15 Long-term contracts and relational contracts

Nick van der Beek*

For a long time the study of long-term contracts enjoyed relatively little attention in the law and economics agenda. This is now changing. These contracts are used in a variety of situations, notably franchise, supply chains and the sharing of intellectual property. This chapter discusses the main economic literature on long-term contracts. Section 1 discusses the properties of long-term transactions and presents an analysis of the comparative advantages of long-term contracts from the perspective of the new institutional economics. As many long-term contracts are incomplete, a discussion of the fundamentals of the incomplete contract literature is the subject of section 2. Then a further methodological shift is made by going into the complete contracting literature on the soft budget constraint in section 3, followed by a discussion of repeated hidden actions in section 4. Section 5 builds on the relational characteristics of long-term contracts through a discussion of the relational contracting literature. Finally, some avenues for further research are discussed in section 6. As usual, a bibliography is included.

1. The Long-term Relationship

An analysis of a contractual arrangement, or a group of contractual arrangements, must start with the question of why contracts exist. Contracts do not create welfare on their own, but instead facilitate the creation of welfare by supporting efficient transactions, especially if the transaction contains an element of non-simultaneous exchange (Cooter and Ulen, 2007; Shavell, 2004; and De Geest, 1994, pp. 98 ff). According to the economics of governance, which is part of the new institutional economics, it is the transaction which should be the basic unit of analysis (Williamson, 1985, 1991, 2002; and 2005). The economics of governance, and transaction cost economics in general, studies how various alternative governance mechanisms (that is, different contractual arrangements) facilitate the allocation or choice problem (Williamson, 1988, p. 66; 2002). As such, it supplements

* The author thanks Antoon Spithoven for his comments on an earlier version of this chapter. The chapter has benefited from the remarks of two anonymous referees; their cooperation is much appreciated.
neoclassical economics (Williamson, 2002, p. 438). The transaction cost theory, following John R. Commons, takes the transaction as the unit of research and makes use of two important behavioral assumptions that differ from those of neoclassical economics (Williamson, 1985, pp. 44 ff). The first is opportunism, meaning that economic agents seek to maximize their own utility without regard to the consequences their action or choice have for other parties' well-being. The second is bounded rationality, meaning that people are 'willingly rational, but only limitedly so'.

Transaction costs economics defines three dimensions of a transaction: frequency, asset specificity and uncertainty (Williamson, 1985). Frequency simply refers to the number of times that the transaction takes place. A one-time transaction is significantly different from one that is repeated over and over again. For example, information problems are compounded in a repeated or continuing interaction, as we will see in sections 3 and 4.

Asset specificity is the degree to which the resource required for the transaction creates more value for the current transaction compared with the value it would create when employed in the second-best transaction. Think, for example, of an experimental laser with a unique wavelength, developed for a particular specialist treating patients with a rare disease. Because the device cannot be used to treat any other condition, if the current transaction is unsuccessful, the producer cannot make any money from the device. For a classic discussion of the influence of asset specificity, see Joskow (1988). When, as in the example, the asset has no alternative use, it is said to constitute a sunk investment: once the investment is made, it cannot influence the continuation decision, creating the risk that the investing party is not able to recoup the added benefits of his investment. This is known as a holdup situation, following Klein et al. (1978). The economic consequence of a holdup situation is inefficient levels of investment. Section 2 contains a more elaborate discussion.

The third dimension of the transaction, uncertainty, introduces the constant need for adaptation resulting in a requirement for flexibility. Usually, actions and investments need to be adjusted to the requirements of the parties and the external environment. If those variables are not fixed, the parties deal with risk and uncertainty (Knight, 1921). If potential events can be described, or at least have utilities assigned to them, and agents are able to assign some (subjective) probability to their occurrence, then the agents are dealing with risk. The difference with uncertainty is that for those events, agents do not have a probability measure. Risk can be analyzed using Von Neumann and Morgenstern utility functions (Von Neumann and Morgenstern, 1944) and Savage's model of subjective expectations (Savage, 1954), but uncertain events cannot. For an illustration of the difference between risk and uncertainty, think of a clinical trial for a new and
revolutionary type of drug. The producer faces a risk in that either the treatment is effective or not. The outcomes are fixed and known, although the subjective probabilities assigned to these outcomes might differ between the CEO, the head of the research group, and those participating in the trial. Side effects, on the other hand, constitute uncertainty. It is very possible that the drug causes a biochemical reaction no one has ever observed before, and therefore is unanticipated. Neither Williamson nor Coase makes a distinction between risk and uncertainty. In terms of flexibility, it does matter whether one faces risk or uncertainty: risk can be anticipated and planned for, uncertainty by definition allows exclusively for ex-post solutions. Therefore, flexibility matters with uncertainty. Risk and uncertainty require the alignment of actions and investments; parties coordinate among themselves and respond to the external environment. At the core of the problem created by risk and uncertainty lies the conflict between personal interests, mutual interests and the need to adapt to external factors.

What characterizes the transaction that takes place in a long-term relationship? These transactions are not instantaneous; they take time to complete. In a dynamic environment, this implies change and thus uncertainty. Additionally, long-term transactions take time because not all the necessary conditions for trade are fulfilled at the outset, for example, because special equipment has to be produced or special training is required. Often these preparations involve specific assets. In broad terms, the long-term transaction distinguishes itself in the combination of uncertainty and specific investments (Ménard, 2004).

Now that we have characterized the long-term transaction, it is time to investigate how it relates to long-term contracts. The key linking long-term transactions to long-term contracts is governance: in order to realize the potential gains of trade or corporation, order must be brought out of chaos. Otherwise, the opportunistic nature of the parties will make cooperation impossible. With the help of contracts, parties create a private order, thereby mitigating the hazards resulting from opportunism and bounded rationality (Williamson, 2002, p. 439). Long-term contracts, or hybrids as they are known in the new institutional economics lexicon (Ménard, 2004), are a governance mechanism. The analysis of governance mechanisms is an important topic in the new institutional economics. This literature builds on the work of Coase and Williamson, focusing on the triangle consisting of transaction costs, contracts and property rights (Ménard, 2008, p. 282). In his seminal

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1 There is a distinction between the definition used in neoclassical economics and in the property rights literature (Allen, 2000). See also for a discussion on the definition of transaction costs (De Geest, 1994, p. 41 ff). The property
article of 1937, Ronald Coase made the crucial and path-breaking observation that both markets and firms serve the common purpose of organizing transactions. The firm was more than just the neoclassical unit of production; it was a way of organizing transactions outside the market. This idea focuses on the question of why a plethora of mechanisms govern transactions, rather than one single efficient mechanism. The answer lies in the observation that all governance mechanisms have their costs of organizing transactions, where no single mechanism dominates the others over the whole range of transactions. For example, for some transactions the costs are lowest if they are organized by the market, and for other transactions the costs are lowest when organized within a firm (Coase, 1937). Although it took quite some time before this insight by Coase was operationalized, since then much work has been done on comparative institutional research, most notably in what is now known as transaction cost economics and its derivative, the economics of governance (Williamson, 1988, p. 65; 1998, p. 75). Comparative institutional analysis (for example, Williamson, 1985, 1991) has applied Coase’s insight to the microeconomic level. Williamson coined the following term for governance structure of the firm: hierarchy.

For the purpose of this chapter, we shall limit ourselves to a discussion of the following three mechanisms: the Market, Hybrids and Hierarchies. Although transaction cost economics also investigates other mechanisms, among them regulation, these three are – according to the literature – the most relevant. The market is a narrower concept than that of neoclassical economics. It is a way of organizing transactions where all parties remain independent and coordinate through the price system. Hierarchies are best characterized by their reliance on command as a coordination device rights definition has a broader scope, looking at the costs of establishing and maintaining property (or ownership) rights, that is, ‘the right to use an asset, the right to appropriate returns from that asset and the right to change the form and/or substance of that asset’ (Williamson, 1985, p. 27) with reference to Furubotn and Pejovich (1974, p. 4). These transaction costs make long-term cooperation necessary in the situation where one cannot purchase a certain asset in very small quantities, for example, a part of a piece of real estate. Therefore, partnership among three medical doctors, mutually purchasing a piece of real estate, is an efficient answer to capital market imperfections. The neoclassical definition of transaction costs, on the other hand, focuses on the costs associated with the transfer of property rights, for example, the costs of finding a suitable trading partner. In those situations, the problem is not one of property rights, that is, the good can be purchased on the market in a sufficiently small or large quantity, but instead the problem is that effectively transferring ownership rights from one party to another is costly. In addition to the search costs mentioned above, one might think of the cost of drafting and enforcing a legal contract.
Long-term contracts and relational contracts

Given the insight that no governance mechanism dominates the others, we are forced to ask what are the strengths and weaknesses of the various mechanisms and how this translates to the dimensions of the transaction. For this purpose, the discrete alignment hypothesis has been put forward. It claims that each governance form must be tailored to fit the characteristics of the transaction (Williamson, 1991). Transactions can be distinguished according to their characteristics in terms of incentive intensity, administrative control, autonomous adaptation, coordinated adaptation, and contract law regime. Governance mechanisms differ with regard to their effect on these characteristics. Efficient governance requires that a transaction is governed by that mechanism that fits its characteristics best. If we use these dimensions to rank the aforementioned governance mechanisms, the list shown in Table 15.1 emerges (Williamson, 1991; Ménard, 2004).

The incentive intensity refers to the degree to which pay is sensitive to increased effort. In markets, the harder you work, the larger your reward. Likewise, administrative control shows to what degree pay is related to following orders. If you structurally neglect the orders of your superior, your career is quickly over. The low incentive intensity and high administrative control of hierarchies implies that working hard in violation of direct orders will not make you a wealthy person. These elements constitute the instruments of the governance mechanism. Governance mechanisms also influence the way agents respond to changes. This is important as ‘adaptation is the central economic problem’ (Williamson, 1991). Two modes of adaptation are distinguished: *autonomous adaptation*, where people respond to changes without consultation or discussion (for example, responding to a higher price by increasing output), and *coordinated adaptation*, where some form of communication between agents precedes the realignment of actions (for example, a series of consultations

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and the necessary authority one party exercises over others. Hybrids are a mix of market and hierarchy; parties remain autonomous entities and are bound by the sharing of pooled resources.

Table 15.1  The relative performance of governance structures
within a factory preceding a series of orders). The effect of both methods of adaptation differs: autonomous adaptation assures that the actions of the agents are aligned with the external environment, whereas coordinated adaptation ensures that the actions of the agents involved are aligned. Finally, the institutional environment, that is, the public order, of the governance mechanisms differs. Whereas markets are governed by hard and fast rules typical of classic contract law, hybrids are related to neoclassical contract law, with a higher degree of flexibility through the use of open norms. Finally, hierarchies tolerate only a very limited amount of interference from the courts – to put it bluntly, the firm is its own court of ultimate appeal.

The term hybrid is used to indicate ‘autonomous entities doing business while mutually adjusting without the help from the market and sharing technology, capital, products and services without any form of unified ownership’ (Ménard, 2004). Think for example of clusters, networks, symbiotic arrangements, supply chain systems, franchise arrangements, or partnerships, to name just a few organizations which qualify as hybrids. As parties remain autonomous, long-term contracts are an essential part of these governance mechanisms. Although for a long time the stability of hybrids was questioned, they are now accepted as a separate governance mechanism (Williamson, 1985; Ménard, 2004, 2008). Key elements are that (a) the parties remain autonomous, that is, they retain most decision rights, (b) they coordinate via some mechanism other than the price system and (c) some assets are shared or pooled, that is, these assets do not belong to a single entity but remain the property of the participant. This latter property also links the hybrid arrangement with the long-term transaction: pooling only makes sense with some continuity (Ménard, 2004, p. 352). This definition emphasizes the hybrid as an intermediate governance form separating markets and hierarchies: like the market, and unlike hierarchies, the parties involved in the transaction remain separate legal entities. However, unlike the market, and very much like hierarchies, the price mechanism is not the central method of coordinating actions; there is always some form of mutual decision-making, introducing a degree of authority. The combination of pooled resources, autonomy and specialized coordination systems causes hybrids to promote investment in relation-specific assets when risk or uncertainty is consequential. The degree to which risk and uncertainty are consequential depends on the influence of adjustment on the total value of the transaction. If the value of the transaction, holding actions fixed, does not respond to a change in the environment, risk and uncertainty are non-consequential. On the other hand, if getting things right is a matter of complete success or utter failure, the uncertainty and risk are highly consequential.
When combining resources, the assets might be complements or substitutes. Early work in the field of transaction cost economics and the property rights literature focused on complementary assets; for example, production lines and distribution networks. Although it was initially assumed that hybrids were also built around complementary assets, later research showed that hybrids often concern assets which are substitutes; for example, combining each other’s resources in order to achieve the minimum efficient scale (Ménard, 2008, p. 295). The type of specific assets in hybrids extends beyond the classic physical assets such as real estate, inventory and machinery. Loasby (1994) emphasizes that in hybrids human assets play a major role. This may be because of the human capital intensity of the product, for example, legal services by a network of law firms, or because of the specialized nature of the human capital required, for example, specific training for a unique machine. See Ménard (2008, p. 356) for more examples and references.

Uncertainty and risk also have their effect on the long-term contract: rather than containing a perfect and complex plan, such as predicted by many of the neoclassical-based contract theoretical models, they contain huge gaps and rely on additional formal governing bodies. A striking property of the long-term contracts used in hybrids is their relative simplicity and lack of detail. They are a framework, containing clauses that, for example, specify the selection of partners and related quality criteria, stipulate the duration of cooperation, contain adaptation clauses such as index clauses and delegation of authority, and stipulate some form of dispute resolution and similar safeguards. More detailed rules are created during the relationship using ex-post mechanisms such as formal governing bodies (Ménard, 2008, p. 299). Through this set-up, hybrids are able to cope with the problems of sharing assets in an uncertain environment while retaining the autonomy of the parties. Eger (1995) discusses some options that contracting parties may choose between for the optimal mix of autonomy and bonding, or rigidity and flexibility as this trade-off is better known. The reader is reminded that the optimal degree of flexibility and rigidity depends to a large degree on the extent that the matter under investigation concerns some pooled resource and consequential risk or uncertainty. Those aspects of cooperation in which no pooling exists can be expected to rely relatively more on hard and fast rules than on ex-post mechanisms. Similarly, issues of risk require less flexibility than uncertain

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2 Arguably the delegation of authority can also be seen as a formal governing body. See the discussion of the incomplete contract literature for the notion of transferable control.
events, as the latter is hard to plan for since the parties, by definition, have no information on the potential states of nature.

The sharing of rents, for example, is a classic source of potential conflict: at some point, the rents of the transaction need to be shared, and the sharing of rents is a classic non-cooperative game. At the same time, the rules on the sharing of rents must not interfere with the adaptation. A major issue with long-term contracts therefore is securing cooperation without foregoing the benefits of decentralization.

Because of the incomplete nature of the long-term contract, hybrids rely heavily on relational aspects. Where the market transaction is to a large degree anonymous, identity matters in long-term contracts (Goldberg, 1980; Buton, 2002; Williamson, 1985). As we will see in the discussion below, both problems of dynamic commitment and relational contracting as a complement to formal contract clauses benefit from efficient screening ex ante. When the participants in a long-term transaction taking place in a hybrid invest substitutable assets, it is natural to expect that there is less informational asymmetry between them than in transactions requiring complementary investments.

The autonomy of the parties also introduces an element of competition, strengthening the incentives that face the parties. This competition is comprised of two dimensions. First, there is competition within the relationship, where the contracting parties (especially, for example, in franchise contracts) might be direct competitors in a certain market. Second, there is competition among hybrids, potentially luring away existing partners or introducing new ones. While the first element of competition helps ensure that the participants retain productive efficiency at the interim stage, the second type of competition helps to mitigate some dynamic commitment problems at the ex-post stage by introducing new projects.

The formalism of the governing bodies varies with the degree to which the uncertainty is consequential. If the uncertainty is of relatively low importance, parties rely on trust (relational contracting). At the other end of the scale, where correctly adapting to uncertainty is of major importance, governing bodies that have a large degree of autonomy and authority are created. Parties are able to coordinate actions through the formal governing bodies, allowing for coordinated adaptation, but at the same time, the parties can keep a sufficient stake in the transaction to foster efficient incentives and autonomous adaptation.

The new institutional economics literature discussed above provides us with an elegant framework to analyze hybrids and long-term contracts. The rest of this chapter contains discussions of separate strands of literature that help to explain some of the observed properties of hybrids. The incomplete contract literature shows us that ex-post mechanisms, designed
at the ex-ante stage, can indeed overcome limitations in contracting technology, even though it limits itself to the study of risk and tells us nothing about uncertainty. Likewise, the repeated adverse selection literature explains why hybrids can cope with the soft-budget constraint syndrome using screening and ex-post competition. The literature on repeated moral hazard also emphasizes the need for ex-post competition, while the literature on relational contracting offers another example of ex-post mechanisms that benefit from the ex-ante screening possible in hybrids.

2. The Incomplete Contracting Approach
Long-term contracts are incomplete, often both literally and economically. Literal incompleteness refers to the situation where the contract does not deal with all possible situations, either because there is no clause dealing with the current problem (linguistic under-determination) or because some contractual clauses conflict in the particular circumstance (literal over-determination) (Hermalin et al., 2007). Both situations are part of the general class of ‘unforeseen contingencies’, meaning that the contract does not foresee a way of dealing with the current circumstances, regardless of the fact that the parties have or could have foreseen the situations themselves. One explanation for this kind of incompleteness is transaction costs (Dye, 1985). With regard to linguistic over-determination, it has been suggested that this serves as a mechanism that postpones the decision regarding which rule applies to the time when it is necessary, if it is necessary. Because of the linguistic over-determination, the parties, by using the interpretative process, are more or less free to choose among the n possible rules, but at the same time are bound to that and that set only, which implies that ‘agreeing now to argue later’ is an ex-post mechanism (Hart and Moore, 2004). Although linguistic interpretation is problematic in daily practice, it does not warrant a need for regulation nor can it be a starting point for analysis if it does not have some effect on social welfare (Kaplow and Shavell, 2002). In short, linguistic incompleteness must have economic consequences, that is, there must be an incomplete contract in economic terms.

The complete-contracting literature relies on the lessons from the Nash implementation literature (Maskin, 1999 (original 1977); Moore and Repullo, 1988; Maskin and Moore, 1999). Given rational actors, complete contracts, no collusion and costless communication it is, according to Maskin (1999), in principle possible to incentivize parties that observe the same piece of information to truthfully reveal it to a third party, for example, a court. The incomplete contract literature deviates from the complete contracting assumption in an attempt to create a theory that explains the prevalence of highly incomplete contracts in practice. As noted above, long-term contracts in particular are incomplete as they serve
as a framework, distributing decision-making authority in addition to the classical hard and fast rules.

The incomplete contract literature to a large degree is based on methodology developed by Grossman, Hart and Moore in their influential literature on property rights (Grossman and Hart, 1986; Hart and Moore, 1990). It has been used to analyze the above-mentioned holdup problem. For a more detailed discussion, consider a buyer and a seller who wish to trade a ‘widget’. This widget must be produced, and in order to produce the widget the buyer must make an investment $i$. The level of investment determines the cost of producing the widget in a stochastic manner. The cost is either low, $c_L$, or high $c_H$, with the probability of the costs being low $\Pr(c_L)$ equaling the level of investment. At the same time, the buyer must make an investment $j$ in order to use the widget. This investment determines his valuation of the widget. That is, valuation is either $v_H$ or $v_L$, and $\Pr(v_H) = j$. The important thing to note is that the investment costs, $\varphi(i)$ for the seller and $\psi(j)$ for the buyer, are sunk. Once the money is spent, there is no way to recover it. For simplicity, assume that trading is ex-post efficient if and only if the high valuation and low cost events occur.

The utility functions of the buyer and the seller are:

$$U_B = qv - P - \psi(j)$$
$$U_S = P - qc - \varphi(i)$$

Expected social welfare, being the sum of both functions for all possible situations, is:

$$W = ij(v_H - c_L) - \psi(j) - \varphi(i)$$

This equation states that social welfare consists of the value created when trade takes place (the difference between a high valuation and low costs), corrected for their expected occurrence ($i \times j$), minus the costs of investment ($\psi \times \varphi$). This equation is concave in $i$ and $j$, and has one optimum, which we can derive from its first-order conditions.

$$\frac{dW}{dj} = i(v_H - c_L) - \psi'(j) = 0 \rightarrow i(v_H - c_L) = \psi'(j^*)$$

$$\frac{dW}{di} = j(v_H - c_L) - \varphi'(i) = 0 \rightarrow j(v_H - c_L) = \varphi'(i^*)$$

If we assume that the parties cannot write a contract based on the valuation, cost or their investment, but instead establish the price ex post
according to a certain sharing of the spoils with a share $\alpha$ going to the buyer and $1 - \alpha$ going to the seller, where $0 < \alpha < 1$, then the seller and buyer have the following expected utility functions:

$$EU_B = ij\alpha(v_H - c_L) - \psi(j)$$
$$EU_S = ij(1 - \alpha)(v_H - c_L) - \varphi(i)$$

With regard to their choice of investment levels, both agents choose the level of $j$ relative to $i$ that maximizes their expected utility:

$$j^* = \arg\max_j EU_B \rightarrow i\alpha(v_H - c_L) - \psi'(j) = 0 \rightarrow i\alpha(v_H - c_L) = \psi'(j)$$
$$i^* = \arg\max_i EU_S \rightarrow j(1 - \alpha)(v_H - c_L) - \varphi'(i) \rightarrow j(1 - \alpha)(v_H - c_L) = \varphi'(i)$$

From these equations, it becomes clear that there will be too little investment compared with what is socially optimal. The problem is that each party will try to get a piece of the other’s investment. The consequence is that the investing party never recoups the full benefit of his investment, diminishing his incentive to invest.

Note that we have some pooling of resources ($i$ and $j$) among two otherwise autonomous entities, so that the lesson carries over to long-term contracts: if transactions like these are organized via a market mechanism, underinvestment will occur. Following this insight, economists have tried to answer the question of under which conditions the underinvestment problem can be overcome with long-term contracts. One approach of especial interest for the study of long-term contracts is the renegotiation design approach.

Renegotiation Design and Option Contracts
In essence, renegotiations are an ex-post mechanism, as the terms of trade are determined ex-post. Rather than being dependent on a third party, such as in the case of spot markets or index clauses, here the position and bargaining power of the contracting entities fully determine the outcome. Renegotiation design builds on the observation of Hart and Moore (1988). In that article, the effect of a given ex-post bargaining game is analyzed. Aghion et al. (1994) extend the analysis by allowing the parties to design the renegotiations. This is done by allowing parties to choose not only a default price and quantity, but also a division of bargaining power through the application of contract terms that make one of them
more impatient than the other (for example, time-based penalty clauses). Additionally, they mould the renegotiation process in a Rubinstein-Stahl revolving-offer model of bargaining with outside options (Binmore et al., 1986). The revolving-offer model of bargaining describes the following bargaining game, based on Muthoo (1999). Two players, $A$ and $B$, need to divide an amount of wealth $\delta > 0$. In each round, one player has the right to make an offer describing the share each player would get under agreement $(x_A, x_B)^3$ and the other player has the right to accept or decline. If the player chooses to decline, the roles are reversed and he gets the right to make the offer, and the other player gets the right to accept or decline. Declining is not without its consequences; with each extra round, the value of agreement decreases. More specifically, the utility function of player $m$ is described by $U_m = x_m e^{-m \Delta}$ that is, his share $x_m$ of the total wealth adjusted for the depreciation rate $r_m$ (the rate at which postponement makes the agreement less attractive for player $m$) multiplied by amount of time spent $t \Delta$. The depreciation factor can be redefined as $e^{-r_m \Delta} = \delta_m$.

A depreciation factor of 1 would imply that the player does not care about waiting – rather, he is very patient; a factor of 0, on the other hand, would imply extreme impatience – the deal only creates value today. These extremes are excluded in the model.

Theoretically, the game could go on forever without the players reaching any agreement. Also, each player has an incentive to make an offer which is most interesting for himself. So, would each player make an ‘all mine’ offer, which the other would decline and replace with a ‘no, all mine’ counter-offer, until one has to budge? Note that this would be wasteful, as the value of the deal decreases with each round, a fact that would not concern a player directly, as long as his or her share is large enough. The answer turns out to be no. There exists a unique subgame perfect equilibrium (Selten, 1965) for this game, with agreement being reached in the first round. Assume, for the sake of argument, that the players are symmetrical, that is, they have similar depreciation factors. Each player understands that, in order to convince the other player to accept the offer, he must at least offer a share $x_0$ equal to what the other expects to get when making an offer. Working backwards, we note that after $n$ rounds, the value of the deal has been completely lost due to depreciation. After that, each player is indifferent between each division of value, as $U_m = 0$ for all $(x_A, x_B)$. Therefore, the player making an offer just before the value is completely

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3 Naturally, $0 < x_A + x_B \leq \delta$, $0 < x_m \leq \delta$.
4 $r_m > 0$, $t \geq 0$, $\Delta > 0$, $m = A, B$.
5 $0 < \delta_m < 1$. 
Long-term contracts and relational contracts

lost (say $A$) offers $B$ nothing and keeps the last bit of value for himself. $B$ though, realizes that he can preclude $A$’s capture of the last bit of value by using his right to make an offer in the round before, with $A$ getting the value he would get from the penultimate round and keeping the rest of the value for himself. This reasoning goes on until round 1. In that round, player $A$ makes the equilibrium offer with $A$ acquiring the value lost by waiting and the rest of the value being shared according to their relative depreciation factors. Effectively, each player acquires what the other would lose by waiting. The model has some nice properties in that (a) agreement is reached in the first round, (b) as a consequence, efficiency is retained since no depreciation occurs, and (c) the division of bargaining power depends on the relative depreciation factor of the players. The outside option model extends the standard-revolving offer model by allowing a third option for the player who receives an offer. In addition to accepting or declining, he can also opt for an outside option, in which case the players receive a pay-off $w_m$, with $w_A + w_B < \delta$. The outcome of the game can potentially change, because the outside option might be more attractive to one player than the equilibrium offer under the standard model. If this is the case, the other player will offer a bigger share, equal to the outside option. It serves as a sort of threshold for the equilibrium offer.

Aghion et al. (1994) apply these insights through the introduction of option contracts. This creates outside options, and penalty clauses are used as instruments to make parties more impatient, that is, to set the bargaining powers. Since their inquiry was made from a purely economic standpoint, they do not address what such a contract should look like and to what extent it is legally feasible. Take the game discussed above and now allow the parties to write a contract in stage one which allocates the ex-post bargaining powers $\dot{\alpha}$ and an option contract $r$, specifying a quantity and price, which both parties can call. The trick is to allocate the bargaining power to the buyer and at the same time make the outside option the best choice for the seller, regardless of the state of the world. Note that decreasing the bargaining power of the seller implies lowering his equilibrium share and thereby making the outside option more attractive. The result is similar to the previous long-term contract and renegotiation model: since the seller expects to get its outside option regardless of the actual state of the world, he has an incentive to minimize costs and therefore choose $\bar{j}$. The buyer, being the residual claimant and expecting the seller to invest efficiently, also chooses the efficient investment level $\bar{j}$. This model is relevant for the study of long-term contracts in that it discusses the use of an ex-post mechanism designed at the ex-ante stage, but furthermore, this is possible without having to rely on unrealistic contract clauses. Note, though, that the model does rest on the assumption that
parties will not renegotiate after the default option is chosen and deals with risk, not uncertainty.

Noldeke and Schmidt (1995) study the influence of specific performance and option contracts on the underinvestment result. They show that option contracts can create both the required allocation of bargaining power and the efficient default price. The bargaining power in the ex-post trade is allocated by giving the right to decide whether the good is delivered or not to the seller. Ex post it is the buyer who must convince the seller to take the efficient action, which is done by offering the seller a sum. Noldeke and Schmidt define a contract that creates the choice between a default price $P_0$, which is paid if no trade occurs, and an option price $P_1$, which the buyer must pay if the trade goes ahead. Define $P_1 = P_0 + K$, where $K$ is the extra price to be paid in case of a trade. Specifically, $K$ determines the way the game is played.

If $K < c_L$, the seller will never use the option to sell the good, even if that is efficient. If $\hat{e} = (v_H, c_L)$, trade is efficient and the seller will offer the buyer a renegotiated price $P_B = P_0 + c_L$, which the seller accepts, as it leaves him indifferent between no trade, which earns him $P_0$, and trade against the renegotiated conditions, which earns him $P_B - c_L = P_0$.

If $c_L < K < c_H$, the seller will always wish to trade if $\hat{e} = (v_L, c_L)$. The buyer, on the other hand, would prefer not to trade if $v = v_L$. In that case, the buyer offers the seller a renegotiated price for no trade $P_B = P_1 - c$. The seller again is indifferent between the options of producing the good or accepting the new price, as in both cases he earns $P_1$. Ex-post trade is once again efficient.

Finally, if $K > c_H$, the seller always prefers to produce the good. Analogous to the first situation, the buyer now offers the seller not to produce in exchange for a price $P_B = P_1 - c$, where $c$ is either $c_L$ or $c_H$ when $\hat{e} = (v_H, c_L)$, resulting in ex-post efficiency.

With ex-post efficiency being guaranteed, what happens to the incentives to invest? First, note that the investment level is a function of $K$. If $K < c_L$, the seller always receives $P_0$ and therefore has no incentive whatsoever to invest and chooses an investment level of 0. If $K > c_H$, the seller prefers the low-cost state to the high-cost state, as he gains $c_H - c_L$ in a low-cost state. So, for a large enough $K$, his investment level will become 1. This relationship of $i$ and $K$ is continuous, implying there exists a level $K$ which induces an efficient investment level for the seller. Second, because the buyer is the residual claimant, given the efficient investment level of the seller, he too has an incentive to choose the socially optimal investment levels.

The preceding shows that option contracts are indeed able to allocate bargaining power and set prices so that efficient trade and investment are feasible.
Aghion et al. (2002) and (2004) apply a partial contracting methodology where contracting on authority is allowed. Here too the problems of incomplete contracts can be reduced, although here on the basis of the transfer of decision-making authority. As observed in the new institutional economics literature, transfer of authority (the creation of formal governing bodies) helps to alleviate the problems created by imperfect contracting technology in an environment of asymmetric information.

Although the incomplete contract literature has come in for serious criticism regarding its foundations (Tirole, 1999), there are some general lessons for the study and design of long-term contracts: institutions matter. The use of ex-post mechanisms, such as renegotiation design and contractible control, helps to alleviate the underinvestment problem typical of pooling arrangements among autonomous entities.

What is interesting with these models is that they all apply some ex-post mechanism in order to solve the problems created by the limitations in contracting technology. As we have seen in the discussion of the new institutional economics literature on hybrids, long-term contracts are usually accompanied by the presence of various formal governing bodies or rely on some third-party signal such as index prices. Thus, part of the incomplete contract literature explains the observed use of ex-post mechanisms. The notion of transferable control perhaps comes closest to the reality of contracting, with mechanisms more focused on who is allowed to decide about what rather than directly creating the applicable rule. As such, transferable control and renegotiation design share characteristics with relational contracts, which are discussed below.

3. Dynamic Commitment
The complete contracting literature has analyzed the influence of repeated interactions on information problems such as hidden action and hidden information. From this literature, two strands are of interest for the study of long-term contract: dynamic commitment and repeated moral hazard. The problem of dynamic commitment, or the lack of it, is illustrated by the Coase conjecture: a monopolist selling a durable good over multiple periods in a market with hidden valuation is in effect in competition with itself. A related problem of lack of dynamic commitment relevant for the study of long-term contract is the soft budget constraint syndrome (Kornai et al., 2003), a discovery of economists studying firms in socialist economies that faced shortages. The softness of the budget constraint refers to the likelihood that another party bails out the failing firm. In the context of socialist economies, that third party is the government, but in different contexts, private entities, for example, trading partners, banks, and other suppliers of capital, act as a supporting organization. There are various
motives for supporting organizations to bail out a budget-constrained firm: paternalism, political motives, fear of damage to the reputation of the supporting organization, large negative consequences (for example, when the constrained firm is too big to fail), and corruption. However, the motive most applied in economic research is the lack of credible enforcement: ex post, that is, after the budget constraint entity has failed, it is in the best interests of the supporting organization to bail out the failed firm. Such bailouts are not necessarily one-time events and are by no means an unexpected event, rather the contrary. The problem is not the bailout itself, but rather the effect an expected intervention has on the behavior of the budget constraint entity. The softness of the budget constraint diminishes the incentives to produce efficiently or adapt, with a loss of welfare as a result. A similar problem of dynamic commitment is the ratchet effect, in essence the mirror image of the soft budget constraint problem. Instead of being too soft with the agent, here the principal cannot commit not to be too hard (Berliner, 1952). The classic example is the behavior of managers of Soviet firms foregoing a bonus if production exceeded targets. They anticipated that, if they achieved such a target, the government would respond by raising the targets for the next year. By foregoing a bonus in the initial year, the managers avoided facing increasingly difficult targets in the future.

A major contribution to the theoretical study of the soft budget constraint syndrome in the contract theory literature is Dewatripont and Maskin (1995), where the problem is modeled as a dynamic commitment problem. An investor faces a risky investment decision. He must choose among a number of projects, each of which is either good or bad. All projects require an initial investment of $I$, but bad projects require an additional investment and have a lower return than good projects. The investor does not know the type of an individual project at the outset. A manager, who knows the type of the project, runs the project. If a project is successful, the investor receives a pay-off of $R$ and the manager receives a non-monetary pay-off of $B$, after which the game ends. If a project fails, the project is either liquidated, resulting in a pay-off for the investor and manager of $L$ and $s$ respectively, or rescued, which costs the investor an additional investment resulting in a pay-off of $r$ for the investor and $b$ for the manager. Let $\alpha$ denote the proportion of good projects and set $I < r < R, 2I > r, B > b > 0 > s$ and $L < r - I$. The dynamic commitment problem presents itself here through the sequential optimality of refinancing: although from an ex-ante perspective, the investor would be unwilling to finance bad projects as $2I > r$. But after the initial investment is sunk, he cannot do better than to refinance, as liquidation gives $L$, which is strictly less than the expected pay-off from refinance, $r - I$. Managers of bad
projects, anticipating the refinancing, offer bad projects as they expect a positive pay-off. If the investor could commit not to refinance failed projects, he would be better off as managers of bad projects would refrain from offering them, since that would give them a negative pay-off of $s$. As a consequence, the investor would always choose a good project, raising his expected pay-off from $\alpha(R - I) + (1 - \alpha)(2I - r)$ to $R - I$. Responses to the soft-budget constraint include trying to relax the information asymmetry through screening (Berglöf and Roland, 1998), avoiding repeated interactions (Dewatripont and Maskin, 1995) and allowing the entry of new projects (Berglöf and Roland, 1998).

Given the properties of long-term transactions as described by the new institutional economics, the soft budget constraint can pose a significant problem. The pooling of assets, especially those that are substitutable, creates the potential for dynamic commitment problems: if one party at some point delivers assets of lower quality, it may well be optimal for the other party to increase its own share rather than accepting a sub-optimal outcome. Yet the contract theory literature suggests that hybrids are remarkably well suited to dealing with the hazard of soft budget constraints. First, as most hybrids are created around a pooling of substitutable assets, the initial informational asymmetry is to some extent mitigated. The emphasis on selecting the right partners, caught by the phrase 'identity matters', in effect describes a screening mechanism. Screening becomes more effective as the entity potentially rescuing a failing partner has more expertise. This has been brought forward to explain why the soft budget constraint syndrome occurred less within the aircraft industries of the USSR compared with its computer industries. There was a lot of knowledge on the design of good military aircraft, whereas the computer industry was in its infancy. In addition to this screening at the door, hybrids are also characterized by a significant degree of competition, both within hybrids and among hybrids. In effect, this introduces new projects, thereby creating a credible threat not to refinance or bail out. If the expected value of new projects is sufficiently large, they become an attractive alternative to bailing out failing partners. So, in short, hybrids can be expected to suffer less from soft budget constraints than hierarchies. Without these safeguards, the transaction costs would be higher for these kinds of long-term transactions as hierarchies would suffer from soft budget constraints, while attempts to avoid repeated interactions, in effect opting for the market mechanism, would diminish incentives to invest in pooled assets.

Although hybrids retain a degree of competition, this is undeniably lower compared with competition in the market. This is helpful in an environment where some good projects take more time to complete, but ad interim cannot be distinguished from bad projects, a situation studied
in von Thadden (1995). Take the example above and introduce a second potential project for the good type. Whereas the first took one period and resulted in an investor pay-off of $R$, the new project takes two periods and requires an interim refinance of $I$, but it results in a pay-off of $\Pi > 2R > 2I$ for the investor and $\beta > 2B$ for the manager. If a good long-term project is terminated, it results in a pay-off of $L$ and $s$ for the investor and manager respectively. The problem here is that the impossibility of distinguishing between projects at the intermediate stage results in a coordination problem among managers of good projects. They are only willing to select the long-term project if they expect the investor to refinance. A hard budget could result in too few good long-term projects being selected. Hybrids can mitigate this problem as they, to a degree, control the level of competition and thus the hardness of the budget constraint. By limiting the competition, they create a credible commitment to refinance second-period projects. Additionally, because of the intensive ex-ante screening, investing in long-term projects would be efficient for hybrids even when the ratio of good projects is low.

Even though both the classic holdup problem and the soft budget constraint syndrome include sunk investments, they differ in that the soft budget constraint is the result of dynamic consistency problems, whereas the classic holdup problem is one of incomplete contracting. If we were to allow complete contracts in the Williamson model, the holdup problem would be solved as the contracting parties want and they would hold each other to their earlier promises. In the case of soft budget constraints, complete contracts do not change the outcome as the supporting organization wants to refinance, rather than being forced to refinance.

4. Repeated Hidden Actions
Hidden actions are now a classic part of microeconomics. From the static framework, consisting of one (potentially multidimensional) action and one (potentially multidimensional) output, it is known that hidden actions pose a problem because of the combination of informational asymmetry and either a risk-averse agent or a wealth-constrained agent (Laffont and Martimort, 2002). A natural extension of the static framework is the introduction of multiple actions, consumption and output. The literature on repeated moral hazard has done just that (Chiappori et al., 1994). A straightforward method for introducing dynamics is a repeated version of a static game; a principal and a risk-averse agent play a series of consecutive games of moral hazard, with each action-output pair being independent of the preceding one and the wealth of the agent varying depending on the outcome of the games. The question then is whether a renegotiation-proof contract exists. A (long-term) contract is renegotiation proof if the
continuation of the contract ad interim is a Nash equilibrium; sticking
to the contract must always be optimal, otherwise the parties would tear
up the contract and write a new one. The efficacy of a long-term contract
depends on whether the principal is able to observe and control the savings
of the agent. If the agent’s risk attitude changes with his endowments, the
principal has an incentive to keep the agent as risk-averse as possible, that
is, to keep him poor. That way, the incentive contract retains the biggest
‘bang’ for the buck.

Unfortunately for hybrids and therefore for long-term contracts, due
to the retained autonomy of the participating parties, information about
financial status is likely to be private. In such a situation, renegotiation-
proof long-term contracts are feasible only under very rare conditions
(Fudenberg et al., 1990). The ‘contract as a framework’ approach, where
parties write one general contract at the start of the relationship and write
more simple contracts for specific transactions, gives rise to repeated
interactions which enable the parties to cope with the problems created by
repeated moral hazard. The value of repeated interaction in situations of
hidden actions comes from two sources. First, if the number of outputs rel-
ative to the number of actions is sufficiently large, the principal has more
signals at his disposal. These signals are the foundation for the rewards and
punishment of the agent. Better information allows for a more accurate
assessment of the agent’s actions. This improves the agent’s incentives not
only because he is more likely to be rewarded for his effort and punished
for shirking, but also because it additionally decreases the risk that the
(risk-averse) agent is facing, thereby lowering the risk premium the princi-
pal pays the agent (see, for example, Hart and Moore, 1988). Second, the
repeated interactions give the agent the opportunity to self-insure, thereby
further decreasing the costs of risk (Fudenberg et al., 1990).

5. Relational Contracting

Hybrids are based on incomplete contracts. As we have seen above, this
incompleteness creates the need for additional mechanisms. One such
mechanism is the relational contract. Like the repeated-hidden-action
models, relational contracting is based on the notion of an ongoing rela-
tionship. Rather than building credible threats by making the promises
legally enforceable, relational contracts are based on actions and expecta-
tions regarding the continuation of the relationship. This is best illustrated
by the prisoner’s dilemma (see Table 15.2).

Two players, A and B, face the static game depicted in Table 5.2. The
problem from an economic point of view is that, although (Up, Left) max-
imizes social welfare, each party has an incentive to defect because what
is socially optimal is not privately optimal. If A chooses Up, B is better
off opting for R as this gives him 18 rather than 10. Likewise, A prefers (Down, Left) to (Up, Left). Even if we were to assume that only B would have an incentive to choose something other than the social optimum, (Right, Up) is also no equilibrium because A can do better by moving down, since $1 < 4$. As each player anticipates the defection of the other, the only attainable outcome (Nash equilibrium) is (Down, Right). Twelve units of welfare are lost in the static game.

Now let us analyze an infinite repetition of this game, with each player having a low discount value (that is, both value future pay-offs, although not necessarily as much as current pay-offs). If both players adopt a simple trigger strategy, choosing to cooperate if the other has cooperated in the previous round and defect otherwise, repetitions solve the prisoner’s dilemma for a certain number of rounds. To see this, note that in each round a player chooses between receiving a short-term gain of cheating now or the long-term gain of cooperation. If a player cheats, he gets 18 in this round rather than 10, but can expect to receive no more than 4 thereafter. On the other hand, if a player cooperates, he can expect to receive 10 forever. The discounted value of a sum of money received for an infinite number of rounds is $S/r$, where S is the amount of money received and r the discount value. So infinite cooperation is possible if $18 + 4/r < (1 + 1/r)10$, with each player playing the equilibrium strategies described above.

Relational contracts serve as a complement to legal contracts. When legal contracts are unable to regulate all future contingencies efficiently, that is, when they are incomplete, relational contracts can fill in some of the gaps. For example, relational contracts are based on optimal responses to observed events, rather than verifiable events. Additionally, relational contracts can adapt quickly to changes in the environment, as their efficacy is not based on past promises but on current actions and expectations about the future. However, unlike the options contracts analyzed in the incomplete contract literature, parties cannot structure the relational contract. It is fully determined by variables that are usually exogenous, such as the difference in pay-off from cooperation and defection and the discount value.

The study of relational contracts has been extended by allowing for shocks in the exogenous variables and by introducing hidden actions and
hidden information. The latter problems are discussed in Levin (2003). There it is shown that relational moral hazard contracts are similar to complete contracting moral hazard contracts when the agent is risk-neutral and has limited liability. The self-enforcement constraint introduces limits on the maximum reward and punishment, which are such that they determine the implemented rewards and punishments. In the same paper, it is shown that the efficiency as the top property of complete contracts no longer holds. Additionally, bunching is optimal when the number of types exceeds two. Therefore, although relationships are stressed in the literature on hybrids, the relational contract literature suggests that parties are wise to choose different solutions when it comes to hidden actions and information.

6. Further Research
Although considerable progress has been made in the field of long-term contracts, an important limitation is the methodology used in the study of behavior under uncertainty. Much of the literature discussed above uses the framework developed by Savage (1954). This allows for subjective probabilities, that is, although it is objectively fully determined whether a flip of the coin results in heads or tails, we do not know the actual outcome beforehand and hold subjective expectations instead. However, the agent is required to know at least all potential outcomes, that is, the state space is objective. This is problematic as it takes away the potential of surprise: it does not allow for uncertainty, but only for risk, in the definition of Knight (1921). It is very unrealistic to assume that a researcher already knows all future theories of physics, including those whose inventor has not yet been born. Therefore, although these models hold some valuable lessons for the design of long-term contracts, they do not tell us the whole story. The objective state space assumption also overstates the efficacy of planning as it rules out surprises. The study of ex-post mechanisms, which play such an important part in long-term contracts, would greatly benefit from the introduction of a subjective state space.

Another avenue of research, which can be expected to develop sooner, is the relationship between hybrids and growth. The relationship between institutions and growth has received considerable attention in the past and is far from new in the economics literature. There is, however, a debate in the growth literature that indirectly relates to hybrids. That debate is on the relationship between human capital and economic growth. As noted above, human capital plays a crucial role in hybrids. This then raises the question whether hybrids, if supported by efficient institutions, support smart growth because of their effect on human capital. Other authors have stressed the importance of entrepreneurship for growth in a capitalistic society (Baumol et al., 2007). They view entrepreneurs as small firms
engaged in innovation. The transactions in which such entities are engaged can be expected to have characteristics that make hybrids the optimal governance form. If indeed entrepreneurs are a driving force behind long-term growth, and if their transactions require autonomy, involve specific assets, and take place under uncertainty, then efficient institutions supporting hybrids should foster growth. These questions are open for research.

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Long-term contracts and relational contracts

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306  Contract law and economics


Long-term contracts and relational contracts


312 Contract law and economics


Long-term contracts and relational contracts


