in R&D partnerships in section 2.5. Although research is mostly done by case studies, we clearly can see that trust plays an important role in R&D partnerships. Especially the case studies from Lyons (1994), Gulati (1995) and Buskens et al. (2000) show that learning plays an important role in R&D partnerships because trust grows if partners have a longer relationship. The control factor we can see in Gulati (1995) who provides evidence for control through embeddedness in a social network and shows that international alliances are more likely to be equity based than domestic ones.

2.7 Competition in R&D partnerships

Competition by R&D partnerships can work in two ways: exogenous competition and endogenous competition (Butler et al. 1996). First of all, partnerships will increase competition for any firm which is not in the partnership but is in the same sector as the firms in the joint-venture. That is what we call exogenous competition. This form of competition works this way because a partnership gives a company a better position on the market, so the companies who are in the same sector want to keep or reclaim their leading position. Exogenous competition also tends to an increased need for trust within the partnership itself, because external threat to a body with a common interest increases cohesion (Butler et al. 1996:84). The second form is increased competition within the partnership itself. That is what we call endogenous competition. However, increased competition from within the partnership will lead to damage between the partners, because if one partner starts competing with another, trust is likely to breakdown (Butler et al. 1996:84). This is because if one partner starts competing with the other, the other company feels a threat for its own company and shall also start to compete, or in other words: both partners start to abuse their own partnership. Endogenous competition would increase the need of trust, because the partners must believe that the other company is not going to abuse their partnership. Only endogenous competition will act against the factors that are needed to let trust grow, especially networking, because it seems strange that partners would remain networking if they are competing with each other (Butler et al. 1996).

2.8 Theory and research on R&D in different economic sectors

There is not much literature about R&D partnerships in different economic sectors. Although we did not find any theory about it, we did find a lot of research which focuses on specific sectors for R&D partnerships. However it does not compare sectors, only describes some of them.

A good example of this description of sectors is done by Hagedoorn (2002). He analysed the MERIT-CATI database and gives some specific characteristics for R&D in some economic sectors. He made a 'relative contractual partnering index' per sector, which expresses the degree to which contractual R&D partnerships are more important in some sectors than in others (Hagedoorn 2002:484). He found that in the pharmaceutical, information technology, aerospace & defence and instrument and

medical equipment industries, there are more contractual R&D partnerships than the average for all industries (Hagedoorn 2002:485). For the industries engineering and exploration, metals, food and beverages, electrical equipment, consumer electronics, chemicals and automotive, Hagedoorn found that in these sectors there are less contractual R&D partnerships than the average for all industries. He did not explain his findings in his article. What he did try to explain is the fact that he also found that equity based partnerships are primarily found in medium-tech and low-tech industries and non-equity based partnerships have become so apparent in many high-tech industries. As an explanation for this finding, Hagedoorn said that that equity based partnerships are less flexible, and therefore more used in sectors where technological development is usually less turbulent and slower; the medium- and low-tech industries (Hagedoorn 2002:490).

2.9 Influence of economic sectors on trust in R&D partnerships

Although there is much literature on R&D partnerships in different economic sectors, we have not found literature that compares R&D partnerships in the same or different economic sectors and investigate to the influence of economic sectors on trust in these partnerships. Neither did we find theoretical explanations for the findings about the flexibility of economic sectors we mentioned in paragraph 2.8.

2.10 Conclusion

We have seen that there has been a lot research done on trust in R&D partnerships. Not only theoretical frameworks were made, but also theory was tested in case-studies or through data-analyses. We have seen that the mechanisms control and learning seem to work in R&D partnerships (e.g. Larson 1992, Gulati 1995 and Lyons 1996). Furthermore, we have seen that a partnership leads to two ways of competition (exogenous and endogenous) and national partnerships are more likely to be non-equity based (Gulati 199 and Butler et al. 1996). At last we have seen that for our research subject no theory has been developed and also no specific research has been done.

Section 3 Main question and hypotheses

In this section we give a temporary answer on our main and sub-questions, based on our findings from literature. From these answer we formulate hypotheses that we test with our data analysis.

Our main question is:

How does trust differ between economic sectors in an R&D partnership?

To answer this question there are two sub-questions:

- 1. What is the influence of trust in R&D partnerships?*
- 2. Does the influence of trust change over different economic sectors?*

In section 2 we concluded that there was no research done yet about the influence of economic sectors on R&D partnerships. However, we have seen that the influence of trust in a partnership has two possible ways for the trust game. Trust plays an important role at the beginning of a partnership and trust plays an important role during the partnership. Furthermore, the mechanisms learning and control can both be used to let trust grow while competition has a negative influence on trust. By beginning the partnerships trust plays an important role in what partners know about each other and how trustworthy a partner was in the past. During the partnerships trust plays an important role in the sanctions partners can apply if one of them abuses trust, and if the partner shows to be trustworthy, third-parties will more easily trust the partner also.

The theory did not show a clear answer to our second sub-question. However, we can use earlier research on trust and R&D partnerships to formulate a hypothesis we can test. Therefore we make some assumptions based on theory.

First of all, we make the assumption that organizations can be compared by the region they are in. In this comparison it is expected, based on theory, that trust in an R&D partnership is higher between companies from the same sector or in the same region than between companies from a very different economic sector or from different regions (e.g. Buskens et al. 2002, Gulati 1995 and Lyons 1994). This is because we assume that these companies are closer in a denser network and the sanctions for abusing trust are therefore higher than in a partnership between two different economic sectors in different regions and therefore a less dense network.

However, we also concluded in section 2 that companies, who are each other's competitors, will be less willing to start an R&D partnership than companies who are not each other's competitor (Butler 1995). This is because theory showed that competition in an R&D partnership will increase the need of trust in a partnership but at the same time competition only acts against the factors that are needed for trust. Therefore, competition gives partners a motivation to start to abuse the contract.

Combining these arguments we come to the following three hypotheses based on literature study:

1) Trust in an R&D partnership is more likely in a partnership between companies in the same economic sector

2) Trust in an R&D partnership is more likely in a partnership between partners which are not each other's competitor.

3) Trust in an R&D partnership is more likely in a partnership between companies in the same region.

These situations provide the best opportunities to make a less detailed contract for the partnership and the partnership has the best chance to last long. We are now going to test if these hypotheses, based on theory, are confirmed by our dataset.

Secondly we also control for the numbers of partnerships over time and for the flexibility of the economic sector. We saw in section 2 that these two things also can have effect on the form of the partnership. Gulati (1995) showed that partners who more often interact with each other trust each other more and Hagedoorn (2002) showed that there are differences in the forms of partnership in economic sectors with a different flexibility.

Section 4 Data & Methods

In this section we explain which dataset we used for testing our hypothesis. Furthermore we also operationalized our hypothesis and our variables and control variables.

To answer our hypothesis from section 3 we need a dataset that gives us information about R&D partnerships. We need to know between which companies there is an R&D partnership and which forms of partnership are used. Furthermore we need to know between which sectors the partnership is. Is it between two different sectors or are the companies in the same sector? Furthermore we need to know in which part of the sector the companies are, so that we can see if they are each other's competitor or not. Fourthly, we also need to know in which countries the companies are based and how many times the companies already have had a partnership before. These last two we need to know because these are control variables that theory has showed us to be influencing trust in an R&D partnership, as seen in section 2.

4.1 Data

For our data analysis we use the Thomson Financial SDC Platinum database. In this dataset we can find the above described information. The database gathers information on newly formed partnerships from press releases, specialized journal articles, and other business-oriented databases (Bojanowski 2009:9). The first records of the database are from the early sixties and with multiple records collected over the decades the database gives us a lot of information about partnerships all over the world in all different economic sectors. There are also a few disadvantages of the database. A first limitation lies in the method of collecting information about partnerships, because the partnerships are only registered in the database if the companies have made a press announcement of it. Secondly the database is based on English speaking news services and thus, Anglo-Saxon companies are more likely to be in the database than other companies (Bojanowski et al. 2009:10). Thirdly the database does only register whether the partnership is an equity based partnership or not and does not say anything about the form of partnership if it is not an equity based partnership. Finally, the dataset does not register when a partnerships ends and if the partnership was successful or not.

Concluding to what we say above, we have a dataset with 9131 partnerships from 1985 till 2006 with relevant information in it. We now take a closer look to the variables we need for testing our hypothesis.

4.2 Dependent Variable

First of all we use *trust* as a dependent variable. In section 2 we already showed that research partnerships can be formal or informal. If they are formal they can either be research partnerships that are equity based and focus on R&D or they can be non-equity based partnerships which are mainly contractual arrangements (Hagedoorn et al. 2000:569). By an equity based partnership we mean that at least two firms combine their R&D through equity joint ownership of a separate firm, and mostly this firm only has R&D within the broader context of the research agenda of the two firms. By a non-equity based partnership we mean that the partnership is created so that firms and other organisations can use each others resources in order to undertake joint R&D activities. This means that there is not a new firm created. Thus, we assume that there is more trust in a non-equity based partnership where not a new firm is created, than in an equity based joint-venture partnership where a new firm is created and more detailed contracts are made (e.g. Gulati 1995 and Hagedoorn et al. 2000).

Our variable in the dataset for trust is if the partnership is based on having an equity or non-equity based partnership. The codebook of the Thompson Financial SDC Platinum database tells us that when a partnership is equity based, the alliance is a cooperative business activity, formed by two or more separate organizations for strategic purposes, which creates a new firm. Therefore we say that when a partnership is equity based in our dataset and a new firm is created, there is less trust than when a partnership is a non-equity based joint-venture and a new firm is not created (Gulati 1995).

4.3 Independent Variables

Our independent variables are *economic sector*, *competitors* and *being in the same region*. By *economic sector* we mean the sector in which the company is operating. In section 2 we saw that trust can grow through embeddedness in a social network and that learning and control are two mechanisms for how embeddedness in a social network can affect trust (e.g. Granovetter 1985, Buskens et al. 2002). Economic sectors can be a social network for companies and through this economic sector companies mostly have much information about each other. It is therefore important to find out what the influence of the economic sector is on trust in a partnership.

Our variable for an *economic sector* in our dataset is the Standard Industrial Classification (SIC) Code for every company. SIC codes are like zip codes and tell us precisely in which type of business a company is (SICCODE.com 2010). We can recode the SIC codes to ten different sectors seen as in table 2. The numbers that are missing, such as 6800 to 6999, are not SIC codes.

Code	Sector	Value
0100-0999	Agriculture, Forestry, Fishing	1
1000-1499	Mining	2
1500-1799	Construction	3
2000-3999	Manufacturing	4
4000-4999	Transportation & Public Utilities	5
5000-5199	Wholesale Trade	6
5200-5999	Retail Trade	7
6000-6799	Finance, Insurance, Real estate	8
7000-8999	Services	9
9100-9999	Public Administration	10

Table 2 SIC codes representing economic sectors

Our second independent variable is *competitors*. In chapter 2 we noticed that trust in a partnership theoretically is the best between companies who are in the same economic sector but are not each other's competitor (e.g. Butler et al. 1996). By using the SIC codes we can distinguish if companies are each other's competitor or not, which means that if companies have exactly the same SIC code they are each other's competitor and if they do not have exactly the same SIC code they are not.

The third variable we use is the variable *being in the same region*. Through this variable we control for the region of residence from the partnership. By that we mean that we control of there is any influence of distance between partners on trust. This also follows from our theoretical findings in chapter 2 where we saw that trust can grow through embeddedness in a social network; how closer the partners are how higher the change on growing trust (e.g. Granovetter 1975, Buskent et al. 2002). In our dataset we can see from which country a company is and we can therefore easily see if two companies are in the same region. We compute this variable by using the country of residence from the partnership and recode this to a region variable for America, Europe, Asia and a remaining category. We compute to regions and not to countries because we think that more companies who are having an international partnerships wit partners in the same region and because we have many companies from America.

4.4 Control Variables

In section 3 we also noticed that there are other variables we need to check. In this research the control variables are *number of partnerships in time* and *flexibility of the economic sector*. Theory showed us that these two variables could have influence on the chance of having a joint-venture partnership.

By controlling for the *number of partnerships in time* we mean that we control if there is influence on trust in a partnership if partners have had a partnership before. Theory showed us that if partners have more partnerships with the same partner, they know each other better; have more information about each other and there for they trust each other more (e.g. Lyons 1994, Larson 1992, Buskens et al. 2000). We can control this by computing a variable which counts the numbers of partnerships

between companies. After doing that the variable shows us for every year how many times companies had a partnership together.

The last control variable we use is the *flexibility of the economic sector*. In section 2 we saw that Hagedoorn (2002) found that partnerships in a high-tech sector, which is very flexible, make more use of non-equity based partnerships than companies in the low-tech sectors. He explains this by saying that high-tech sectors are very flexible and therefore the partners need a flexible contract so they can keep up with the technological changes in the sector. The fewer details in the contract, the more flexible the contract seems to be (Hagedoorn 2002). If we look to our ten different sectors, we can categorize them also into high, medium and low tech sectors, using the same definition Hagedoorn does (table 3).

Code	Sector	Value
0100-0999	Agriculture, Forestry, Fishing	Low
1000-1499	Mining	Low
4000-4999	Transportation & Public Utilities	Low
9100-9999	Public Administration	Low
1500-1799	Construction	Medium
2000-3999	Manufacturing	Medium
5000-5199	Wholesale Trade	Medium
5200-5999	Retail Trade	Medium
6000-6799	Finance, Insurance, Real estate	High
7000-8999	Services	High

Table 3 Sectors used by SIC codes

4.5 Methods

The Thomson Financial SDC Platinum database is a database which is based on relations between companies. The dataset shows us between which companies there is a partnership and in which sector the companies are. Every row in the dataset tells us something about two companies and therefore one partnership.

We choose to analyse this dataset by using regression analysis, or more specific binary logistic regression analysis. Logistic regression is used when there is one binary dependent variable and one or more independent variables which could be binary but that is not necessary. Characteristic for the dependent variable is that it is binary, what means that this dependent variable has only two values. In our research the dependent binary variable is *joint-venture* and the outcome can be a joint-venture or not. Therefore the value of the variable can either be 0 or 1 (0 means not a joint-venture and 1 means a joint-venture). So, if we want to know if there is a relation between, for example, two partners who are in the same sector and the chance on a joint-venture or not, then we use logistic regression because this is a statistic method to describe these kinds of relations.

This statistical method does not describe a value but describes the probability on something, mostly called *odds*. The odds ratio is the proportion between the fractions of two possible outcomes (Agresti et al. 2009).

Section 5 Results

In this chapter we present the results of our statistical analyses. We start with describing our data after recoding our variables and continue with the results of our regression analyses.

5.1 Descriptive statistics

Joint-Venture

The most interesting variable for our research is the variable *partnership*. Looking at our dataset we see in table 4 that only 9.2 percent of the partnerships in our dataset are an equity based partnership.

Partnership	Number	Percent
Non-equity based	8287	90.8
Equity based	884	9.2
Total	9131	100.0

Table 4 Joint-Venture

This 9.2 percent is not as much as we expected. It has two possible explanations; or there is a lot of trust between partners in our database or it can be that an equity or non-equity based joint-venture partnership does not represent trust between partners. We will discuss the more specific in the discussion.

Sectors

Starting with the ten different sectors, we see that most companies are in sectors 4 and 9. This leads naturally to the fact that the most partnerships are also in sector 4 and 9 as we also can see in table 5. Sector 4 and 9 stand for the sectors Manufacturing and Services.

Sector	Companies		Partnerships	
	Number	Percent	Number	Percent
1	63	0.3	20	0.2
2	158	0.9	33	0.4
3	50	0.3	14	0.2
4	9152	50.1	3179	34.8
5	868	4.8	221	2.4
6	607	3.2	495	5.4
7	259	1.4	72	0.8
8	754	4.1	1738	19.0
9	6326	34.5	3279	35.9
10	65	0.4	80	0.9
Total	18262	100	9131	100

Table 5 Number of companies and partnerships in different sectors

This is not so surprising because in literature we saw that one of the reasons to start an R&D partnership is reducing costs (e.g. Hagedoorn 2000). In these two sectors you can easily reduce costs by starting an R&D partnership because these sectors have many different steps in their production process.

Now that we know how the sectors are distributed, we take a look at how many partnerships there are between companies in the same sector. We see in table 6 that 53.1 percent of the partnerships are in the same sector and that 46.9 percent is not.

Same Sector	Number	Percent
No	4280	46.9
Yes	4851	53.1
Total	9131	100.0

Table 6 Number of partnerships which are in the same sector

This is a bit surprising because we expected that there where a lot more partnerships between companies which are in the same sector, because they know each other better and therefore trust each other more. It might be explained by the fact that the companies that are in the same sector are also companies which are each other’s competitor.

Competitors

When we look at the number of competitors, we see in table 7, that 19.1 percent is each other competitor. The interesting question now is how many partnerships are between companies which are in the same sector but not are each other’s competitor.

Same Sector	Competitor		No		Total	
	Yes Number	Percent	Number	Percent	Number	Percent
Yes	1745	35.9	3106	64.1	4851	100.0
No	0	0.0	4280	100.0	4280	100.0
Total	1745	19.1	7386	80.9	9131	100.0

Table 7 Crosstab between Competitor and being in the same sector

We see in table 7 that from our partnerships from companies which are in the same sector 35.9 percent is each other’s competitor and that 64.1 percent is not each other’s competitor. This is what we expected because companies which are in the same sector are in a denser network and should trust each other more because of that. However, most partnerships are still between partners who are not in the same sector.

Flexibility of the sector

Now we take a look at the flexibility of the sectors and how many partnerships are in a low, medium or high flexible sector. As we can see in table 8 most partnerships are in the high and medium flexibility sectors. Only a small percentage of the partnerships are in a sector with low flexibility. This is interesting because literature only showed us that there were more equity based partnerships in the low flexible sectors, but not that there were fewer partnerships. It could be that because companies are in a low flexible sector, they do not need a partnership that much because there are not that many technological changes. Looking to the partnerships which are in the low flexible

sectors we see that 27.7 percent is an equity based partnership and 72.3 percent is a non-equity based partnership. Comparing this to the medium flexible sectors, we see that there are 11.1 equity based partnerships and in the high flexible sectors only 6.8 percent. This is what we expected from the theory (e.g. Hagedoorn 2000), because we see that how higher the flexibility of the sector, how less equity based partnerships there are. However, we expected that there was a bigger difference than we see now.

Flexibility Partnership	Partnership Equity based		Non-equity based		Total	
	Number	Percent	Number	Percent	Number	Percent
Low	76	27.7	198	72.3	274	100.0
Medium	425	11.1	3415	88.9	3840	100.0
High	343	6.8	4674	93.2	5017	100.0
Total	844	9.2	8287	90.8	9131	100.0

Table 8 Crosstabs between Joint-Venture and Flexibility of the partnership

Regions

We recode our data about the country of residence of the partners to four regions; America, Europe, Asia and other (such as Africa). In table 9 we see that most companies are in America. Furthermore we see that Europe and Asia are close together.

Region	Number	Percent
America	13370	73.3
Europe	2271	12.5
Asia	2229	12.3
Other	322	1.9
Total	18262	100.0

Table 9 Crosstabs between Region and Companies

If we look at both of the partners to find out if they are in the same region, we see in table 10 that from the partnerships which are in the same region 17.1 percent are equity based and 82.9 percent are non-equity based. Furthermore, from the partnerships which are not in the same region, 5.6 percent is equity based and 94.4 percent is non-equity based. It is surprising to see that there are more equity based partnerships by partners who are in the same region than by partners who are not in the same region. This is not what we expected because we assumed, based on theory, that partners which are in the same region should trust each other more because they know each other better and therefore not choose for an equity based partnership (e.g. Hagedoorn 2000, Buskens et al. 2002).

Same Region	Partnership Equity based		Non-equity based		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	493	17.1	5755	82.9	2883	100.0
No	351	5.6	2532	94.4	6248	100.0
Total	844	9.2	8287	90.8	9131	100.0

Table 10 Crosstab between joint-venture and being in the same region

Previous Alliances

Looking to table 11 we see that there are not so many previous alliances. Only 88 partnerships of the 9131 have had an earlier partnership. Looking to all the previous partnerships we see that only 7.9 percent is equity based and that 92.1 percent is non-equity based. From the partnerships which did not have a previous partnership, 91.6 percent is equity based and 8.4 percent is non-equity based. This is what we expected because we theory showed us that if people have trusted each other earlier, they are more likely to trust each other in the future and we assumed that this is the same for partnerships (e.g. Buskens et al. 2002).

Partnerships in time	Partnership Equity based		Non-equity based		Total	
	Number	Percent	Number	Percent	Number	Percent
Previous partnerships	7	7.9	81	92.1	88	100.0
Not a previous partnership	8280	91.6	763	8.4	9043	100.0
Total	8287	90.8	844	9.2	9131	100.0

Table 11: Crosstab between previous alliances and joint-venture

5.2 Results Regression Analysis

For testing our three hypotheses and our three control variables we developed five different models.

We use the 9131 partnerships which provide information on the variables we want to test.

	Model 1	Model 2	Model 3	Model 4	Model 5
Same Sector	-0,176* (0,082)	-0,195* (0,082)	-0,225** (0,83)	-0,224** (0,083)	-0,215* (0,084)
Competitor	-0,011 (0,107)	-0,010 (0,107)	0,034 (0,108)	0,036 (0,108)	-0,067 (0,111)
Being in the same region		-0,490** (0,074)	-0,471** (0,074)	-0,472** (0,074)	0,156 (0,082)
Flexibility Sector			-0,672** (0,062)	-0,672** (0,062)	-0,702** (0,063)
Previous Alliances				-0,227 (0,360)	-0,238 (0,363)
<i>Region 1 (U.S.)</i>					-1,238** (0,189)
<i>Region 1 (Europe)</i>					-0,253 (0,196)
<i>Region 1 (Asia)</i>					-0,632** (0,203)
<i>Region 2 (U.S.)</i>					-1,141** (0,200)
<i>Region 2 (Europe)</i>					-0,334 (0,209)
<i>Region 2 (Asia)</i>					-0,506* (0,213)
Constant	-2,192** (0,051)	-1,869** (0,068)	-0,241 (0,161)	-0,237 (0,161)	1,265** (0,283)
-2 Log Likelihood	5620,866	5578,147	5463,016	5462,259	5212,278
Nagelkerke R Square	0,001	0,012	0,039	0,039	0,097

* = significant (0.01 < p < 0.05)

** = significant (p<0.01)

(...) = Standard Error

N = 9131

Table 12: Result Regression Analysis on the dependent variable *joint-venture*

Model 1

In model 1 we test our first two hypotheses, namely that *being in the same sector* has a negative effect on the odds of having an equity based partnership and that *being each other's competitor* has a positive effect on the odds of having an equity based partnership. By using the logistic regression method, we see in table 12 that our variable *being each other's competitor* is not significant and that it has a negative effect. This is not what we expected because theory showed that competition in a

partnership should lead to less trust (Butler et al. 1996). It could be that when partners are each other's competitor the control mechanism from the network is so strong that abusing the contract simply does not happen. In that situation it is more likely that partners choose for a non-equity based partnership because that form is less expensive. The variable *being in the same sector* has a negative effect on the odds of having an equity based partnership and is significant. This is what we expected; because an equity based partnership is a more detailed form of partnerships, than a non-equity based partnership. We see that Nagelkerke R Square is very low in this model, which means that this model explains very little.

Model 2

In model 2 we test our third hypothesis. Our expectations are that partners which are in the same region have a negative effect on the odds of having an equity based partnership. In table 12 we see that the variable *Being in the same Region* is indeed significant and negative as we expected. Secondly we see that for our first hypothesis the variable *being each other's competitor* still is negative and not significant. However, our variable *being in the same sector* still is significant and in the right direction. Nagelkerke R Square is a higher than in model 1 but still explains very little.

Model 3

In model 3 we test the effect of our first control variable. Our expectations are that the flexibility of the sector has a negative effect on the odds of having an equity based partnership. In table 12 we see that our control variable is significant and negative. This is what we expected because the more flexible the sector is, the less change there is that the partnership will be equity based (Hagedoorn 2002). Furthermore, we see that the variables *being in the same sector* and *being in the same region* still are significant and in the right direction. Surprisingly, our variable *competitor* is still not significant, but it has the positive effect we expected. In this model we see again that Nagelkerke R Square is higher than before but still explains little.

Model 4

In model 4 we test also the effect of the control variable 'Previous Alliances'. Our expectations are that previous alliances have a negative effect on getting an equity based partnership. In table 12 we see that the variable indeed has a negative effect, but that it is not significant. Furthermore, we see that the variable *competitor* still is not significant, but still has a positive effect. The effect of the variables *being in the same sector*, *being in the same region* and our control variable *flexibility of the sector* are still significant and in the direction we expected. In this model we see that Nagelkerke R

Square has the same value as in model 3, so the extra control variable does not explain more than model 3 does.

Model 5

In model 5 we test the effect of our control variables *regions*. We do this by using dummy variables; because therefore we can analysis our variables of regions in a regression analyse despite it has four categories. In table 12 we see that there are Region 1 and Region 2. This is because in each partnership there are two companies. The reference category is the fourth category from the variable, which is *other*. In table 12 we see that the region Europe is not significant. That is interesting because the other regions are significant. It could be that Europe has strong relations with both Asia as America and therefore it has no influence. Furthermore, we see that the variable *being in the same region* no longer is significant, that it has less effect and that it even changed direction. This could be explained by the fact that almost seventy percent of our companies are in America and in this model we check for every region specifically and we see the effect from the region compared the region *other*. We suspect that the effect of *being in the same region* has more to do from which region the partner is (such as America or Asia) than that it has to do with the fact of partners are both in the same region. In this model we see that Nagelkerke R Square has the highest value of all models and therefore model 5 is the best model to use although Nagelkerke R Square is low and the model still explains little.

Section 6 Conclusion & Discussion

6.1 Conclusion

This research started with the question how trust works between humans. In the next part we tried to find out how trust differs in partnerships between firms in different economic sectors. In this section we combine these theories with our analyses and answer our research questions.

Our hypotheses are:

- 1) *Trust in an R&D partnership is more likely in a partnership between companies in the same economic sector.*

- 2) *Trust in an R&D partnership is more likely in a partnership between partners which are not each other's competitor.*

- 3) *Trust in an R&D partnership is more likely in a partnership between companies in the same region.*

First of all we found that being in the same economic *sector* leads to more trust and therefore to a higher chance on a non-equity based partnership. This is what we expected from theory, because if companies are in the same sector they are likely to be in a more dense network and therefore have better access to mechanisms for trust such as learning and control (e.g. Buskens et al. 2002, Granovetter 1985). Secondly, we found that being each other's competitor does not lead to more or less trust in an R&D partnership. Thirdly, also the fact that partners are in the same region does not lead to more or less trust in an R&D partnership. Why these last two things are not having any influence on trust in an R&D partnership will be discussed in the discussion.

However, it is confirmed that the more flexible the sector of the partnership, the higher chance there is on trust between partners in an R&D partnership. It confirms the theory that more flexible companies use a more flexible contract form, which in this research is the non-equity based partnership (Hagedoorn 2002).

Having previous alliances did not lead to more or less trust in an R&D partnership. This is surprisingly because theory showed that the more positive experiences a trustor has, the more the trustor is convinced that he is playing with a trustee who does not have any reasons to abuse trust (Buskens et al. 2002). Why this does not have any influence on trust in an R&D partnership will be discussed in the discussion as well.

Putting these conclusions together, we must reject our second and third hypotheses, because there seems to be no influence on trust in an R&D partnership if partners are each other's competitor or if they are in the same region. However, our first hypothesis can be accepted because we have seen that an R&D partnership between partners in the same economic sector leads to a higher chance on more trust and therefore to a non-equity partnership.

Furthermore, we have seen that the more flexible the sector of the partnership is, the more trust there is between partners. We also saw that partners in America and Asia compared to the region others also lead to a higher chance on more trust in an R&D partnership. Previous alliances do not have any influence on the trust there is in an R&D partnership.

6.2 Discussion

Looking back on this research there are some statements about the results we found that we want to make. We start with the dataset we used. The Thomson Financial SDC Platinum database is based on English literature about partnerships. This means that the dataset only looks at English sources to find out if there are new partnerships. Therefore the non English speaking countries are possibly less represented in the dataset. This argument could explain why we have so many partnerships in the region America. Furthermore it could also explain why our variable *being in the same region* is not significant because there are a lot of the partnerships in America, a region where English is spoken and therefore the other regions are not represented well. This could have influenced the analysis.

Secondly our dataset only showed ten percent equity based partnerships. This is not as much as we expected. It can mean that choosing for an equity based partnership as a measure for trust in partnerships is not a valid measure. This is underlined by the fact that the database does not show what kind of partnership the alliance is when it is a non-equity based partnership. It can also mean that the network of the partners in the Thomson Financial SDC Platinum database is very dense and therefore there is much trust in each other and therefore only a few equity based partnerships are in the database. Bojanowski et al (2010) however showed in their research that the network in the Thomson Financial SDC Platinum database is not so dense, so this argument does not explain the fact that there are only ten percent equity based partnerships. At last we want to refer to a statement Butler et al. (1996) makes when he says that the contract only makes a little contribution to the successful generation of trust, because when the contract becomes dominant, the partnership is doomed. This seems to lead to the conclusion that choosing for the contract form as a measure for trust is not a totally valid measure. However, Butler et al. also seem to say that this only works when

the contract becomes dominant. Hagedoorn (2002) says that choosing for a non-equity based partnership happens today more often because the price of such a contract is lower and therefore companies do not choose an equity based partnership. This has nothing to do with trust anymore, but only with costs.

A last argument to explain why there are so little equity based partnerships has to do with the size of the companies. If one company is very huge and the other very small, we assume that it is more likely that the partnership is not equity based. This because the bigger company would probably also have a bigger part in the partnership because they probably would also invest more in the partnership. If we want to test if this assuming is true, we need not only the name of the companies from the partnership, but also we need to know the size of the company. This information is mostly found on the websites of companies or it is registered at the national government in the country of residence.

Another weak point in the Thomson Financial SDC Platinum database is that there are only a few previous alliances. This could be because companies change names over time or it can be that the database mostly does not record when two companies start another partnership. This could lead to the results that our variable *previous alliances* was not significant. Another explanation could be that the theory we found about previous relations (e.g. Camerer and Weigelt 1988 in Buskens et al 2002, Gulati 1995, Buskens et al 2002) does not work for trust in partnerships. An explanation therefore can be that the partnership is between two companies, but that these companies are represented by many employees and that therefore the R&D partnership is made under the name of a company but experienced by employees. These employees change positions over time and therefore it can be that when two partners start another partnership, new employees discuss the contract and personally they do not have had much contact with the partner before. This can explain why the theory does work in small experimental cases where two exact the same people have more transactions, but that it not work between companies with changing employees.

In our literature review we did not find any theory about how trust differs between economic sectors in an R&D partnership. We thought that if partners are in the same economic sector they trust each other more (Gulati 1995, Buskens et al 2002). Our results showed that this was true and that when partners are in the same economic sector this also leads to more trust. However, our results also showed that when partners are in the same region, this has negative effect on trust in an R&D partnership and that is was not significant. This is surprising, because it was in a different direction than we expected it to be. It can mean that either our theory does not work or that the assumptions we made were incorrect. We think that the last argument explains why the effect is not significant.

Firstly, because the theory is confirmed by our results in the situation when partners are in the same sector and Gulati (1995) also founds that when partners are in the same country a non-equity based partnership is more easily made. Therefore we think that the theory still is confirmed. Secondly, the regions America, Europe, Asia are very huge regions. Therefore we maybe should have made smaller regions or just checked for being in the same country or not. Thirdly, it can also be that being in the same region only influences trust when partners are in the same sector. This interaction effect could be tested by also using the Thomson Financial SDC Platinum database. Why the result is in a different direction than we expected can be explained by knowing that partners who are in the same region can also be each other's competitor. In this situation there will be less trust when partners make a partnership because they are not only each other's competitor but also in the same region. Therefore, this could have influence on the direction of the effect of partners being in the same region.

Furthermore, the Game Theory is based on the actions of the trustor, but what about the trustee? We have not taken a look to what the trustor thinks about the trustee. For example, if the trustee is a family member of the trustor, that trust can be given despite of that the trustee not has been trustworthy in the past or does not give the best payoffs than another company.

Surprisingly, we also found that there were only a few partnerships in the low flexible sectors. Theory showed us that there is more trust in more flexible sectors (e.g. Hagedoorn 2002) and this theory is confirmed, but we did not found theory that stated that there are fewer partnerships in low flexible sectors. An explanation for this can be that in low flexible sectors the need to make a partnership is not that high, comparing to medium and high flexible sectors where technology changes fast and companies need to be up to date to win the competition with other companies.

It is interesting that being each other's competitor had no significant effect on trust in an R&D partnership. It can be that the exogenous and endogenous competition Butler et al. (1994) describe does not work for trust by an R&D partnership. However, we think that the forms of competition Butler et al. (1994) describes, do indeed work but that exogenous and endogenous competition has no effect on the form of the partnership. This because both form of competition does not work when the partnership is not there yet, so the mechanism start to work after the contract is signed and when the partnership is already started. Therefore if we want to test what the influence of being each other's competitor is on the trust in an R&D partnership, we must look at how the partnership develops over time and not only look to the form that is chosen in the beginning of the partnership. We could do this by collecting data about the forms of partnerships and if they changed during the

partnership. Another explanation can be that the network from companies who are each other's competitor is so dense, that abusing trust is absolutely not done because the consequences are too high.

We also saw that the region Europe did not have a significant effect on the trust in an R&D partnerships. An explanation for this can be that the partners in Europe are in a very dense network and have mostly partnerships with partners in Europe. Or it can be that partners in Europe mostly have partnerships with partners from America and Asia but not with companies in the other regions. To find out if this is true, we should take a look in further research to the density of the network structure from the companies in Europe.

The variable *flexibility of the sector* was not a binary variable, but we did test it as a binary variable. We choose to do this because 274 partnerships were in the low flexible sector, which is only 3 percent of the total percentage of partnerships. However, if we want more reliable test results, we should test this variable in another way. We could do this the same as we tested the four different regions and use the Thomson Financial SCD Platinum database.

We did not look at the mechanism of providing guarantees in our analyses. Guarantees also can provide trust, because both the partners take responsibility for letting the partnership succeed (Snijders 1996). In a new research we could take a closer look to these guarantees. We think that this could be done by using a huge dataset where more specifically can be found what kind of partnerships is made and what kind of guarantees there are.

Neither did we investigate whether for example learning becomes more important than control after some time. It could be that trustworthiness of a partner is more important in the beginning than in the end, and that control becomes less important through time. In a next study about this subject, it would be good to also take a look to these factors. We could use qualitative data from all kind of different companies to find out how their relations with other companies started and developed. Another option would be to make a new database where all different partnerships forms from a partnership through time are registered so we can analyse it to see if learning becomes more important through time. We could do this by working more closely with partners and have a regular check up to see if the partnership still has the same form as when the partnership started.

Finally, we think that there should be more research on how trust in a partnership works in companies who are each other's competitor. Our results showed that there was no influence but we

think, based on theories from section 2, that there must be some kind of influence. What is the role of the network in this situation and how do learning and control work? A better and more specific dataset is needed to do this research. Furthermore, there can be more research done on how previous alliances influence newer alliances. Our database gave us just a few previous alliances to analyse, but with a better database we think that we can better analyse how previous alliances work in real-life and what the influence of the change of employees in companies is.

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