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4 CONTACTS AND CONTRACTS:
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6 DYADIC EMBEDDEDNESS AND
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8 THE CONTRACTUAL BEHAVIOR
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10 OF FIRMS
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16
17 **ABSTRACT**
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19 *This chapter addresses social embeddedness effects on ex ante management of*
20 *economic transactions. We focus on dyadic embeddedness, that is the history*
21 *of prior transactions between business partners and the anticipation of future*
22 *transactions. Ex ante management through, for example, contractual arrange-*
23 *ments is costly but mitigates risks associated with the transaction, such as risks*
24 *from strategic and opportunistic behavior. Dyadic embeddedness can reduce*
25 *such risks and, hence, the need for ex ante management by, for instance, mak-*
26 *ing reciprocity and conditional cooperation feasible. The chapter presents*
27 *a novel theoretical model generating dyadic embeddedness effects, together*
28 *with effects of transaction characteristics and management costs. We stress*
29 *the interaction of the history of prior transactions and expectations of future*
30 *business. Hypotheses are tested using new and primary data from an extensive*
31 *survey of more than 900 purchases of information technology (IT) products*
32 *(hard- and software) by almost 800 small- and medium-sized enterprises*
33 *(SMEs). Results support, in particular, the hypotheses on effects of dyadic*
34 *embeddedness.*
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INTRODUCTION

The contractual behavior of firms depends not only on characteristics of transactions but also on prior and expected future business contacts between the contracting parties. This chapter offers theory as well as empirical evidence on how contacts affect contracts. While contracts are a standard way of protecting parties against opportunistic behavior and other risks in business relations, we know empirically at least since Macaulay's seminal and meanwhile classic study (1963) that the use of contracts as a safeguard for problems in transactions between firms is limited. Macaulay studied business relations by analyzing contracts, jurisprudence, and by conducting interviews with businessmen. His main finding (1963, p. 58) was that non-contractual agreements are more important than had often been assumed: "Business men often prefer to rely on 'a man's word' in a brief letter, a handshake, or 'common honesty and decency' – even when the transaction involves exposure to serious risks (...) keep it simple and avoid red tape."

Macaulay points out that contracts are but one way to prevent problems with a transaction. They are not always used because less costly alternatives exist. For instance (Macaulay, 1963, pp. 63–64), an ongoing stream of transactions with the partner allows for various "effective non-legal sanctions" and these discourage opportunism. A typical case is that "sellers hope for repeat for orders, and one gets few of these from unhappy customers." More generally, the prospect of recurrent transactions facilitates reciprocity through conditionally cooperative behavior so that the partners can economize on the writing of otherwise extensive contracts. We address the effects of this kind of social embeddedness on *ex ante* management of economic transactions.

Contracting is a core feature of inter-firm relations. Such relations are addressed in a rapidly growing body of research (see, e.g. Jones et al., 1997; Oliver & Ebers, 1998; Nohria & Eccles, 1992; Sitkin et al., 1998 for surveys of such work as well as examples of specific theoretical and empirical studies). *Transaction cost theory* (Coase, 1937; Williamson, 1985, 1996), a research program initiated outside sociology, offers a theoretically coherent approach towards explaining characteristics of contractual relations between firms (Shelanski & Klein, 1995 as well as Blumberg, 1998, ch. 2 provide surveys of the empirical literature; a representative selection of empirical applications can be found in Masten, 1996). Transaction cost theory focuses on how "economic" characteristics of a transaction affect contracting. Typical characteristics (e.g. Williamson, 1985, ch. 2) are specific investments associated with a transaction and uncertainty about future contingencies. For example, if transactions are associated with uncertainty, it is unfeasible or at least costly to safeguard them exclusively with explicit and binding contracts that are enforced by third parties like the courts. Explicit

- 1 contracting is associated with transaction costs (Williamson, 1985, pp. 20–22).
2 These include:
- 3 (1) costs of anticipating the conceivable contingencies that might arise in the
4 course of a relation;
 - 5 (2) bargaining and decision costs associated with reaching an agreement on how
6 to deal with these contingencies;
 - 7 (3) costs of writing a sufficiently clear and unambiguous contract that can be
8 externally (e.g. legally) enforced;
 - 9 (4) costs of external enforcement (see Hart, 1987, p. 166).
- 10

11 The basic idea of transaction cost theory is that firms choose their arrangements
12 for the governance of transactions by economizing on the anticipated costs for
13 reaching and enforcing agreements, so that all potential gains from trade will be
14 realized. In general, economizing will imply that explicit contracts are incomplete
15 in the sense that many conceivable contingencies are not – at least not clearly and
16 unambiguously – covered. In such a case, transactions rely on implicit contracts
17 (Azariadis, 1987), that is contracts that are partly unwritten, tacit, and not formally
18 binding (see also Macneil, 1980). Williamson (1985, ch. 3) elaborated this idea and
19 developed a typology of arrangements, or *governance structures*, together with
20 conditions specifying when a particular type of governance structure is appropriate.
21 For instance, if transactions are recurrent, involve “sufficient” uncertainty, and re-
22 quire investments that would be useless in other transactions, firms may choose not
23 to write contracts on a *transaction by transaction* basis, but instead specify future
24 terms of trade in a *long-term contract* (Joskow, 1987). Under extreme conditions,
25 such as recurrent transactions that require completely idiosyncratic investments,
26 firms may decide to remove their transaction from the market and produce the good
27 internally, thereby integrating production and exchange (*vertical integration*).

28 Transaction cost theory tends to neglect the social environment and the
29 interconnectedness of transactions (e.g. Granovetter, 1985; but also Milgrom &
30 Roberts, 1992, pp. 32–33). Of course, Williamson (1985, chs. 2 and 3) highlights
31 “frequency” together with asset specificity and uncertainty as one of three
32 principal dimensions for developing a predictive theory of economic organization.
33 However, his frequency dimension refers strictly to “buyer activity in the market”
34 (1985, p. 72) rather than addressing repeated transactions between the same
35 partners or relations of business partners with third parties. The effects of the social
36 environment and the interconnectedness of transactions have always been a typical
37 focus of *sociological approaches to contracting*. Durkheim has forcefully argued
38 in his analysis of the division of labor in society (1893, book I, ch. 7) that typical
39 features of many economic transactions deviate from those of transactions that are
40 conventionally assumed in standard models of neo-classical economics. Real-life

1 economic transactions are different from what economists usually label as “spot
2 exchange on perfect markets.” More specifically, Durkheim highlighted the limits
3 of what is today often called “contractual governance” of economic transactions.
4 As Durkheim clearly realized, the governance of transactions exclusively via
5 bilateral contracts requires that the present and future rights and obligations of the
6 partners involved in the transaction are specified explicitly for all circumstances
7 and contingencies that might arise during and after the transaction. Anticipating
8 much of the modern economic and game theoretical literature on incomplete
9 and implicit contracts, Durkheim pointed out that such purely contractual
10 governance of economic transactions is problematic: Typically, many unforeseen
11 or unforeseeable contingencies could or actually do arise during or after a
12 transaction. Negotiating a contract explicitly covering all these contingencies
13 would be unfeasible or at least prohibitively costly. Likewise, renegotiations in the
14 case that contingencies arise are also costly. Such renegotiations characteristically
15 offer incentives for opportunistic behavior since an unexpected contingency will
16 often strengthen the bargaining position of one of the partners while weakening
17 the position of the other. Hence, Durkheim argued, mutually beneficial economic
18 exchange presupposes that trading partners follow non-contractual norms and
19 moral obligations, such as norms of trust, reciprocity, and solidarity, that cannot be
20 enforced through the courts and that complement contractual arrangements. Thus,
21 written contracts may be a standard way but presumably not the only way of pro-
22 tecting parties against opportunistic behavior and other risks in business relations.

23 Durkheim’s analysis of economic transactions addressed not only a crucial
24 feature of societies based on division of labor and economic exchange between
25 its members. His analysis was likely meant to show that sociology could offer
26 insights in the analysis of economic exchange that would add in important ways to
27 the “utilitarian” market model of economics. Given that, it seems surprising that
28 sociology has neglected for quite some time to elaborate Durkheim’s arguments
29 and to support them with systematic empirical evidence. The topic Durkheim ad-
30 dressed did not speedily induce the development of a coherent and broad research
31 program on the “sociology of economic life.” Rather, renewed sociological interest
32 on this topic emerged from the sociology of law. Interestingly, arguments on the
33 limits of contractual governance of economic transactions similar to Durkheim’s
34 had already been presented by Weber in his sociology of law (see [Weber, \[1921\]](#)
35 [1976](#), p. 409). However, it seems fair to say that it was [Macaulay \(1963\)](#) who put
36 the topic back on sociology’s agenda. First, Macaulay presented a broad range
37 of “qualitative” evidence on the limited use of contracts, thus demonstrating
38 the empirical validity of Durkheim’s point. Moreover, he offered a rich set of
39 intuitive explanations why non-contractual relations in business are feasible and
40 how they complement contractual governance. The “law and society” approach in

1 the sociology of law built on Macaulay's study (see, e.g. [Beale & Dugdale, 1975](#);
2 [Ellickson, 1991](#) as an important recent contribution), providing rich qualitative
3 case studies as well as more elaborated though typically informal theoretical
4 accounts.

5 The currently most influential sociological approach to the analysis of economic
6 exchange is undoubtedly the *new economic sociology* (see [Smelser & Swedberg, 1994](#)
7 for a representative overview as well as collections like [Swedberg, 1993](#)).
8 This research program has been heavily influenced by [Granovetter's \(1985\)](#) pro-
9 grammatic article that revitalized [Polanyi's \(1944\)](#) notion of the "embeddedness"
10 of economic action and argued forcefully for systematically incorporating the ef-
11 fects of social embeddedness in the analysis of economic transactions. The notion
12 of embeddedness covers a variety of dimensions (for a discussion, see [Weesie &
13 Raub, 1996](#), pp. 203–205) so that it is useful to outline how these relate to our anal-
14 ysis here. First, embeddedness refers to institutions, that is, to the constraints for
15 economic (and other) action and exchange that result from human behavior itself.
16 Institutions structure the incentives in social relations. In other words, institutions
17 such as contract law, the availability of standard contracts, warranties and guaran-
18 tees, or arbitration procedures but also credit rating services constitute the formal
19 or informal "rules of the game" in which economic actors are involved ([North,
20 1990](#), ch. 1). A characteristic feature of sociological approaches to institutional
21 embeddedness is a focus on the explanation of the emergence and stabilization (or
22 decline) of institutions as a result of "social construction" (see, e.g. [Granovetter,
23 1992](#)) rather than assuming institutional embeddedness as exogenously given. Sec-
24 ond, and closer to our concerns in this article, embeddedness of economic exchange
25 refers to ties and relations between the partners as well as their ties and relations
26 with third parties. Such ties and relations include non-economic, personal ones that
27 have repercussions for economic exchange. [Macaulay \(1963, p. 64\)](#) observed that
28 gossip exchange at meetings of purchasing agents' associations and trade associa-
29 tions as well as at country clubs and social gatherings may deter opportunism and
30 hence reduce the need for contractual arrangements. [Granovetter \(1985, p. 492\)](#)
31 points out that the fascinating practice of diamond exchange sealed by a handshake
32 and without contractual insurance against theft and fraud is supported by the
33 embeddedness of such exchange in close-knit communities of diamond merchants:
34 behavior can be easily policed by quick spread of information and sanctions of
35 malfeasance include the loss of family, religious, and community ties (see also
36 [Coleman, 1988](#), p. S99). However, the embeddedness of a focal transaction likewise
37 includes *other* economic exchange between the partners as well as their economic
38 exchange relations with third parties. [Granovetter \(1985, pp. 490–492\)](#) ably
39 observed the effects of past dealings with the partner as well as effects of expected
40 future dealings with the partner for a focal transaction. He likewise observed the

1 repercussions of economic exchange relations with third parties. In particular, Gra-
2 novetter points out that the embeddedness of a transaction in a relation of past and
3 future dealings between the partners as well as in a network of economic relations
4 with third parties provides information on the partner as well as sanctioning oppor-
5 tunities via reputation effects (see [Raub & Weesie, 1990](#) for a theoretical analysis of
6 such reputation effects). Research in the spirit of the new economic sociology has
7 meanwhile produced a sizable amount of empirical evidence supporting that effects
8 of social embeddedness exist (see, e.g. many contributions in [Nohria & Eccles,
9 1992](#); [Sitkin et al., 1998](#); [Swedberg, 1993](#)). Much of this work does indeed focus
10 on the effects of embeddedness in the sense of other dealings with a partner as well
11 as economic relations with third parties (see, e.g. [Baker et al., 1998](#); [Gulati, 1995a,
12 b](#); [Gulati & Gargiulo, 1999](#); [Larson, 1992](#); [Lyons, 1994](#); [Uzzi, 1996, 1997](#); in this
13 volume, see the contributions by [Stuart, 2003](#) as well as [Gulati & Wang, 2003](#)).

14 In this chapter, we contribute to clarifying the effects of embeddedness on
15 economic exchange. Rather than considering personal, non-economic ties and
16 relations or ties with third parties, we focus on *dyadic embeddedness* of a
17 transaction in a sequence of economic exchanges between the same partners.
18 Effects of dyadic embeddedness have been investigated in a number of recent
19 studies. Some of these focus on the effects of prior business on the present
20 transaction (e.g. [Gulati, 1995b](#); [Lyons, 1994](#)). These studies do address various
21 features of contracting and how transactions are arranged *ex ante*. For example,
22 Gulati addresses the choice between equity and nonequity alliances. Other
23 studies try to incorporate the effects of expected *future* transactions (e.g. [Heide
24 & Miner, 1992](#); [Noordewier et al., 1990](#); [Parkhe, 1993](#)). A common feature of
25 these latter studies is that they address effects of dyadic embeddedness on *ex
26 post performance* rather than the effects of dyadic embeddedness on the ways
27 of arranging transactions *ex ante*. They ask how dyadic embeddedness affects
28 outcomes such as shared problem solving between partners, restraint in the use
29 of power, the avoidance of opportunistic behavior, or the fulfillment of various
30 strategic needs of the partners. We consider the effects of dyadic embeddedness
31 on *ex ante* contracting and, more generally, *ex ante* management. Note that this
32 provides a stronger test of hypotheses on embeddedness. Analyzing performance
33 effects of embeddedness focuses on whether economic actors react in predicted
34 ways to the incentives associated with embeddedness. Hypotheses on effects of
35 embeddedness on contracting assume such reactions as given and ask the theo-
36 retically deeper question whether contracting characteristics can be understood
37 using the assumption that actors choose such characteristics with performance
38 effects in mind (see [Prendergast, 1999](#) for a similar argument in a different but
39 related context: the design of compensation contracts by employers to align the
40 interests of employees). We add two novel contributions to previous research on

1 the effects of dyadic embeddedness on contracting in inter-firm relations. First, we
2 distinguish explicitly between the history of prior transactions between business
3 partners (“*shadow of the past*”) and their anticipations of future transactions
4 (“*shadow of the future*,” see Axelrod, 1984). Our analysis includes effects of both
5 the shadow of the past *and* the shadow of the future on contracting and *ex ante*
6 features of transactions. Second, we show how the shadow of the past and the
7 shadow of the future *interact* in affecting contractual planning of transactions. We
8 argue that the way in which expected future business affects present contracting
9 depends decisively on previous transactions between the partners.

10 A striking feature of previous empirical research on contracting is that virtu-
11 ally all studies consider the *choice between governance structures*: some kind
12 of specification is included in the contract or not, production occurs in-house or
13 not, or questions of a similar nature. Essentially, this has been the main thrust
14 of the empirical literature within and outside transaction cost economics: govern-
15 ing a transaction is costly, and properties of the transaction as well as, eventu-
16 ally, embeddedness characteristics determine which governance structure is the
17 least costly and therefore the most appropriate. Instead, we focus on the *extent*
18 to which a transaction is governed. Given that contracts are used to govern a
19 transaction, the question remains how much time and effort will be invested in
20 *ex ante* management, and how explicit the contract is going to be. Our focus
21 on the *degree of governance* not only yields a new *explanandum* but also al-
22 lows for more robust explanations by employing more parsimonious assumptions.
23 Deriving hypotheses on the choice between different governance structures re-
24 quires assumptions on which governance structure is optimal at a certain trans-
25 action cost level (e.g. Williamson, 1996, ch. 4; see Milgrom & Roberts, 1996,
26 pp. 466–467 on some problems associated with such assumptions) *in addition*
27 to the assumption that firms will economize on transaction costs. By focusing
28 on hypotheses on the *extent* to which a transaction is governed rather than on the
29 choice between different governance structures, we no longer need to employ addi-
30 tional assumptions on comparative-cost relations between alternative governance
31 structures.

32 We try to develop two points theoretically as well as empirically. First, following
33 Durkheim’s theme as well as the research program of the new economic sociology,
34 we wish to show how contractual governance of economic transactions is comple-
35 mented and supplemented by norms of solidarity and reciprocity that allow for
36 trust. Following a simple and common conceptualization (see, e.g. Barber, 1983;
37 Burt & Knez, 1995; Coleman, 1990, ch. 5; Gambetta, 1988; Snijders, 1996, ch. 1)
38 we consider trust as the willingness of an actor – the trustor – to incur a risk. More
39 precisely, the trustor places him- or herself in a situation where another actor – the
40 trustee – can perform two different actions: either the trustee performs an action

1 so that the trustor is better off than had he or she not placed trust or the trustee
2 performs an action such that the trustor is worse off than if trust were not placed.
3 This concept of trust covers two different cases. The case where the risk is that the
4 trustee is willing to perform in the interest of the trustor but lacks the resources,
5 knowledge or skill to do so. This is “trust in competence,” often referred to in
6 the literature as “confidence.” And, the case where the risk is that the trustee has
7 the resources, knowledge or skill to perform in the interest of the trustor, but is
8 not willing to do so. This is the case of “strategic trust” that is analyzed in game
9 theoretical models (see [Camerer & Weigelt, 1988](#); [Dasgupta, 1988](#); [Kreps, 1990](#)).
10 We wish to show how trust in both senses is stabilized by one specific dimension
11 of social embeddedness of economic transactions. In addition, we try to *endog-*
12 *enize* trust as a “lubricant” ([Arrow, 1974](#)) of economic exchange. We do this by
13 conceiving of norms of solidarity and reciprocity as rules of conditionally coop-
14 erative behavior and by asking when it will be in the best interest of (rational)
15 economic actors to follow such norms. In other words, we consider costly contrac-
16 tual governance and trust based on conditional cooperation as alternative modes of
17 coping with the problem potential involved in economic transactions and analyze
18 how social embeddedness of transactions affects the rational choice between con-
19 tracts and trust. In [Williamson’s \(1993\)](#) sense, our approach centers on “calculative
20 trust.”

21 By incorporating the assumption of rational behavior as the theoretical core of
22 the analysis, we certainly deviate from the approach Durkheim envisaged as well as
23 from much of the new economic sociology. However, a rational choice approach
24 *per se* is less at odds with criticism on the narrow neoclassical model than one
25 might think (see [Voss, 2003](#) for a thorough discussion in this volume). Note that
26 [Granovetter \(1985, pp. 505–506\)](#) advocated precisely such a combination of as-
27 sumptions on the embeddedness of economic behavior and robust assumptions on
28 rational and – in principle – selfish behavior in his often cited programmatic sketch.
29 Granovetter’s criticism of the shortcomings of the neoclassical model of perfect
30 markets of “atomized” actors and transactions has often been enthusiastically en-
31 dorsed and taken to imply that one had better abandon rational choice models in
32 favor of more “realistic,” socially inspired models of man. It has been widely over-
33 looked that he sharply opposes “psychological revisionism” which he characterizes
34 as “an attempt to reform economic theory by abandoning an absolute assumption
35 of rational decision making” (1985, p. 505). Rather, he suggests to maintain the
36 rationality assumption: “[W]hile the assumption of rational action must always be
37 problematic, it is a good working hypothesis that should not easily be abandoned.
38 What looks to the analyst like nonrational behavior may be quite sensible when
39 situational constraints, especially those of embeddedness are fully appreciated”
40 (1985, p. 506). He argues that investments in tracing the effects of embeddedness

1 are more promising for sociologists than investments in the modification of the
2 rationality assumption: “My claim is that however naive that psychology [of rational
3 choice] may be, this is not where the main difficulty lies – it is rather in the neglect
4 of social structure” (1985, p. 506). In fact, Granovetter advocates an approach that
5 is surprisingly similar to the position typically associated with Coleman (1987;
6 see Voss, 1985 for an early discussion of a similar perspective). In this article, we
7 exploit the idea that rational choice arguments and an approach focusing on the
8 embeddedness of economic action “have much in common” (Granovetter, 1985,
9 p. 505). We try to contribute to the construction of an interface for both approaches
10 that profits from their strengths while avoiding their weaknesses. Simple principles
11 of action from rational choice theory that are useful for deriving testable hypotheses
12 explicitly and systematically from a common theoretical core are often neglected
13 in the new economic sociology. On the other hand, we introduce a core aspect of
14 the social organization of economic exchange into the analysis that differs from
15 the context typically studied in economic approaches.

16 To test our hypotheses, we present data on the market for IT-products (hardware
17 and software), based on extensive primary data collection on 971 IT-transactions
18 between 788 Dutch small and medium-sized enterprises (SMEs) and their
19 IT-suppliers in the period 1990–1995. We first outline some characteristics of
20 the Dutch market for IT-products and argue that transactions on this market
21 offer strategic opportunities for an empirical study of the management of trust
22 in economic transactions. The following two sections offer intuitive verbal
23 theory on, first, effects of transaction characteristics on *ex ante* management
24 and, second, effects of dyadic embeddedness. Subsequently, we introduce
25 a novel formal theoretical model generating these hypotheses. We then de-
26 scribe our data and present estimation results. We conclude with a general
27 discussion.

28 29 30 **BUYER-SUPPLIER RELATIONS ON THE DUTCH** 31 **IT-MARKET** 32

33 The Dutch market for hardware and software applications has grown rapidly in
34 the last two decades (Schellekens et al., 2000; Statistics Netherlands, 1998). IT
35 is widely used in every industry and IT-investments constituted about 2.2% of
36 the domestic product in 1997. Though this is still below the U.S.-level of 3.2%,
37 it is above average in comparison with other European countries (Jacobs & de
38 Vos, 1992) and the importance of the IT sector is growing. The impact of IT on
39 economic growth is a debated issue, but according to Dutch calculations 25% of
40 the economic growth in the Netherlands in 2000–2001 was due to the IT sector

1 (van der Wiel, 2000; see also [Hollanders, 2000](#) and for thorough recent studies of
2 the situation in the U.S. [Oliner & Sichel, 2000](#); [Brynjolfsson & Hitt, 2000](#); [Gordon,
3 2000](#)). In the seventies and early eighties, potential customers had relatively little
4 knowledge about IT-products, but often had the idea that they should invest in it to
5 keep their market position. As a consequence, the market could be characterized,
6 loosely speaking, as a typical seller's market. Firms specializing in IT – and willing
7 to reap quick and substantial profits – rapidly emerged. The relative ignorance
8 of the potential buyers, the widespread existence of suppliers not that concerned
9 about their reputation, and the substantial risks associated with IT-purchases (due
10 to, e.g. complexity of the products, monitoring problems, and often high switching
11 costs) made for transactions regularly hampered by problems. These problems
12 frequently emerged because of discrepancies between what the customer thought
13 he would get and what the IT-supplier actually provided (see [Auer & Harris, 1981](#);
14 [Riesewijk & Warmerdam, 1986](#)). Over time, the market settled somewhat: some
15 of the less reliable IT-suppliers disappeared and IT-buyers got more acquainted
16 with the kind of benefits investments in IT can generate.

17 Furthermore, several institutional reactions are noteworthy. Since 1992, the sepa-
18 rate business associations of Dutch software and hardware suppliers have joined
19 forces in a new organization, the *Federation of Dutch Information Technology*
20 (*FENIT*). At the same time, buyers have organized themselves in user associ-
21 ations. For instance, some user associations have specifically been founded to
22 reassure updates and maintenance of software applications when original suppli-
23 ers do no longer exist or have been taken over by other (larger) IT-companies.
24 Since potential IT-buyers got both better informed and better protected, the market
25 changed from a seller's market to a buyer's market. Most firms know reasonably
26 well what they want to have, and that they can get what they want at more than one
27 place. However, rapid improvement of hardware performance and software appli-
28 cations still causes considerable uncertainties with respect to price and quality. In
29 addition, the young and growing market for IT-consultancy and services is still
30 characterized by high rates of firms going bankrupt as well as frequent mergers
31 and acquisitions. Thus, uncertainty with respect to the continuity of transactions
32 still implies considerable risks associated with specific investments and long-term
33 business relations (see, e.g. [Schellekens et al., 2000](#)). To summarize, while our the-
34 ory will obviously apply to transactions on other markets as well as to exchange
35 in inter-firm relations different from buyer-supplier relations, the IT-market ap-
36 pears to be a suitable context and a strategic research site for studying trust and
37 contracting in inter-firm relations. Because of the nature of the IT-business, incen-
38 tives for opportunistic behavior exist, buyers of IT-products are by now aware of
39 this, and they face the problem of finding an adequate way to manage the specific
40 transaction.

1 **THEORY AND HYPOTHESES ON CONTRACTING:**
2 **EFFECTS OF TRANSACTION CHARACTERISTICS AND**
3 **MANAGEMENT COSTS**
4
5

6 We consider investing in transaction management to be a response to the *problem*
7 *potential* associated with a transaction. Potential problems include unforeseen or
8 unforeseeable contingencies like sudden changes in market prices for components.
9 Also, problems can result from strategic risks such as opportunistic behavior.
10 Investing time and effort in *ex ante* management, the actors may try to reduce such
11 risks. For example, investing time and effort in communication can mitigate co-
12 ordination problems. Likewise, investing time and effort in negotiating a contract
13 that includes additional or more detailed specifications can mitigate risks from
14 external contingencies. Or, investing time and effort in negotiating warranties,
15 guarantees, and penalty clauses can reduce incentives for opportunistic behavior
16 and it can compensate for the damage inflicted when – in spite of all efforts –
17 opportunistic behavior occurs. Consequently, increasing investments in transac-
18 tion management increases the probability that the transaction runs smoothly and
19 that a party suffering from a problem gets compensated for losses. However, this
20 decrease in risks comes at a price, namely, the price of typical transaction costs.
21 It could make sense to include some explicit clauses on the time of delivery of
22 the product in a contract – an especially appropriate example given that we are
23 considering the IT-market. On the other hand, negotiating and writing these clauses
24 takes time and effort, so it could be that including them is not efficient. Instead,
25 it may make more sense to invest in trying to make sure that delivery problems
26 will not occur by investing extra time in communicating the specifications of
27 the product. The partners confront the complicated decision to find the optimal
28 investment in governing the transaction. We try to explain such decisions from
29 rational behavior of the transaction partners. Basically, if the problem potential is
30 small, actors have good reasons to trust and have thus fewer incentives to invest in
31 costly *ex ante* management. Conversely, if risks increase, trust is problematic and
32 costly management makes sense. From the perspective of trust as the willingness
33 of an actor to incur risks, it makes sense to distinguish between two dimensions of
34 the problem potential. One dimension, to which we will refer as the *opportunism*
35 *potential*, are the possibilities and incentives of the trustee to behave opportunisti-
36 cally (that is, in a way that impairs the trustor). The other dimension will be refered
37 to as the *damage potential* and represents the extent to which the trustor would
38 be hurt if the trustee does not perform in the interest of the trustor. Hence, the
39 trustor's risk increases with increasing opportunism potential as well as increasing
40 damage potential and increasing risk induces more *ex ante* management.

1 We concentrate on the buyer's risks in buyer-supplier relations and on how the
2 buyer invests in *ex ante* management. Putting more effort in preventing problems
3 increases the probability that the transaction runs smoothly, but the extra effort
4 comes at a price. Thus, the transaction is conceived as a trust problem in which
5 the buyer is the trustor and the supplier is the trustee. In order to avoid complex
6 modeling of bargaining and negotiation between buyer and supplier, we employ
7 a standard way of including market conditions in game theoretical models on be-
8 havior in markets (see, e.g. [Rasmusen, 1994](#), pp. 169–170 for a more technical
9 discussion) and assume for simplicity that, given a match between a buyer and a
10 supplier has formed, the buyer determines the degree of planning for the trans-
11 action. The buyer must balance costs and benefits of extra management of the
12 transaction. More specifically, we assume that the buyer takes into account how
13 a rational supplier will react to the buyer's planning efforts. The buyer chooses a
14 degree of planning such that the supplier's utility level from the transaction equals
15 the reservation utility, i.e. the minimum for which the supplier would be willing
16 to deliver. Given the market under scrutiny, it is reasonable to assume that the
17 supplier is one of many competitors, so that the buyer can always find another
18 supplier who is willing to sell on the buyer's terms if the transaction is marginally
19 profitable for the supplier. Whereas this assumption does abstract from many of
20 the dynamics of real life dealings between business partners, the assumption that
21 the buyer determines the degree of planning is less problematic than might appear
22 at first sight and does not imply that we completely neglect the role of the supplier
23 in contracting. First, the supplier has an incentive to accept the buyer's demand
24 for contractual safeguards or to even provide them voluntarily because otherwise
25 the buyer might not be willing to buy at all. Second, the supplier's reservation
26 utility could be set such that the safeguards do not exceed those the supplier would
27 have had to provide if the buyer had to compete with other buyers for the same
28 delivery.

29 By explaining contractual planning as a device for mitigating the problem
30 potential associated with a transaction we neglect the internal communication
31 function of contracts within the buyer's firm as well as within the supplier's
32 firm (see [Macaulay, 1963](#), p. 65 for a discussion of this feature of contractual
33 practices). Also, by addressing investments in contractual planning we neglect
34 search and selection processes (see, e.g. [Blumberg, 1998](#); [Gulati & Gargiulo, 1999](#)).
35 That is, we neglect the cases where a buyer might carefully and extensively
36 search for a trustworthy supplier offering a good product for a reasonable price in
37 order to invest less in subsequent contractual planning. In our statistical analyses
38 we will control for this neglected communication function as well as for search
39 and selection efforts. As we will show, our empirical results do not depend on
40 these assumptions (see the section on **stability of results**).

1 We now consider conditions that determine the extent to which buyers invest in
2 *ex ante* management of a focal transaction through explicit and implicit contracting,
3 starting with determinants of such investments that can be conceived as transaction
4 characteristics. Such transaction characteristics are the typical focus of economic
5 approaches to contracting.

6 7 8 *Opportunism Potential* 9

10 It is close to tautological that the problem potential of a transaction increases
11 with the number of possibilities for opportunistic behavior and the incentives for
12 such behavior. One of the determinants of *opportunism potential* is the size of the
13 transaction (for a detailed overview of the indicators that were used in the analyses,
14 see the section on *data and measurement* and [Appendix B](#)). Transaction size can be
15 defined in terms of its financial volume – which is the proxy we use in our analyses
16 – or, often but not always closely related, the number of products or components
17 of a product involved in the transaction. The more products are included in the
18 transaction, the more possibilities for buyer and supplier to disagree about some
19 aspect of the transaction. For instance, a hospital buying a database program is less
20 likely to experience trouble than a hospital buying a database program, network
21 facilities, and cabling. In daily practice, this problem is sometimes anticipated and
22 dealt with by splitting up transactions involving a larger number of goods into
23 separate deliveries, thereby spreading the opportunism potential across different
24 points in time (see, e.g. [Burt, 1992](#), ch. 7). Here, we try to explain the management
25 of transactions that vary in size but are assumed to be restricted to one certain point
26 in time.

27 A second determinant of the opportunism potential is the degree to which moni-
28 toring problems exist. The more difficult it is to judge the quality of a product or
29 service, the larger the opportunism potential surrounding a transaction. Consider
30 for instance a firm selling an automated baking machine to a bakery. For some
31 reason, the baking machine performance does not meet the bakery's standards.
32 If the bakery does not know what a good baking machine can produce, the sup-
33 plier could tell the bakery that this is as good as baking machines get, and get
34 away with selling an inferior product. Whether monitoring problems are the result
35 of the objective complexity of the machine, or the result of the ignorance of the
36 bakery, is not so much the issue here. The point is that in anticipation of moni-
37 toring problems, the baker would be wise to consider investing more in managing
38 this transaction. This can be achieved, for instance, by investing time in getting
39 acquainted with the technology. Note the difference between this definition of tech-
40 nological uncertainty and uncertainty in the sense of [Williamson \(1985, pp. 56–59\)](#).

1 Williamson distinguishes between uncertainty due to external contingencies and
2 strategic, or behavioral, uncertainty that results from risks due to opportunistic be-
3 havior of the partners, including “strategic non-disclosure, disguise, or distortion
4 of information” (1985, p. 57). We stress that monitoring problems due to objec-
5 tive complexity of a product or lack of expertise of the buyer make opportunism
6 feasible and individually attractive for the supplier. Hence, monitoring problems
7 increase opportunism potential and are thus expected to induce less trust and more
8 investments in *ex ante* management.

9
10 **Hypothesis 1.** The opportunism potential (as indicated by volume and moni-
11 toring problems) of transactions will have a positive effect on the investment of
12 the buying firm in *ex ante* management.

13 *The Consequences of Problems: Damage Potential*

14
15
16 Apart from the possibilities and incentives for opportunism, it also matters how
17 severe the consequences would be if problems actually do occur. The extent to
18 which these problems would hurt the business partners determines the transaction’s
19 *damage potential*. Again, the financial volume of a transaction can serve as an
20 indicator for the damage potential. The more expensive the transaction, the larger
21 the impact on the firm’s profits if problems arise, and thus the larger the damage
22 potential. The importance of the transaction for the buyer in terms of the importance
23 of the durability of the product and the importance of the product for the buyer’s
24 profitability likewise indicate the damage potential. Another indicator are the costs
25 that would be incurred if the product would fail and had to be replaced. This
26 implicitly includes capital that is lost because of investments that are specific to the
27 transaction (see [Williamson’s, 1985](#) arguments on the effects of asset specificity).
28 The larger these costs, the more the firm would suffer losses on the deal, and
29 therefore the larger the damage potential.

30
31 **Hypothesis 2.** The damage potential of transactions (as indicated by the
32 financial volume, the importance of the transaction for the buyer and the
33 replacement costs for the buyer if the product fails) will have a positive effect
34 on the investment of the buying firm in *ex ante* management.

35 36 37 *The Costs of Management*

38
39 The efficiency of preventing potential problems of a transaction by *ex ante* manage-
40 ment also depends on how *costly* it is to *prevent these problems*. First, firms need

1 to know or find out which kind of problems are likely to occur. Two firm resources
2 are important in this respect. For firms with legal expertise, it is easier to realize
3 an accurate contract since they know better which kind of problems to prevent.
4 Consequently, other things equal, these firms will invest more in contracting: they
5 write longer contracts (which implies more *ex ante* management) because for them
6 the marginal transaction costs are lower. Additionally, some firms have tried in the
7 past to minimize their overall costs of management by implementing standardized
8 procedures that are to be followed during negotiation and contracting. Assuming
9 that these procedures indeed decrease the costs of management (as compared to
10 the situation without these procedures), such firms will on the average invest more
11 than others in contracting, since their management is less costly at the margin.

12
13 **Hypothesis 3.** The marginal costs of *ex ante* management (as indicated by the
14 legal expertise and standardized procedures of the firm) will have a negative
15 effect on the investment of the buying firm in *ex ante* management.

16 17 18 **THEORY AND HYPOTHESES ON CONTRACTING:** 19 **EFFECTS OF DYADIC EMBEDDEDNESS** 20

21 Despite the major impact of the transaction costs approach, criticisms were not
22 slow in coming. A general point of criticism is that too much attention has been
23 given to the “economic” characteristics of transactions like volume and damage
24 potential, and too little attention has been paid to the social environment of trans-
25 actions. As mentioned before, we focus on one aspect of social embeddedness,
26 namely, the dyadic embeddedness of a focal transaction in the sense of connec-
27 tions with other dealings between trading partners (rather than embeddedness in
28 personal, non-economic ties). We distinguish between two features of dyadic em-
29 beddedness: prior transactions between the same two partners (the shadow of the
30 past) and expected future transactions between them (the shadow of the future).
31 Effects of the shadow of the past have been a topic of previous research on contrac-
32 tual management of inter-firm relations (Gulati, 1995b; Lyons, 1994). The shadow
33 of the future is a central factor in game theoretical models for cooperative behavior
34 as has been forcefully argued by Axelrod (1984). Noordewier et al. (1990), Heide
35 and Miner (1992), and Parkhe (1993) have shown empirically that the shadow
36 of the future has performance effects in inter-firm relations. In the following,
37 we examine the interplay between both types of dyadic embeddedness and the
38 *ex ante* management of firms (see Raub, 1996). Hence, we integrate the con-
39 ventional sociological focus on trust as emerging from past exchanges and the
40 economic perspective on trust as a result of incentives related to future exchanges

1 (see [Burt & Knez, 1996](#)). We argue that the effects of the shadow of the future
2 depend crucially on the shadow of the past.
3
4

5 *Shadow of the Past*

6

7 The history of transactions with the same partner provides information about the
8 characteristics and the exchange behavior of each of the partners. When entering
9 a new relation, there is a positive probability that the partner is incompetent or ex-
10 cessively inclined to behave opportunistically. This could be the case, for instance,
11 when the partner is on the verge of bankruptcy so that short-term incentives for op-
12 portunistic behavior outweigh even severe long run costs from sanctions. In other
13 words, when entering a new business relation, firms do not know whether they face
14 a “normal” partner who is competent and not excessively inclined to opportunism,
15 or a “deviant” partner who is either incompetent or opportunistic. Once firms find
16 out their partner is either not competent or not reliable, this knowledge is probably
17 sufficient to make firms try to find better partners (our data will in fact support this:
18 almost all the firms in the data who have previous experiences with their partner,
19 have positive experiences). We thus assume that buyers with bad experiences will
20 try to find a more suitable supplier, so that buyers having bad experiences with a
21 given supplier and likewise expecting future business with the same supplier do
22 not exist. Hence, we do not model exit of buyers from *bad* relations with suppliers
23 explicitly and assume that exit costs are not prohibitive because alternative
24 suppliers are available and relation specific investments in the past are sufficiently
25 small. Conversely, positive information on previous transactions will increase
26 trust in the partner’s competence and in the partner’s capability to withstand a
27 short-term temptation for opportunistic behavior. In the latter case, the need for
28 investments in *ex ante* management of the focal transaction is reduced.

29 A second reason why favorable previous relations with the same business partner
30 may decrease the current investment in management is because partners can make
31 use of their prior investments. Previous investments such as reusable contracts,
32 earlier agreements on certain quality standards, and knowledge about the way to
33 approach the partner will decrease the need for costly new investments in current
34 management. In other words: management investment is probably not completely
35 *transaction specific*. It seems reasonable to assume that a positive past relationship
36 comes along with relationship-specific investments not only in management but
37 also in other respects. For example, the supplier may have invested in training of
38 employees specifically designed to facilitate service and maintenance of products
39 of the supplier that have been purchased by the buyer. One-sided relationship-
40 specific investments of the buyer increase unilateral dependency of the buyer on

1 the supplier and thus enhance the problem potential because the buyer's damage
2 from malperformance of the product or the supplier increases. Conversely, *mutual*
3 previous investments reduce the opportunism potential (see [Williamson, 1985](#),
4 pp. 190–195) and, through a reduced opportunism potential, reduce investments
5 in *ex ante* management of the current transaction. In short, we expect negative
6 previous experience to lead to termination of the partnership and positive previous
7 experience to a decrease in the investments in current *ex ante* management.

8
9 **Hypothesis 4.** Positive previous experiences with the same supplier will have
10 a negative effect on the investment of the buying firm in *ex ante* management.

11 Note that, in the spirit of Granovetter's argument, we focus on "anchoring effects"
12 of prior investments in management exclusively as a result of fully rational deci-
13 sion making. Biases due to non-rational adjustments, a typical focus of (social)
14 psychological research on anchoring (see, e.g. [Tversky & Kahneman, 1982](#) for an
15 overview), are not taken into account.

16 17 18 *Shadow of the Future*

19
20 In his classic study, Macaulay specifically addressed the use of long-term contracts.
21 Instead of standard short-term agreements, long-term contracts can be used to con-
22 trol business relations. Long-term contracts provide a future, and thereby a way to
23 build up a general business reputation ([Macaulay, 1963](#), p. 63). Analyzing the coal
24 market, [Joskow \(1987\)](#) showed that there is a relation between contract duration
25 and relationship-specific investments: coal suppliers and energy plants more often
26 rely on long-term contracts as relationship-specific investments become more im-
27 portant. At first sight, a large perceived probability of future transactions indeed
28 facilitates less investment in current *ex ante* management. If transactions are likely
29 to be followed by future transactions, this shadow of the future provides opportu-
30 nities to preclude opportunistic behavior through *tit-for-tat* like (i.e. conditionally
31 cooperative) behavior. This is the core argument of game theoretical approaches
32 to repeated interactions (see [Kreps, 1990](#) for an informal account and [Taylor,](#)
33 [1976/1987](#) as well as [Axelrod, 1984](#) for stimulating and influential applications in
34 political science). The threat of sanctioning opportunistic behavior implicit in the
35 mechanism of conditional cooperation makes extensive *ex ante* management of
36 the focal transaction superfluous. Thus, given a sufficient shadow of the future, it
37 becomes individually rational to indeed follow a norm of reciprocity. Obviously,
38 this would allow substituting trust for costly investments in *ex ante* management.

39 However, there are reasons to argue exactly the opposite with respect to the
40 relation between the shadow of the future and investments in *ex ante* management.

1 Partners who deal with each other for the first time and have reasonable expect-
2 tations about the future have incentives to invest more in *ex ante* management
3 because future transactions will benefit from the set-up investments in the current
4 transaction (see Williamson's, 1985, pp. 60–61 related discussion of “frequency”
5 of transactions that favors specialized governance structures). In general, some
6 proportion of the investment in management of a given transaction will be use-
7 ful for the management of future transactions with the same partner as well. For
8 instance, firms who are likely to deal with a business partner more often in simi-
9 lar transactions may choose to be extra careful in the design of the first contract,
10 since it will guide subsequent transactions. Even if transactions are diverse, some
11 parts of contracts written earlier may be useful in future transactions (our data
12 will support the assumption that written contracts are often reused). Moreover,
13 management of a transaction with an unknown partner requires *set-up investments*
14 of other kinds, like getting to know the partner, knowing whom to call for which
15 kind of information, and the like.

16 We therefore argue that the shadow of the future has two effects on investments
17 in *ex ante* management. One of these is a *reciprocity effect*: reciprocity as a basis
18 of trust and, thus, as a substitute for contractual governance is facilitated and this
19 reduces incentives for costly *ex ante* management. The other is an *investment*
20 *effect*: costly *ex ante* management of the focal transaction has long run effects for
21 future transactions and can be partly reused, thus increasing incentives for *ex ante*
22 management. These effects yield two implications. First, with regard to business
23 partners *without* common previous transactions, the relation between a shadow of
24 the future and transaction management is *unknown*. On the one hand one would
25 expect a negative relation because of future sanction threats deterring opportunistic
26 behavior. But on the other hand one would expect a positive relation because of the
27 need for and the long run benefits from set-up investments. We have no arguments
28 regarding the relative weight of both arguments. Second, however, a shadow of
29 the future leads to a decrease in *ex ante* management in those cases where set-up
30 investments have already been made (hence: a shadow of the past exists). If a
31 shadow of the past exists, the effects of investments in *ex ante* management of
32 the focal transaction on the management of future transactions are smaller. Thus,
33 we derive a novel hypothesis regarding the interaction effect between the shadow
34 of the past and the shadow of the future on investments in *ex ante* management.
35 Business partners, who are past the stage of set-up investments, should indeed
36 benefit from a large shadow of the future by investing less in *ex ante* management.

37
38 **Hypothesis 5.** Given positive previous experiences with the same supplier, the
39 shadow of the future will have a negative effect on the investment of the buying
40 firm in *ex ante* management.

1 Summarizing, note that our hypotheses show how and when rational actors will
 2 substitute trust at least to some degree for costly investments in *ex ante* manage-
 3 ment. Hence, we capture Durkheim’s conjecture that contractual arrangements are
 4 complemented by reciprocity. Moreover, we have argued how the choice between
 5 contractual and non-contractual management is affected not only by “economic”
 6 features of a transaction but also by a core dimension of the social embeddedness
 7 of the transaction, namely, dyadic embeddedness.

8
 9
 10 **FORMAL MODEL SPECIFICATION**

11
 12 We now provide a theoretical model that captures in a more formal way the argu-
 13 ments we have just put forward. At the heart of the model, we envisage a buyer’s
 14 utility function depending on opportunism potential, damage potential, costs of
 15 management, embeddedness characteristics, and – finally – effort invested in man-
 16 agement, which is the buyer’s choice variable. We first define some variables cap-
 17 turing the dimensions we have put forward. I_{past} represents an indicator function
 18 equal to 1 if a shared past exists, O represents the opportunism potential, F a
 19 function that maps the real numbers to the unit-interval (for instance the standard
 20 normal cumulative distribution function), c the marginal costs of management, w
 21 the probability of future business, and D the damage potential for the focal trans-
 22 action. Putting more effort in preventing problems increases the probability that
 23 the focal transaction runs smoothly, but the extra effort comes at a price. Costs and
 24 benefits of extra management of the transaction must be in balance. The following
 25 theorem makes the relation between optimal management and our independent
 26 variables explicit. Details can be found in [Appendix A](#).

27
 28 **Theorem.** Consider a match between two actors in a durable relationship, who
 29 have to decide the degree of planning for a focal transaction. Let this focal
 30 transaction be characterized by the tuple $(I_{\text{past}}, O, c, w, D)$ with meanings as
 31 described above. Here, we choose these two parties to be a buyer and supplier,
 32 but other kinds of actors are, in principle, just as feasible. Assume that the buyer
 33 determines the degree of planning. Under these conditions, the optimal amount
 34 of management (m_{opt}) can be characterized by:

35
 36
$$m_{\text{opt}} = (1 - g_1 I_{\text{past}}) \left(-b_0 + b_1 O + b_2 F'^{-1} \left(\frac{c(1 - wg_1)}{b_3 D} \right) \right) - g_0 I_{\text{past}},$$

37
 38 where the b_i and g_i are parameters to be estimated and supposed to be positive.

39
 40 **Proof.** See [Appendix A](#). □

1 Note that the theorem indeed connects optimal management with the theoretic-
 2 cal dimensions of the previous sections in the hypothesized ways. This shows
 3 that our hypotheses can be derived from a more general model of choice. Op-
 4 timal investment in management increases with the opportunism potential (O ;
 5 [Hypothesis 1](#)) and the damage potential (D ; [Hypothesis 2](#)). Conversely, optimal
 6 management decreases with the marginal costs of management (c ; [Hypothesis 3](#)).
 7 Furthermore, optimal investment in management decreases if a shared past exists
 8 (I_{past} ; [Hypothesis 4](#)). In particular, using a linear Taylor expansion $t_0 +$
 9 t_1x ($t_1 < 0$) for $F^{-1}(x)$, we can conclude that the coefficient of the interaction
 10 effect between past and future (the coefficient of wI_{past}) equals $(g_1^2ct_1)/(b_3^2D) < 0$.
 11 In other words, the model also implies that the interaction effect of past and future
 12 is indeed negative ([Hypothesis 5](#)).

13 The model adds – besides being more general as well as explicit about assump-
 14 tions and relevant variables – several distinct advantages to our intuitive arguments
 15 and hypotheses on transaction management. First, it allows us to specify additional
 16 hypotheses, which would have been difficult to derive on the basis of intuitive rea-
 17 soning alone. Second, the formal model directly implies the nonlinear statistical
 18 model on the basis of which the hypotheses need to be tested (as opposed to just
 19 adding all indicators into a linear regression analysis). Third, the formal model
 20 allows indicators to enter the statistical analysis more than once. For instance, the
 21 volume of the transaction serves as an indicator of the damage potential *and* as an
 22 indicator of the opportunism potential. Using standard linear regression analysis,
 23 such specifications are impossible. Finally, as we briefly elaborate in our discus-
 24 sion section, the model is potentially useful for two-party relationships other than
 25 the specific buyer-supplier relationships we consider here. As long as assuming a
 26 similar underlying structure of the relationship is reasonable, the model provides
 27 the building blocks for subsequent analysis.

30 DATA AND MEASUREMENT

31 *Sample*

32
 33
 34 “The External Management of Automation 1995” (MAT95) is a large-scale survey
 35 on the purchase of IT-products by Dutch SMEs (5–200 employees; [Batenburg,](#)
 36 [1997a; Batenburg & Raub, 1995](#)). A reason for a survey on IT-purchases of
 37 SMEs was that these buyers typically lack expertise and resources for the in-
 38 house production of such products. Hence, we can neglect the make or buy-
 39 decision and assume the transaction as exogenously given. In fact, according to
 40 one of the questions in MAT95, less than 5% of the transactions (46 out of 971)

1 involve IT-products that could have been produced easily or very easily by the
2 buyer.

3 The sampling frame was a business-to-business database of Dutch SMEs that
4 contained information about the characteristics of these SMEs with respect to
5 automation. The database is known to be far more up to date and reliable than the
6 often used database of the Chamber of Industry and Commerce. It is owned and
7 developed by Directview, a Dutch firm specialized in IT marketing data of Dutch
8 organizations. About 80% of all Dutch firms with more than five employees are
9 included in the database. The database can be considered to be representative
10 for the Dutch population of SMEs (see [Batenburg, 1997a](#)). Three criteria were
11 used for stratification. First, the sample was stratified according to the number
12 of IT-specialists employed by the firm. Three groups were distinguished: firms
13 with no specialist, firms that had only part-time specialists, and firms with one
14 or more full-time specialists. Second, the strength of inter-firm relations within
15 certain sectors of industry was determined by judgements of 28 business experts.
16 Their judgements were based on how often firms meet informally and how many
17 activities within the sector were organized to bring firms together. Using these
18 expert judgements, sectors were divided in three groups: sectors with weak,
19 medium, and strong inter-firm relations. The third stratification criterion was the
20 type of IT-products bought by a firm. This criterion distinguished four groups of
21 products: standard hardware, complex hardware, standard software, and complex
22 software. These three stratification criteria were used because they represent three
23 important theoretical dimensions. The expertise of the buyer and the complexity
24 of the transaction are indicators of monitoring problems, while contacts between
25 buyers represent “network embeddedness” (see [Buskens, 2002](#), ch. 5 for an
26 analysis of the effects of network embeddedness). The three stratification criteria
27 resulted in a sampling design with 36 ($3 \times 3 \times 4$) cells. Randomization procedures
28 for sampling transactions were used until at least 15 cases were collected for
29 each cell.

30 Key informants of buying firms were first briefly interviewed by a structured
31 Computer Assisted Telephone Interview (CATI). In the CATI-interview, coopera-
32 tion was asked from an employee responsible for automation in the firm. Most of
33 the key informants were IT-managers of the buying firm. The CATI-interview was
34 then used to randomly select a particular IT-investment the firm had made in the
35 past, in order to define beforehand on which transaction the main questionnaire
36 would focus. More precisely, the transaction was selected randomly from all the
37 IT-investments of the firm in the previous five years that met the third stratification
38 criterion (type of IT-product) and on which the respondent was well informed.
39 Usually, the respondents were involved themselves with and often responsible for
40 the purchase.

1 Following this sampling procedure, a main sample of 547 IT-transactions was
2 obtained. Subsequently, the data set was extended with an additional sample. This
3 additional sample was collected in order to obtain more observations on innovative
4 and complex IT-products. Transactions were sampled from SMEs in sectors that
5 typically use such products. Using judgements of IT-market researchers and fig-
6 ures from Statistics Netherlands, five such sectors were identified (food and metal
7 industry, transport equipment, wholesale trade, and road transport). The additional
8 sample was stratified using only the criterion related to the IT-specialists in the
9 buyer's firm. Complex transactions are assumed to be associated with a higher
10 opportunism potential. Therefore, we include both samples in our analyses. Note
11 that, in contrast with the first stratified sample, the additional sample is not repre-
12 sentative for Dutch SMEs. Another 241 questionnaires were collected within this
13 additional sample.

14 About 25% (463 out of 1,798) of the firms contacted turned out not to be suitable
15 for our purposes, either because there were no suitable respondents, no independent
16 IT-investments, or no IT-products used in the firm, or because the firm had ceased
17 to exist, was too large, or too small. Given willingness to cooperate, a member
18 of the fieldwork team visited the respondent with the main questionnaire on a
19 convenient date and time at the site of the firm. Respondents were asked to fill out
20 a questionnaire regarding the purchase of the agreed upon IT-product. From the
21 main sample and the additional sample, data are obtained from 788 (547 + 241)
22 IT-buying firms. About 25% (183 out of 788) of the respondents were willing to
23 fill out a second questionnaire regarding the purchase of a different IT-product, in
24 most cases from a different supplier. In these cases, another questionnaire was left
25 at the site of the firm and returned by mail. In total, the data set thus consists of 971
26 (547 + 241 + 183) transactions, of which 183 are *second transactions* from the
27 same buyer. In about 15% (132 out of 788) of the cases, respondents were willing
28 to participate but did not agree with a visit. Questionnaires were then sent to them
29 by mail. The bulk of the questionnaires were filled out between January and June
30 1995. For 28 transactions, the name of the supplier is unknown. The remaining
31 943 transactions were furnished by 602 different suppliers. On average, a single
32 supplier is involved with about 1.5 transactions in the data. Four large suppliers
33 occur more frequently: IBM (30 transactions), Baan (18), MAI (15), and Raet (13).

34 The average response rate to the CATI-interview was 67% (902 out of 1,335).
35 Multiplied with the field response rate of 87% (788 out of 902), the total response
36 rate equaled 59% (788 out of 1,335). This is a high response rate in comparison
37 with other surveys among organizations (cf. [Kalleberg et al., 1996](#), chs. 1 and 2).
38 Non-response analysis showed that the response group is not biased on crucial
39 firm characteristics such as size, industry or region. In addition, we know from a
40 question in the CATI-interview that firms in our sample do not differ from firms

1 refusing to fill out the main questionnaire in their general satisfaction with IT-
2 suppliers. Hence, it is unlikely that we have oversampled firms with either untypi-
3 cally many or untypically few problems with their IT-suppliers (Batenburg, 1997b).
4

6 *Measurement*

7
8 Next, we describe the questions in the survey that were used to operationalize
9 the theoretical concepts as introduced in the previous sections. In principle, one
10 could try to find indicators for each of the parameters in the theoretical model. For
11 tractability we restrict ourselves to indicators for the opportunism potential (O),
12 the marginal costs of management (c), the shadow of the future (w), the shadow
13 of the past (I_{past}), and the damage potential (D).

14 As indicators for the opportunism potential, we use answers to survey questions
15 about the financial volume of the transactions (*volume*) and about monitoring
16 problems (*monitoring problems*). Hence, we neglect that *mutual* relation specific
17 investments, indicated by the shadow of the past, may reduce the opportunism
18 potential. As indicators for the damage potential (D), we again use answers to
19 survey questions about the financial volume of the transaction (*volume*), about
20 replacement costs (*replacement costs*), the importance of the product for the profit
21 of the buyer's firm (*importance for profitability*), and the importance of the dura-
22 bility of the product for the buyer (*importance of durability*). Our indicators for
23 the marginal costs of management are the existence of standardized procedures in
24 contracting (*standardized procedures*) and the availability of own legal expertise
25 (*legal expertise*). The expectation w of future business with the same supplier is
26 measured by asking the respondent for an estimate of the volume and frequency of
27 new and additional transactions with the supplier (*future*). The shadow of the past
28 was measured by an indicator variable, equal to 1 if buyer and supplier had done
29 business before (*past*). More detailed information about frequency (see Gulati,
30 1995b who uses such a variable) and volume of past transactions with the supplier
31 and the buyer's satisfaction with these past transactions are available but do not add
32 much statistically; the important difference lies between having past experiences
33 or not (see below). Half of the firms had a history with the supplier, with an average
34 length of 6.3 years (excluding those without past experience). In some of the anal-
35 yses, we present two control variables, the size of the supplier's firm (*size supplier*)
36 and of the buyer's firm (*size buyer*). Note that this is one way of controlling, albeit
37 roughly, for the internal communication function of contracts if one is willing to
38 assume that the need for internal communication increases in the size of the firm.
39 Other controls, such as the type of industry and characteristics of the respondent,
40 were included in the analyses as well. To avoid cluttering up the tables with a lot of

1 controls having no substantial effects on the results, we incorporate only the size of
2 the firms explicitly. The subsection on **stability of results** provides further details.
3 As the dependent variable (*management*) representing investments in contractual
4 *ex ante* management and, hence, transaction costs actually associated with pur-
5 chasing the product, we used a weighted average of various indicators. First, we
6 included the number of person-days of employees of the buyer that were spent on
7 negotiating with the supplier and drafting the contract, the number of departments
8 of the buyer involved in negotiations with the supplier, the use of external legal
9 advisors, and whether the contract was mainly a standard or a tailor made contract.
10 Second, the questionnaire contained a list of 24 financial and legal clauses typically
11 included in contracts for IT purchases as well as a list of 24 technical specifica-
12 tions. For each financial and legal issue, respondents were asked to specify how
13 extensively it was addressed during the negotiations and whether it was arranged
14 verbally or written down in a contract. For each of the technical specifications,
15 respondents were asked how extensively it was addressed in the contract. Note
16 that about 65% (625 out of 971) of the contracts are standard contracts or modified
17 versions of standard contracts (e.g. [Berkvens et al., 1991](#)). However, such stan-
18 dard contracts for IT transactions are typically adapted by the users in a flexible
19 way and, in fact, are often provided in a format (e.g. electronically) that facilitates
20 “fine tuning” by the contracting parties. Hence, for the IT transactions considered
21 here, the use of standard contracts does not preclude transaction or relationship
22 specific contractual management. For a more detailed description of the indicators
23 and the construction of variables, we refer to [Appendix B](#). Obviously, one should
24 appreciate the retrospective nature of our data as well as the fact that the data
25 are collected via the buyer. To minimize potential bias, survey questions focused,
26 wherever possible, not on attitudes of the respondent but on the respondent’s actual
27 behavior and knowledge about specific characteristics of the product, the supplier,
28 the buyer-supplier relation, negotiations, and the content of the contract. [Table 1](#)
29 presents an overview of the variables.

30 The scale of most of the variables is meaningless, since most variables are either
31 scores on a five-point scale (like *future*), or weighted averages of several questions
32 in the survey (like *replacement costs*). To get a feel for the data, we mention that
33 the average transaction involved a firm of about 80 employees buying a product
34 worth roughly 50,000 U.S.\$. Negotiating and contracting took the buyer about five
35 person-days and involved 2 divisions of the buyer’s firm. On average, our respon-
36 dents have been working at their firm since 1985. Since the average transaction
37 took place around 1992, respondents have an average history at their firm of about
38 seven years prior to the transaction. About two thirds of the respondents stated that
39 the transaction was of “great” or “very great” importance for their IT-situation.
40 The bivariate correlations between the variables are displayed in [Appendix C](#).

Table 1. Overview of Variables and Descriptive Statistics.

Variable name	Description	Number of cases	Mean	St. dev.	Min.	Max.
Dependent Variable						
Management	Total investment in management by buyer ^a	964	0	1	-2.29	3.87
Opportunism Potential/Damage Potential						
Volume	Financial volume of the transaction in 100,000 HFL ^b	956	-0.76	1.20	-2.08	1.25
Monitoring problems	Monitoring problems of buyer ^a	964	0	1	-2.31	2.90
Replacement costs	Replacement costs for buyer ^a	955	0	1	-1.82	2.35
Importance of durability	Importance of durability of IT-product for buyer ^a	960	0	1	-3.98	2.03
Importance for profitability	Importance of IT-product for buyer's profitability ^a	963	0	1	-2.84	2.52
Marginal Costs of Management						
Standardized procedures	Standardized contracting procedures of buyer ^c	920	2.49	1.17	1	5
Legal expertise	Legal expertise of buyer ^d	964	0.20	0.40	0	1
Dyadic Embeddedness						
Past	Buyer and supplier have done business before ^d	964	0.50	0.50	0	1
Future	Probability of future business as expected by buyer before transaction ^c	950	2.79	1.38	1	5
Control Variables						
Size buyer	Number of employees buyer ^b	949	3.65	1.04	0	8.70
Size supplier	Number of employees supplier ^b	952	2.95	1.16	0.92	4.32

Note: See Appendix A for details on indicators (original question formulation and answer categories) and variable construction.

^aStandardized factor score.

^bNatural log.

^cFive point scale.

^dDummy, 1 = yes.

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1 Note that our claim that buyers with bad experiences tend to try to find other
 2 suppliers seems to be supported by the data. Only 3% (14 out of 479) of the buyers
 3 who had done business with their supplier before was dissatisfied with these former
 4 transactions but nevertheless continued to do business with that supplier. These
 5 cases were excluded from the analyses. Either including or excluding these cases
 6 does not make a substantial difference for the results. Finally, our data also support
 7 the assumption that past investments in management are useful in subsequent
 8 transactions to a certain extent. In 135 out of 479 transactions where the buyer had
 9 already done business with the supplier, the contract used for the focal transaction
 10 was a more or less adapted version of a contract for a previous purchase of the
 11 buyer from this supplier.

14 STATISTICAL MODEL AND RESULTS

15 We present our results using two types of regression analysis. As a direct test of
 16 our formal model, nonlinear regression is the most appropriate kind of analysis.
 17 Additionally, we present several OLS regressions, allowing for a more robust and
 18 elaborate way of testing our hypotheses.

19 Our theorem shows that optimal management can be characterized by (see the
 20 *formal model specification* section for notation):

$$21 \quad m_{\text{opt}} = (1 - g_1 I_{\text{past}}) \left(-b_0 + b_1 O + b_2 F^{r-1} \left(\frac{c(1 - wg_1)}{b_3 D} \right) \right) - g_0 I_{\text{past}}.$$

22 We estimate this model in two ways. First, we use a linear Taylor expansion for
 23 F^{r-1} , which ensures that we are left with a model that can be estimated using
 24 nonlinear least squares (see, e.g. [Greene, 1993](#), ch. 10). The 176 transactions in
 25 the data set that were second questionnaires filled out by the same respondent,
 26 but dealing with a different IT-transaction, are included in the analyses. Missings
 27 were deleted listwise. Excluding the *second cases* or using pairwise deletion has no
 28 substantial influence on the estimation results. [Table 2](#) summarizes the estimation
 29 results for the model

$$30 \quad \text{Management} = (1 - g_1 \text{Past}) \left(\beta_1 + \beta_2 \text{Volume} + \beta_3 \text{Monitoring} \right. \\
 31 \quad \left. + \frac{(\beta_4 \text{Procedures} + \beta_5 \text{Expertise})(1 + \beta_6 \text{Future})}{1 + \beta_7 \text{Switching} + \beta_8 \text{Durability} + \beta_9 \text{Profit} + \beta_{10} \text{Volume}} \right) \\
 32 \quad - g_0 \text{Past}.$$

33 Note that both the variable *past* and *volume* occur twice in the table. *Past* be-
 34 cause it must allow for an estimation of both g_0 and g_1 , and *volume* because it
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Table 2. Standardized Coefficients from the Non-Linear Least Squares Regression on *Management*.

Independent Variables	Coefficient	Hypothesis	Coefficient	t-value ^a
Opportunism Potential				
Volume	β_2	+	0.38**	6.81
Monitoring problems	β_3	+	0.12**	3.70
Damage Potential				
Replacement costs ^b	β_7	-	-0.12**	4.81
Importance of durability ^b	β_8	-	-0.04	1.73
Importance for profitability ^b	β_9	-	-0.12**	4.51
Volume ^b	β_{10}	-	0.04	1.17
Marginal Costs of Management				
Standardized procedures	β_4	+	0.05	1.84
Legal expertise	β_5	+	0.20**	2.86
Dyadic Embeddedness				
Past ^c (1 = yes)	$(-)g_0$	-	-0.17**	2.97
Past ^c (1 = yes)	$(-)g_1$	-	-0.10	1.25
Future	β_6	+	-0.02	1.35
Constant	β_1	?	-0.65**	10.37
Adjusted R^2			0.38**	

Note: $N = 895$ transactions. Dummy-variables are not standardized.

^a t-values are asymptotic approximations.

^b All indicators for the damage potential are expected to have positive effects on management (e.g. the larger the volume, the more management). Their sign is reversed because they appear in the denominator of the estimated model.

^c We assumed g_0 to be positive, which implies that we assume the coefficient of *Past* ($-g_0$) to be negative. The same holds for g_1 .

* $p < 0.05$; ** $p < 0.01$ (two-tailed tests).

was taken as an indicator for the opportunism potential and for the damage potential. Other than in standard regression, the nonlinear structure of the model allows for such a double inclusion of independent variables. The results do not support the assertion that *initial management carries over* (the g_1 -coefficient is in the hypothesized direction but not significant), but they do support that *a first transaction creates costs for set-up management* (the g_0 -coefficient is significant). Note that the effect of the volume of the transaction is significant only in the case where it represented the opportunism potential and not where it represented the damage potential. This suggests that the volume of a transaction is a better indicator for the opportunism potential than it is for the damage potential.

1 Most estimates are consistent with the hypothesized relationships between the
 2 independent variables and management. There are significant positive effects on
 3 management of replacement costs, of the importance for profitability attached to
 4 the product, of monitoring problems, and of the volume of the transaction. The
 5 existence of a positive past with the same supplier leads to a smaller investment in
 6 management. The conclusion with respect to our hypothesis on the *interaction of*
 7 *shadow of the past and future* cannot be directly derived from Table 2. However,
 8 the value of the coefficient of *past* and *future* in our estimated model mentioned
 9 above equals

$$\frac{-g_1(\beta_4 \text{Stand. Procedures} + \beta_5 \text{Legal Expertise})\beta_6}{1 + \beta_7 \text{Switching Costs} + \beta_8 \text{Importance of Durability} + \beta_9 \text{Importance of Profit} + \beta_{10} \text{Volume}}$$

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 14 Calculating the value of this expression using our estimated coefficients shows
 15 that it is negative for all the cases in the data. Hence, the coefficient of the inter-
 16 action of past and future is negative for all the cases in the data, which supports
 17 our hypotheses. In fact, this also shows that our intuitive arguments regarding the
 18 interaction of past and future involve simplifications. The formal model is not just
 19 the mathematical equivalent of our more intuitive arguments. An implication of
 20 our formal model is that the interaction effect itself turns out to be dependent on the
 21 variables mentioned in the above equation. Hence, the model renders conditions
 22 under which our arguments regarding the negative interaction of past and future
 23 are less likely to be supported, namely, precisely when the values of the vari-
 24 ables in the expression above are such that the expression itself has a value close
 25 to zero.

26 Of course, the results of the nonlinear regression should be considered with
 27 some reservation, since they rely on a strict belief in the functional form of the
 28 theoretical relationships. Therefore, we ran several OLS regressions, of which we
 29 consider a representative one below.

30 Again, the results are consistent with our hypotheses to a large extent. Note
 31 in particular the negative coefficient of the interaction of *past* and *future*. As
 32 hypothesized, the effect of the shadow of the future is larger if there was a
 33 shared (positive) past. Different ways to assess this difference lead to similar
 34 conclusions. For instance, separate (OLS) analyses for cases with and without a
 35 past show a nonsignificant effect of *future* if no past exists (0.04, $t = 1.17$) versus
 36 a significant effect of *future* if a past does exist (-0.12 , $t = -3.13$). Additionally,
 37 bootstrapping (1,000 replications) of the coefficient of the interaction effect leads
 38 to a (bias corrected) 99% confidence interval $[-0.26, -0.04]$. Excluding the
 39 interaction term of *past* and *future* reveals a significant effect of *past* (-0.09 ,
 40 $t = -3.13$) and a nonsignificant effect of *future* (-0.03 , $t = -1.19$).

Table 3. Standardized Coefficients from the Ordinary Least Squares Regression on *Management*.

Independent Variables	Hypothesis	Coefficient	t-value
Opportunism and Damage Potential			
Volume	+	0.33**	9.42
Monitoring problems	+	0.10**	3.16
Replacement costs	+	0.12**	3.58
Importance of durability	+	0.10**	3.42
Importance of profitability	+	0.13**	4.19
Marginal Costs of Management			
Standardized procedures	+	0.05	1.91
Legal expertise	+	0.06*	2.25
Dyadic Embeddedness			
Past (1 = yes)	-	-0.09**	3.12
Future	?	0.05	1.28
Past × Future	-	-0.12**	3.33
Control Variables			
Size supplier	?	0.06*	2.20
Size buyer	?	0.03	1.13
Constant	?	-0.04	0.25
Adjusted R ²		0.39**	

Note: N = 895 transactions. Dummy-variables are not standardized.

*p < 0.05; **p < 0.01 (two-tailed tests).

As stated above, our dependent variable (*management*) is a weighted average of several underlying variables. Its scale is therefore meaningless. To get an idea about the relative magnitude of the estimated effects, we compare the size of the coefficients in Tables 3 and 4. Clearly, the volume of the transaction stands out as the variable with the largest effect on *management*. However, it should be noted that the sizes of the effects of *past* and *future* are comparable to the effects of variables representing more standard transaction characteristics, like *replacement costs* or *monitoring problems*. This suggests that the dyadic embeddedness of transactions is indeed a factor to be reckoned with in the management of transactions.

STABILITY OF RESULTS

We aim to show that, under different reasonable implementations of the data, the coefficients of the independent variables are stable. In particular, we show that

Table 4. Standardized Coefficients from Different Regressions on *Management*.

Independent Variables	Hyp.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		Coeff. (<i>t</i> -value)	Coeff. (<i>t</i> -value)	Coeff. (<i>t</i> -value)	Coeff. (<i>t</i> -value)	Coeff. (<i>t</i> -value)	Coeff. (<i>t</i> -value)
Opportunism and Damage Potential							
Volume	+	0.33** (9.25)	0.34** (9.57)	0.32** (6.14)	0.34** (6.90)	0.33** (5.99)	0.26** (5.64)
Monitoring problems	+	0.09** (2.87)	0.11** (3.60)	0.12** (2.60)	0.07 (1.69)	0.17** (3.12)	0.06 (1.48)
Replacement costs	+	0.12** (3.73)	0.12** (3.62)	0.10* (2.09)	0.12* (2.54)	0.16** (2.72)	0.10* (2.48)
Importance of durability	+	0.10** (3.23)	0.10** (3.56)	0.15** (3.81)	0.04 (0.93)	0.13* (2.43)	0.09* (2.34)
Importance of profitability	+	0.13** (4.36)	0.12** (4.03)	0.12** (2.72)	0.16** (3.36)	0.06 (1.13)	0.15** (3.82)
Marginal Costs of Management							
Standardized procedures	+	0.05 (1.77)	0.06* (2.16)	0.05 (1.31)	0.06 (1.51)	0.07 (1.43)	0.05 (1.52)
Legal expertise	+	0.05 (1.89)	0.13* (2.00)	0.08* (2.06)	0.04 (1.09)	0.03 (0.62)	0.08* (2.26)
Dyadic Embeddedness							
Past (1 = yes)	-	-0.09** (3.08)	-0.19** (3.37)	-0.06 (1.35)	-0.10* (2.46)	-0.02 (0.39)	-0.12** (3.28)
Future	?	0.04 (0.99)	0.04 (1.56)	0.04 (0.66)	0.04 (0.83)	0.06 (0.81)	0.04 (0.91)
Past × Future	-	-0.12** (3.02)	-0.12** (2.93)	-0.12* (2.11)	-0.12* (2.36)	-0.08 (1.16)	-0.15** (3.15)
Control Variables							
Size supplier	?	0.07* (2.46)	0.05* (2.42)	0.08 (1.85)	0.05 (1.33)	0.03 (0.64)	0.09* (2.20)
Size buyer	?	0.03 (1.02)	0.03 (0.97)	0.04 (1.06)	0.02 (0.43)	0.00 (0.08)	0.05 (1.22)
Constant	?	-0.02 (0.15)	-0.04 (0.29)	-0.17 (0.80)	0.12 (0.58)	-0.05 (0.25)	-0.06 (0.29)
Variance of Management							
Volume	+		0.19** (4.91)				
<i>N</i>		895	895	434	461	323	572
Adjusted (variance weighted) <i>R</i> ²		0.40	0.40	0.42	0.35	0.36	0.30

Note: Dummy-variables are not standardized.

Model 1 = Regression with standard errors (Huber-)corrected for clustering on supplier (Huber, 1967). Model 2 = Regression with heterogeneous variance determined by volume. Model 3 = OLS Regression on *hardware* products only. Model 4 = OLS Regression on *software* products only. Model 5 = OLS Regression on *standard* hard- and software products only. Model 6 = OLS Regression on *complex* hard- and software products only.

p* < 0.05; *p* < 0.01 (two-tailed tests).

1 the coefficient of the interaction effect of *past* and *future* remains significant and
2 negative across different kinds of analyses. The results of analyses we considered
3 most important are reported in Table 4. To save space, we only report the relevant
4 statistics for other analyses (see Batenburg et al., 2000 for details).

7 *Alternatives: Statistical Models and Additional Control Variables*

8
9 Several extensions to our regressions are displayed in Table 4. Model 1 addresses
10 the potential problem that the regression results might be influenced by the fact
11 that several buyers had bought products from the same supplier. If this gives rise
12 to excessive “clustering” in the data, we run the risk of finding significant relations
13 where in fact there are none (Huber, 1967). The second model is based on the idea
14 that one should also consider the *variance* in investments in *ex ante* management
15 (instead of only the effects of several variables on the *average* amount of invest-
16 ment). In particular, it seems reasonable to assume that the variance in management
17 is necessarily larger for transactions with a larger volume. The third extension we
18 consider is running the analyses separately for hardware and software as well as
19 for standard and complex IT-products (models 3–6). This is one way of testing
20 whether the kind of product being assessed has an influence on the stability of our
21 results.

22 Several features of the results for these additional models are noteworthy. First
23 of all, we can conclude that under these different implementations of the analyses,
24 the results do seem rather stable. The size of the coefficients is similar and, by and
25 large, *t*-values are of a similar magnitude. Moreover, we indeed find evidence for
26 heterogeneity in the variance: transactions with a larger volume have a larger (log
27 of the) variance (0.19, $z = 4.91$), but it does not seem to affect the parameter esti-
28 mates much. In particular, it does not affect the significant effect of the interaction
29 of *past* and *future* (-0.12 , $z = -2.93$). The largest differences are found when
30 we discriminate between standard and complex IT-products (models 5 and 6 in
31 Table 4). When we consider exclusively standard IT-products (model 5), we only
32 find significant effects of the variables representing the opportunism and damage
33 potential. Indeed, the interaction effect of *past* and *future* is no longer significant
34 here and somewhat smaller in magnitude although it is in the expected direction
35 and has a confidence interval $[-0.20, 0.05]$ containing the previously found value
36 (-0.12).

37 As a further extension of the basic OLS regression analysis in Table 3, we
38 included various additional control variables, none of which revealed significant
39 effects on the amount of management. We considered possible effects of different
40 *sectors* by categorizing buyers by their (single digit) SIC-code (*F*-value 1.70,

1 $df = 7, p = 0.11$). This is close to significant. Careful inspection of the data,
2 however, shows that differences – if they are there – are mainly due to five cases in
3 the data that represent governmental firms (water and energy suppliers). Removing
4 those from the data leads to a sector effect that is more clearly not significant
5 (F -value 1.38, $df = 6, p = 0.22$). Additionally, we controlled for *characteristics of*
6 *the respondent* (some evidence for such effects was found in [Rooks et al., 2000](#)). We
7 used the number of years respondents had been working for the buyer firm ($-0.06,$
8 $t = -1.42$), the number of years of experience with IT of respondents in the buyer
9 firm ($0.004, t = 0.11$), age ($-0.04, t = -1.20$), and education (coded in seven cat-
10 egories) of respondents ($-0.02, t = -0.58$). Post-hoc, we also investigated which
11 of the independent variables in the OLS regression have an effect on the variance
12 in management. Except for the volume of the transaction (as mentioned above
13 and in [Table 4](#)), we find effects for two variables. The variance in management
14 increases with increasing importance for profit ($0.17, z = 3.13$) and there is some
15 evidence for a negative effect of the age of the respondent ($-0.01, z = -1.84$).
16 Thus, as the importance for the profit of the firm increases, respondents start
17 to differ with respect to the amount of management they apply. Similarly, older
18 respondents seem to be “more alike” in the amount of management they choose.

21 *Alternatives: Search and Selection As a Dependent Variable*

22
23 An objection against our choice of the dependent variable is that it does not include
24 search and selection efforts as part of the *ex ante* management (see [Buskens et al.,](#)
25 [2003](#) in this volume). It might occur that extensive search for a suitable supplier
26 can substitute for management of the transaction in a later stadium. For instance,
27 it could be that a buyer invests considerable effort in searching for an adequate and
28 reliable partner as well as for a product with a good enough price and is therefore
29 willing to invest less in writing an extensive contract. Since we do not consider the
30 search for a supplier in our model, this might affect our results: cases in the data
31 where we conclude that *ex ante* management is virtually absent or small could
32 actually be cases where large investments in search and selection efforts were
33 made. However, these substitution effects do not occur. Buyers who invest large
34 amounts of time and effort in search and selection, also invest large amounts of
35 time and effort in contractual *ex ante* management. And, buyers who invest small
36 amounts of time and effort in search, also invest small amounts of time and effort
37 in contractual *ex ante* management. Our data support this claim in several ways.
38 *Search investment* was measured as a factor score of the number of suppliers and
39 products considered in the search and selection process, the number of elicited
40 tenders, the number of person-days involved in searching and selecting supplier

1 and product, the relative number of divisions involved in the search and selection
2 effort, the number of other (potential) buyers that were asked for information,
3 and the number of different ways in which information was collected (through
4 exhibitions, yellow pages, etc.). First, a factor analysis of separate management
5 investments including search (search investment, number of person-days and
6 departments involved in negotiating, whether external advisors were used, whether
7 the contract was tailor made, number of clauses that were orally treated in negotia-
8 tions, number of clauses that were written down in the contract, and the number of
9 technical specifications) shows a strong single factor with positive weights for all
10 variables. Second, using search investment rather than our variable *management* as
11 the dependent variable in an OLS regression with the same independent variables
12 as in Table 3, we find a significant negative effect of the interaction of *past* and
13 *future*, and coefficients that are similar to those in Table 3 to a large extent. To
14 be precise, if we disregard the coefficient of the shadow of the future, we cannot
15 reject the hypothesis that the coefficients of the two analyses are proportional
16 ($p = 0.86$). In other words, investments in search and selection would be an
17 alternative indicator to incorporate in what we refer to as *ex ante* management.
18 Excluding it, as we do, does not affect the results in a substantial manner.

19
20

21 *Alternatives: Operationalizations of Independent Variables*

22

23 The emphasis of our contribution is on the effects of having positive past expe-
24 riences and expectations of future transactions. We mentioned that the effects of
25 having positive past experiences on management are related to the difference be-
26 tween having a past or not, and not so much to differences in the kind of past
27 one had with that same supplier. As noted earlier, “having had past transactions
28 with the same supplier” is almost identical in our data to “having had *positive*
29 past transactions with the same supplier” since there are only a few cases (3%) in
30 which the buyer was unsatisfied with these past transactions. There also appears
31 to be little variation in the volume of previous transactions. For instance, from
32 the 479 buyers who have had previous transactions with the same supplier, about
33 75% of these previous transactions are of limited or moderate volume. We ran
34 three separate OLS regressions to find out whether additional effects of the kind
35 of past with the supplier exist. For each of these regressions, we used the same
36 variables as in Table 3, but added an interaction effect of having a past or not
37 with “frequency of past transactions,” “satisfaction with past transactions,” and
38 “volume of past transactions.” None of the coefficients of the interaction effects
39 approached significance ($p = 0.83$, $p = 0.30$, $p = 0.33$). If we run three sepa-
40 rate OLS regressions on the cases with positive past transactions with the same

1 supplier only, we see a similar result. No effect of the quality of the past exists
 2 ($p = 0.85$, $p = 0.30$, $p = 0.25$). In other words, buyers who do business with
 3 suppliers they have dealt with before do invest less in management. But, whether
 4 these buyers have had frequent or less frequent transactions before, were moder-
 5 ately or highly satisfied, or have had previous transactions with moderate or high
 6 volume, does not have an impact on their transaction management. This is in line
 7 with the result from our nonlinear regression analysis that the first transaction cre-
 8 ates costs for set-up management, while there is no significant carry over effect of
 9 management.

10 A related issue is whether our measurement of the expectations of future transac-
 11 tions is an adequate one. Throughout we consider expectations of future business to
 12 represent something like “the probability that buyer and supplier will meet again,”
 13 and treat it as if it is exogenous. Surely, this is not an adequate representation of
 14 reality. Expectations of future business may also depend on whether buyer and
 15 supplier were satisfied with previous transactions and on whether some kind of
 16 dependency exists between buyer and supplier. An OLS regression indeed shows
 17 that the expectation of future transactions depends on the quality of past transac-
 18 tions ($p < 0.001$) and the dependency of the buyer on the supplier ($p < 0.001$).
 19 However, explained variance is 0.18, which suggests that our measurement of the
 20 expectations of future business is certainly not determined only by these two vari-
 21 ables. Moreover, estimating the coefficients of the OLS regression of Table 3 with
 22 both the quality of past transactions and the dependency of buyer and supplier
 23 shows once again that the interaction effect of *past* and *future* remains negative
 24 and significant ($p < 0.001$).

25 As a final robustness check, we recalculated all variables that are factor scores
 26 in our original analyses. Instead of using the factor scores, we reanalyzed our
 27 OLS regressions using simple addition of the separate indicators. So, for instance,
 28 instead of calculating monitoring problems as

$$\begin{aligned}
 \text{Monitoring Problems} = & 0.20[\text{complexity hardware}] + 0.21[\text{complexity software}] \\
 & + 0.31[\text{complexity services}] + 0.42[\text{quality}] \\
 & + 0.42[\text{tenders}] + 0.47[\text{other products}] \\
 & + 0.45[\text{price-quality}] - 0.22[\text{experience}] \\
 & - 0.08[\text{expertise}] - 0.03[\text{“make” possible}],
 \end{aligned}$$

37 we instead calculated monitoring problems using +1 for indicators with positive
 38 weights and -1 for indicators with negative weights. The resulting OLS regression
 39 on the basis of these new variables shows similar results to the one we reported in
 40 our original analyses. The status of the significance of the effects of independent

1 variables in Table 3 remains unchanged. For instance, the effect of the interaction
2 between *past* and *future* is negative in both cases ($p = 0.046$ in the analysis based
3 on the simplified factor scores).

6 CONCLUSION AND DISCUSSION

7
8 We provided a theoretical and empirical analysis of the extent to which IT-
9 transactions are managed, based on data of 971 IT-transactions between Dutch
10 SMEs and their IT-suppliers. Our analysis considered the extent to which effort
11 invested in writing and negotiating a contract can be explained by the opportunism
12 potential, the damage potential, management costs, and the dyadic embeddedness
13 associated with that transaction. We investigated when and how trust, like trust
14 based on norms of reciprocity and conditionally cooperative behavior, can be used
15 as a substitute for costly contractual governance of economic transactions. We also
16 developed hypotheses on how contractual and non-contractual governance depend
17 on the interplay of economic and social conditions affecting the problem potential
18 associated with transactions. Thus, we tried to integrate two sociological insights
19 with a rational choice approach: the idea of non-contractual complements for con-
20 tractual governance and the idea that the embeddedness of transactions affects
21 the governance of transactions. We showed how non-contractual governance and
22 reciprocity can be a result of incentive-driven behavior and how embeddedness
23 affects the incentives for relying on contractual or, respectively, non-contractual
24 governance. The data support our hypotheses to a large extent. First, management
25 increases with increasing opportunism potential and damage potential. Clearly,
26 the volume of the transaction seems to be the main determinant of the extent of
27 management of the transaction. We also found that the dyadic embeddedness of
28 a transaction has an effect on management of an order of magnitude similar to
29 the other effects of indicators of the opportunism potential and damage potential.
30 This supports the argument that the social embeddedness of transactions is indeed
31 a factor to be reckoned with in the analysis of trust between firms. Specifically,
32 both the shadow of the past and its interaction with the shadow of the future have
33 a negative effect on management. Firms who have done business with each other
34 before invest less in management and, in particular, invest less in management
35 the larger the likelihood of future interaction. The overall effect of the shadow
36 of the future on management is close to zero. For those cases where no shared
37 past exists, the incentive to invest less in contracting because of the feasibility of
38 conditional cooperation seems to be counterbalanced by the incentive to invest
39 more in contracting because of the need for set-up investments. Note that similar
40 analyses using data sets based on a different design, but containing variables like

1 the ones used here, provide considerable support for the validity of our findings
2 (see [Blumberg, 2001a](#); [Rooks et al., 2000](#)).

3 Hardly any of the cases in the data consists of business partners with a negative
4 shared past. This suggests that searching for another partner is the most likely
5 response to a problematic transaction. Apparently, firms anticipate more profit
6 by finding another partner than by writing longer and better contracts. Hence,
7 transaction management through search and selection of reliable and trustworthy
8 partners seems to be a fruitful avenue for future research (see [Blumberg, 2001b](#);
9 [Buskens et al., 2003 in this volume](#); [Gulati & Gargiulo, 1999](#)).

10 It is interesting that “economic behavior” like the behavior of buyers dealing
11 with their suppliers depends on relational aspects even if we abstract from matters
12 that should facilitate to highlight effects of “social embeddedness.” For instance,
13 it seems plausible that the *content* of contractual agreements, which may reflect
14 shared conventions or “definitions of the situation,” is affected by “social” as
15 opposed to purely economic forces. Instead we came up with hypotheses on and
16 empirical support for the effects of social embeddedness, abstracting completely
17 from content, and focusing exclusively on the *amount* of investments in contractual
18 planning. Moreover, one might suspect that the *network of relations* of buyer and
19 supplier with other business partners affects their contractual behavior (see, e.g.
20 [Burt, 1992](#); [Podolny, 1993](#) for a general perspective; [Raub & Weesie, 1990](#) for a
21 game theoretic model; [Buskens, 2002](#) for an empirical analysis based on our data;
22 and [Stuart, 2003 in this volume](#)). Again, we showed that effects of embeddedness
23 are to be expected and empirically confirmed to exist even if we abstract from
24 arguments based on network embeddedness. Finally, we could even abstract from
25 *non-economic personal ties* and focus exclusively on prior and expected future
26 *business contacts* for highlighting embeddedness effects.

27 One of the most rigorous assumptions we made in our theoretical model was that
28 we assumed that the buyer decides on the management of the transaction. As we
29 argued before, we feel this is a reasonable approximation for the Dutch IT-market
30 at this point in time. However, it is indeed only an approximation and for other mar-
31 kets it might be less appropriate. A related argument against our model is that the
32 inherent strategic nature of the situation is now somewhat hidden. We do assume ef-
33 fects of the opportunism potential of the supplier through monitoring problems (the
34 more difficult to monitor, the more likely opportunistic behavior of the supplier),
35 but this was operationalized in a parametric rather than an interdependent manner.
36 Extensions of our model will most likely relax both these assumptions. A first step
37 in this direction would be to explicitly model the behavior of buyer and supplier in
38 terms of Trust Games (cf. [Buskens, 2002](#); [Snijders, 1996](#)). For a game theoretical
39 model of investments in *ex ante* management of transactions, see [Raub and Snijders](#)
40 [\(2001\)](#). Note that although we chose to consider the investment in negotiating and

1 writing a contract, the data set also allows analyzing different stages of the gov-
2 ernance of transactions. For instance, the data permit the analysis of performance
3 characteristics and ex post management such as type and seriousness of conflicts
4 that emerge ex post and different modes of contractual and non-contractual conflict
5 regulation. In addition, although we considered the *extent* to which investments
6 were made, as opposed to [Williamson's \(1985, 1996\) choice of governance struc-](#)
7 [tures](#), it goes without saying that the data allow for both types of analyses.

8 Applying our analysis to other inter-firm relations seems straightforward. Our
9 theory and hypotheses obviously apply to buyer-supplier relations involving
10 the purchase of other types of products or components. They likewise apply to
11 strategic alliances such as R&D-alliances (e.g. [Gulati, 1995b](#); [Parkhe, 1993](#); and
12 the contributions by [Gulati & Wang, 2003](#) as well as [Stuart, 2003](#) in this volume).
13 However, we would like to close with a more speculative remark on our models.
14 Researchers have sometimes argued in favor of a unified analysis of dyadic
15 relations of different kinds (see [Becker et al., 1977](#); [Ben-Porath, 1980](#); [Raub &](#)
16 [Weesie, 2000](#) for a more systematic elaboration of this idea). Such an analysis
17 would consider inter-firm relations, households, and also employment relations
18 as empirical realizations of the same underlying principle (in this volume,
19 [Neckerman & Fernandez, 2003](#) focus on the employment relation from a similar
20 perspective). While such an integrated analysis remains a program that still has
21 to be implemented, note that the models presented here offer useful building
22 blocks for this more ambitious project. For example, our variables have relatively
23 straightforward equivalents if one would consider households. One could then
24 likewise give meaning to concepts like damage potential (e.g. how bad would it be
25 if the relationship broke up), opportunism potential (e.g. the attractiveness of the
26 spouse on the "marriage market"), the costs of management (e.g. the investments
27 in getting to know your spouse, friends of your spouse or visiting in-laws), the
28 dyadic embeddedness (e.g. the duration of the relation and the likelihood of
29 continuation of the relation), and, finally, actual investments in management of
30 the relation (e.g. actual investments in getting to know your spouse and friends of
31 your spouse, but also investments in financial and legal arrangements of household
32 partners; see [Treas, 1993](#)). Our theoretical and statistical models applied here for
33 an analysis of interorganizational relations would then become directly applicable
34 for the analysis of seemingly completely different types of dyadic relations.

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APPENDIX A PROOF OF THE THEOREM

The Base Model

18 Given that a match between a buyer and a supplier has formed, we assume the
 19 buyer determines the degree of planning for the transaction. Putting more effort in
 20 preventing problems increases the probability that the transaction runs smoothly,
 21 but the extra effort comes at a price. The buyer must balance costs and benefits
 22 of extra management of the transaction. That is, buyers are assumed to choose a
 23 level of management m that optimizes their utility U :

$$\begin{aligned} U &= p(m)R + (1 - p(m))S - C(m) \\ &= S + p(m)(R - S) - C(m), \end{aligned}$$

28 where S is the utility of the buyer if problems occur (S for Sucker), R the utility
 29 of the buyer if the transaction runs smoothly (R for Reward), p the probability
 30 that no problems occur, m the amount of management invested in the transaction,
 31 and C the costs of management. The term $R - S$ will be taken to be equivalent
 32 to the damage potential of the transaction (it represents the loss the buyer incurs
 33 if the transaction turns out to be a problematic one). For simplicity, we assume
 34 that management only affects the probability that problems will occur, and not the
 35 payoffs connected with a problematic or unproblematic transaction. We likewise
 36 assume that the optimal amount of management is consistent with the reservation
 37 utility of the supplier. That is, even though the buyer determines the optimal amount
 38 of management, he anticipates that the supplier cannot be forced to participate in
 39 a transaction that is not at least marginally profitable for the supplier. The optimal
 40 amount of management m_{opt} is a (interior) solution of $dC/dm = (R - S)dp/dm$.

1 The probability that the transaction runs smoothly is assumed to depend on
 2 opportunism potential O and the degree of management m itself. In mathematical
 3 terms, we assume

$$\begin{aligned}
 4 \quad p &= F(O, m) \\
 5 \\
 6 \quad &= F(a_0 - a_1 O + a_2 m) \quad (a_{1,2} > 0),
 \end{aligned}$$

7 with F a function that maps the real numbers to the unit-interval, for instance the
 8 standard normal cumulative distribution function (this ensures that p , which is a
 9 probability, is between 0 and 1).

10 The costs of management are assumed to be linear in the amount of management:

$$11 \quad C = c_0 + cm \quad (c_0, c > 0),$$

12 where c_0 are the fixed costs of management and c the marginal costs of an extra
 13 unit of management. The model then reduces to

$$14 \quad U = S + F(a_0 - a_1 O + a_2 m)(R - S) - c_0 - cm,$$

15 and the optimal amount of management m_{opt} can be found by solving $dU/dm = 0$
 16 for m . Through straightforward manipulation, we find that optimal transaction
 17 management in this base model is characterized by

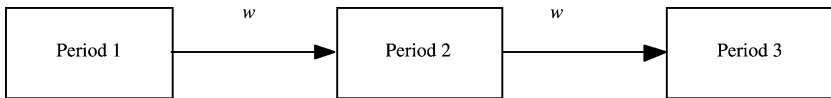
$$18 \quad m_{\text{opt}} [\text{base model}] = -\frac{a_0}{a_2} + \frac{a_1}{a_2} O + \frac{1}{a_2} F^{-1} \left(\frac{c}{a_2(R - S)} \right).$$

19
 20
 21
 22
 23
 24
 25 *Including Dyadic Embeddedness*

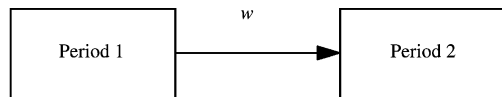
26
 27 The formal model still lacks a dynamic component: experiences from past trans-
 28 actions and potential future transactions are not yet incorporated, but are likely to
 29 affect the amount of management invested in the present transaction. To introduce
 30 the effects of dyadic embeddedness, we distinguish between buyers who have no
 31 past experience with the same supplier and those who have positive past experi-
 32 ences with the same supplier. Thus, we assume that buyers with bad experiences
 33 will try to find a more suitable supplier in the next period and neglect buyers with
 34 bad experiences *and* a positive shadow of the future.

35 A three-period model will represent a transaction between a buyer who has had
 36 a business relation with the supplier. In each of the three periods, the buyer has to
 37 decide the extent to which the transaction will be managed. After the completion of
 38 the first transaction, a second transaction will follow with (exogenous) probability
 39 w . If the second transaction actually occurs, the buyer has to decide the extent
 40 to which the second transaction will be managed. After completion of the second

1 transaction, the third transaction will happen with the same exogenous probability
 2 w . Therefore, buyers who have had (at least) one transaction with the same sup-
 3 plier can be considered to be in the second period of such a three-period model.
 4 They have a shared past, are engaged in a second transaction now, and they have
 5 a potential future of extended transactions. We assume that past investments in
 6 management are useful in subsequent transactions to a certain extent. Hence, we
 7 first assume that a fixed percentage of the investment in management in a given
 8 period will be useful in the next one. For instance, parts of written contracts are
 9 useful in future transactions to some extent. Second, we assume that management
 10 of a transaction with an unknown partner requires *set-up investments*, like getting
 11 to know the partner, knowing whom to call for which kind of information, and the
 12 like. We denote the part of the investment that *carries over* to the next period by
 13 $g_1 (0 < g_1 < 1)$ and the set-up investment by $g_0 (g_0 > 0)$. Similarly, we define a
 14 two-period model for those buyers who have *not* completed a transaction with the
 15 same supplier before. These buyers can be considered to be in the first period of a
 16 two-period model: they are engaged in a transaction now, and they have a potential
 17 future of extended transactions. Note that our model has a fixed number of periods.
 18 Hence, following the standard “backward induction” argument on repeated games
 19 with complete information (see, e.g. Rasmusen, 1994, pp. 121–123), there is no
 20 possibility for conditional cooperation. It would be an option to capture the fea-
 21 sibility of conditionally cooperative behavior by assuming that a large perceived
 22 probability (w) of future transactions reduces the probability that problems occur.
 23 **Figure 1** briefly summarizes our approach.



29 The three-*period model* : period 2 represents the transaction for dyads with a shared past.



36 The two-*period model* : period 1 represents the transaction for dyads without a shared past.

37 **Fig. 1.** Schematic Representation of Transactions with and without a Shared Past.
 38 *Note:* The w represents the exogenous probability that another transaction with the same
 39 partner will occur. Comparing transactions with and without a shared past implies
 40 comparing period 1 of the two-period model with period 2 of the three-period model.

1 As in the base model, we explicitly outline the buyer’s utility function U (indices
2 denote the period). The two-period model then reads

$$3 \quad U = p(m_1)R_1 + (1-p(m_1))S_1 - C(m_1) + w(p(m_2)R_2 + (1-p(m_2))S_2 - C(m_2))$$

$$4 \quad = S_1 + p(m_1)(R_1 - S_1) - C(m_1) + w(S_2 + p(m_2)(R_2 - S_2) - C(m_2)).$$

7 For simplicity, we assume that the costs of management in period i are linear,
8 $C(m_i) = c_0 + cm_i$, and do not change between periods. We also assume that the
9 damage potential is equal for both transactions: $S_1 = S_2$ and $R_1 = R_2$. By setting
10 the partial derivatives to zero, we can derive the optimal investment in the first pe-
11 riod of the two-period model. Of course, we can also derive the optimal investment
12 in the second period, but here we only need optimal management in the first:

$$13 \quad m_{\text{opt}}[\text{first period of two-period model}]$$

$$14 \quad = -\frac{a_0}{a_2} + \frac{a_1}{a_2}O + \frac{1}{a_2}F'^{-1} \left(\frac{c(1 - wg_1)}{a_2(R - S)} \right).$$

18 Optimal management in the two-period model resembles optimal management in
19 the base model. We find that the probability that a future transaction with the same
20 supplier takes place (w) has a positive effect on the optimal amount of management
21 (because F'^{-1} is decreasing). That is, if the buyer has had no previous transaction
22 with the supplier, having a larger shadow of the future will help increase the optimal
23 investment in management.

24 The extension to a three-period model will allow us to say something about the
25 effect of the shadow of the future for those cases in which previous transactions have
26 taken place. Remember that we want to compare the optimal management in the
27 first period of the two-period model (defined above) with the optimal management
28 in the second period of the three-period model. Straightforward manipulation of a
29 similarly defined model with three periods yields that we can express the optimal
30 management in the second period of the three-period model in terms of the optimal
31 management in the first period of the two-period model:

$$32 \quad m_{\text{opt}}[\text{second period of three-period model}]$$

$$33 \quad = (1 - g_1)m_{\text{opt}}[\text{first period of two-period model}] - g_0.$$

36 That is, buyers with a shadow of the past with the same supplier should manage
37 less (since g_0 is positive and $0 < 1 - g_1 < 1$). Intuitively, this makes perfect sense.
38 Buyers with a shared history of investments in management can use some of the
39 investment in management from a previous transaction, which implies that less
40 management is necessary in the current period.

1 Summarizing the above in a single equation, we find that optimal management
2 can be characterized by

$$3 \\ 4 \quad m_{\text{opt}} = (1 - g_1 I_{\text{past}}) \left(-\frac{a_0}{a_2} + \frac{a_1}{a_2} O + \frac{1}{a_2} F'^{-1} \left(\frac{c(1 - wg_1)}{a_2(R - S)} \right) \right) - g_0 I_{\text{past}}, \\ 5 \\ 6$$

7 where I_{past} represents an indicator function equal to 1 if a shared past exists.
8 Substituting D for $R - S$ and bs for the as completes the proof.

9
10
11 **APPENDIX B**
12 **OVERVIEW OF INDICATORS AND VARIABLE**
13 **CONSTRUCTION**
14
15

16 Variable	17 Indicator: original question 18 [variable construction label]	19 Answer categories
20 Management	21 “How much time did you and 22 your colleagues spend on writing 23 down the agreement and on the 24 negotiations with the supplier of 25 this product?” [person-days]	26 Open answer category: 27 number of person-days
	28 “Which of the following 29 departments of your firm were 30 involved in drawing up the 31 agreement?” (management, 32 IT-department, financial 33 department, production 34 department, purchasing 35 department, sales department, 36 legal department) [departments]	37 Not applicable (=0)/no 38 (=0)/yes (=1) (for every 39 department)
	40 “Did your firm make use of external legal advisors to draw up or judge the agreement?” [advisors]	No (=0)/yes (=1)
	“Was the main agreement mainly a standard contract or mainly a tailor made contract?” [tailor]	Mainly standard (=0)/mainly tailor made (=1)

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	<p>“For each of the following financial and legal clauses, can you indicate the extent to which they were treated during the negotiations?” (price determination, price level, price changes, payment terms, sanctions on late payment, delivery time, liability supplier, force majeure, warranties supplier, quality (norms), intellectual property, piracy protection, restrictions on product use, non-disclosure, insurance supplier, duration service, reservation spare-parts, duration maintenance, updating, arbitration, calculation R&D costs, joint management during transaction, technical specifications, termination) [clauses treated]</p> <p>“For each of the following financial and legal clauses, can you indicate how they were arranged?” (same clauses as in previous question) [clauses arranged]</p> <p>“For each of the following technical specifications, can you indicate how they were specified in the agreement or whether the specification was not applicable?” (security, user friendliness, definition system boundary, definition system functions, main board, internal and external</p>	<p>Little (=1)/normal (=2)/much (=3) (for every legal clause). [Clauses treated] is the main principal component of these 24 clauses (eigenvalue 6.89; explained variance 28.7%)</p> <p>Not at all arranged (=0)/only verbally (=1)/in a written document (=2)/(for every legal clause). [Clauses arranged] is a weighted score of the number of clauses that was arranged either verbally or in writing.</p> <p>Very generally (=1)/general (=2)/in some detail (=3)/detailed (=4)/very detailed (=5)/not applicable (=missing) (for every technical specification). [Technical specs] is the average of these 24 clauses (alpha = 0.95).</p>

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
	memory, speed processors, interfaces with other equipment, environment, additional hardware, installation procedure, monitor quality, type operating system, application software, procedure implementation, required memory, system analysis, system methodology, definition data design, definition programs, definition conversion, definition operation, definition benchmark, program language) [technical specs]	
	<i>Management is the main principal component of the indicators mentioned above (eigenvalue 2.35; 33.5% explained variance).</i> Management = 0.45 [person-days] + 0.24 [departments] + 0.35 [advisors] + 0.17 [tailor] + 0.52 [clauses treated] + 0.50 [clauses arranged] + 0.24 [technical specs].	
Volume	“How much was paid to the supplier, not including later supplements?”	Up to 10,000 US\$ (=0.125)/10,000–20,000 US\$ (=0.375)/20,000–50,000 US\$ (=0.75)/50,000–100,000 US\$ (=1.5)/more than 100,000 US\$ (=3.5)

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
Monitoring Problems	<p>“Which of the following products were delivered at that time?” (personal computers, workstation, network configuration, mini computer, mainframe, computer-controlled machines, side equipment, cabling) [complexity hardware]</p> <p>“Which of the following products were delivered at that time?” (standard software, adjusted software, tailor-made software) [complexity software]</p> <p>“Which of the following services were delivered at that time?” (design, training, instruction, consultation, documentation, support) [complexity services]</p> <p>“Was it difficult for you and your employees to judge the quality of the product at the time of delivery?” [quality]</p>	<p>No (=0)/yes (=1) (for every product). [Complexity hardware] is coded as: 0: none of the hardware products is delivered, 1: personal computer/workstation/side equipment/cabling, 2: network configuration, 3: mini computer, 4: mainframe, 5: computer controlled machine.</p> <p>No (=0)/yes (=1) (for every product). [Complexity software] is coded as: 0: none of the software products is delivered, 1: standard software, 2: adjusted software, 3: tailor-made software.</p> <p>No (=0)/yes (=1) (for every service). [Complexity services] is coded as: 0: none of the services is delivered, 1: documentation/support, 2: instruction/consultation, 3: training, 4: design.</p> <p>Very easy (=1)/easy (=2)/somewhat difficult (=3)/difficult (=4)/very difficult (=5)</p>

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
	“Was it difficult for your firm to compare tenders?” [tenders]	Very easy (=1)/easy (=2)/somewhat difficult (=3)/difficult (=4)/very difficult (=5)
	“Was it difficult for your firm to compare the product with other products?” [other products]	Very easy (=1)/easy (=2)/somewhat difficult (=3)/difficult (=4)/very difficult (=5)
	“Was it difficult for your firm to compare the price-quality relation of potential suppliers?” [price-quality]	Very easy (=1)/easy (=2)/somewhat difficult (=3)/difficult (=4)/very difficult (=5)
	“Compared to other firms in your sector of industry, how much experience did your firm have with automation?” [experience]	None (=1)/little (=2)/some (=3)/much (=4)/very much (=5)
	“Does your firm have employees with expertise on automation, or an automation department?” [expertise]	No (=0)/yes (=1) (‘yes’ means having either or both)
	“Does your firm have the possibility to make or adapt this product?” [“make” possible]	No (=0)/yes (=1)
	<p><i>Monitoring Problems is the main principal component of the indicators mentioned above (eigenvalue 3.01; 30.1% explained variance). Monitoring Problems = 0.20 [complexity hardware] + 0.21 [complexity software] + 0.31 [complexity services] + 0.42 [quality tenders] + 0.47 [other products] + 0.45 [price-quality] – 0.22 [experience] – 0.08 [expertise] – 0.03 [“make” possible].</i></p>	

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
Replacement Costs	“What would have been the damage, in terms of money and time spent on purchasing a new product, if the product had failed to function and had had to be replaced?” [new product]	Very small (=1)/small (=2)/moderate (=3)/large (=4)/very large (=5)
	“What would have been the damage, in terms of money and time spent on training personnel, if the product had failed to function and had had to be replaced?” [training]	Very small (=1)/small (=2)/moderate (=3)/large (=4)/very large (=5)
	“What would have been the damage, in terms of money and time spent on data entry, if the product had failed to function and had had to be replaced?” [data entry]	Very small (=1)/small (=2)/moderate (=3)/large (=4)/very large (=5)
	“What would have been the damage, in terms of money and time wasted by idle production, if the product had failed to function and had had to be replaced?” [idle production]	Very small (=1)/small (=2)/moderate (=3)/large (=4)/very large (=5)
<i>Replacement Costs is the main principal component of the indicators mentioned above (eigenvalue 2.33; 58.2% explained variance)</i>		
Replacement Costs = 0.52 [new product] + 0.53 [training] + 0.50 [data entry] + 0.45 [idle production].		

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
Importance of Durability	<p>“How important was a long-term suitability of this product?” [suitability]</p> <p>“How important was a long-term support by the supplier?” [support]</p> <p>“How important was a long-term compatibility of this product with other hardware and software?” [compatibility]</p> <p><i>Importance of Durability is the main principal component of the indicators mentioned above (eigenvalue 1.69; 56.5% explained variance).</i></p> <p>Importance of Durability = 0.61 [suitability] + 0.62 [support] + 0.49 [compatibility].</p>	<p>Unimportant (=1)/hardly important (=2)/moderately important (=3)/very important (=4)/of major importance (=5)</p> <p>Unimportant (=1)/hardly important (=2)/moderately important (=3)/very important (=4)/of major importance (=5)</p> <p>Unimportant (=1)/hardly important (=2)/moderately important (=3)/very important (=4)/of major importance (=5)</p>
Importance for Profitability	<p>“How important was this product for the profitability of your firm?” [profitability]</p> <p>“How important was this product for the automation of your firm?” [automation]</p>	<p>Unimportant (=1)/hardly important (=2)/moderately important (=3)/very important (=4)/of major importance (=5)</p> <p>Unimportant (=1)/hardly important (=2)/moderately important (=3)/very important (=4)/of major importance (=5)</p>

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
	<p>“How important was it that the product delivery time was met?” [delivery time]</p> <p><i>Importance of Profitability is the main principal component of the indicators mentioned above (eigenvalue 1.58; 52.6% explained variance). Importance of Profitability = 0.58 [profitability] + 0.60 [automation] + 0.55 [delivery time].</i></p>	<p>Unimportant (=1)/hardly important (=2)/moderately important (=3)/very important (=4)/of major importance (=5)</p>
Standardized Procedures	<p>“Every firm has its standardized procedures. Regarding the negotiations and agreements with this supplier concerning the product as a whole: To what extent could these be considered to be standard procedures?”</p>	<p>Hardly (=1)/to some extent (=2)/to a moderate extent (=3)/largely (=4)/completely (=5)</p>
Legal Expertise	<p>“Firms need legal expertise. Does your firm have (a) employees with specific legal expertise, (b) a separate legal division?”</p>	<p>No (=0)/yes (=1, if any)</p>
Past	<p>“Has your firm had any kind of business relation with this supplier before the purchase of this product?”</p>	<p>No (=0)/yes (=1)</p>
Future	<p>“To what extent did you expect, before the purchase of this product, that your firm would continue business with this supplier?”</p>	<p>No business (=1)/incidental business of limited size (=2)/some business of limited size (=3)/regular and/or extensive business</p>

APPENDIX B. (Continued)

Variable	Indicator: original question [variable construction label]	Answer categories
Size buyer	“How many full-time employees were working at your firm at the time of the purchase of this product?”	(=4)/very regular and/or very extensive business (=5) Open answer category: number of full-time employees
Size supplier	“How many full-time employees were working at the supplier at the time of the purchase of this product?”	Number of full-time employees (<5 (=1)/5–9 (=2)/10–19 (=3)/20–49 (=4)/>49 (=5))

APPENDIX C
BIVARIATE CORRELATIONS FOR VARIABLES IN THE ANALYSES

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Management	1	–	–	–	–	–	–	–	–	–	–
(2) Volume	0.54	1	–	–	–	–	–	–	–	–	–
(3) Monitoring Problems	0.34	0.36	1	–	–	–	–	–	–	–	–
(4) Replacement Costs	0.41	0.42	0.41	1	–	–	–	–	–	–	–
(5) Importance of Durability	0.30	0.26	0.24	0.35	1	–	–	–	–	–	–
(6) Importance for Profitability	0.39	0.45	0.20	0.42	0.33	1	–	–	–	–	–
(7) Standardized Procedures	–0.08	–0.16	–0.17	–0.08	–0.02	–0.10	1	–	–	–	–
(8) Legal Expertise	0.10	0.08	–0.07	–0.00	–0.00	0.05	0.04	1	–	–	–
(9) Past	–0.16	–0.07	–0.23	–0.12	–0.07	–0.02	0.16	0.06	1	–	–
(10) Future	–0.03	0.00	–0.04	0.02	0.11	0.08	0.10	0.06	0.36	1	–
(11) Size Buyer	0.17	0.33	–0.06	0.05	0.07	0.12	–0.02	0.20	0.03	0.01	1
(12) Size Supplier	0.26	0.39	0.12	0.21	0.12	0.20	0.02	0.07	0.08	0.08	0.26