Abstract

Empirical studies have demonstrated the existence and importance of business relationships. In particular, it has been suggested that investments in such relationships are significant assets of the parties engaged in the relationship. This article analyses in some detail the valuation of such assets in terms of the behavioural pattern of the parties and some other characteristics of the assets. The analysis is based on an interpretation of the relationships as Prisoner's Dilemma games.

Key word

business relationship, cooperation, investment, depreciation, game, asset, valuation, Prisoner's Dilemma.

Business Relationships

A number of studies of business markets have shown that suppliers and customers in such markets often develop lasting relationships with each other (Hallen 1986; Carlton 1986; Gadde and Mattsson 1987). It has also been suggested that such business relationships have strong managerial and strategic
implications (Arndt 1979; Hägg and Johanson 1982; Håkansson 1982; Turnbull and Valla 1986; Webster Jr 1979; Levitt 1982). The empirical studies of business relationships also give evidence that they are associated with significant resource commitments. Thus, the finns involved frequently and at non-negligible costs adapt products, processes and systems to each other in order to bring about a match between their needs and capabilities, thereby raising the joint efficiency (Hallen, Johanson and Seyed-Mohamed 1991). The relationships also involve considerable information exchange in which managers from the two firms with different expertise and at different organizational levels spend considerable time and efforts (Turnbull and Valla 1986).

Although several of these studies indicate that the character of business relationships is structure and history dependent, it has been argued that relationships are to a considerable extent a consequence of relationship strategies of the involved finns (Cunningham and Homse 1982). Some Observers have also argued that at present firms in many industries are abandoning earlier anns-length market relations by actively establishing and developing more exclusive customer-supplier relationships (Gadde and Håkansson 1990). An often quoted example is the automotive industry in which the car manufacturers have reduced the number of suppliers considerably (Raia 1988; Helper 1989; Burt 1989). The reasons for this concentration can generally be expressed as economic gains possible through closer cooperation between the finns, for example through just-in-time delivery systems or joint product development (Hervey 1982).

Given the resource commitments and the observed long-tenn nature of the relationships it has been logical to view them as assets and to consider the investments by which such assets are formed (Williamson 1979; Johanson and Mattsson 1985, 1987). Thus it has been argued that the interaction taking place between suppliers and customers should be regarded as elements in investment processes (Johanson and Wootz 1986). The purpose of this article is to analyse some aspects of the valuation of the immaterial assets of business relationships. The analysis proceeds in two stages. In the first stage we
analyse the prerequisites for cooperative behaviour from a game theoretical viewpoint. In the second stage we analyse the valuation of such assets under the assumption that a cooperative behaviour will be established.

A business relationship is a result of the action of two finns. As long as they go on doing business with each other the relationship continues, but when one of them defects the relationship is hurt or even disrupted. Because of possible gains from cooperation both firms have a collective interest in continuing the relationship. Both may have incentives, however, to deviate from the terms of the relationship. It can be expected that competing suppliers will, from time to time, offer the buyer terms that are more favourable with regard to price or delivery time, and vice versa. As a result the customer could choose the competing supplier or could demand more favourable conditions from his focal supplier. In the absence of possibilities to force the counterpart the supplier cannot take it for granted that the customer will act in a manner which is consistent with the common interest. The same holds for the customer who cannot be certain that the supplier will act in such a manner. Thus, both of the parties will have to base his behaviour on assumptions about the behaviour and response pattern of his counterpart.

The mixed-motive character of relationships outlined above can be both understood and analysed in some depth by using the game of the Prisoner's Dilemma as a conceptual tool (Axelrod 1984). Thus our discussion of the prerequisites for cooperative behaviour will be based on a model of a business relationship scenario in terms of a Prisoner's Dilemma game.

A Business Relationship Scenario Interpreted as a Prisoner’s Dilemma Game

In our scenario, which can be seen as an illustration of the basic underlying motive structure of a business relationship, there is one focal supplier and one focal customer as well as competing suppliers and customers. The focal finns have made relationship-specific investments, e.g. investments in
customized products and joint logistic systems. Because of these investments it is generally more profitable for the two finns to trade with each other than to trade with other firms.

Between the two focal parties there is a general agreement according to which periodic exchanges take place on a regular basis, unless one of the parties informs the other that on the next occasion he will not sell (or purchase) some of the products ordinarily traded. We assume that if the customer defects, he will buy only a part of his usual purchases from the supplier, and that a defecting supplier likewise will sell to the focal customer only a part of what he otherwise would have sold. Such an assumption corresponds fairly well to empirical observations that finns seldom switch in one step from one supplier to another but starts with testing a new supplier before switching. Although it is collectively more profitable for the parties to trade fully with each other than to trade with others, each of them can obtain temporary advantages by purchasing from or selling to other finns.

We assume that if the customer defects by switching some of his purchases to a competing supplier, his gain from defection will be smaller than his loss will be if his counterpart defects and the same holds for the supplier if he switches some of his sales. This relation between the gain from defection and the loss from the defection of the other party can be seen as the consequence of the costly search process associated with finding an alternative counterpart at short notice.

We also assume that if both parties defect, they cause each other such planning problems that their gains from switching are smaller than their losses from the counterpart's switching. This is based on the assumption that it is not likely that the supplier and the customer simultaneously obtain advantageous competitive offers referring to the same products.

Given the above structure of the scenario, it is possible to analyse the relationship in terms of an iterated Prisoner's Dilemma game. In a single Prisoner's Dilemma game each player
has a choice between two alternatives. In our scenario the relevant alternatives are defined as the choice between refusing or accepting an offer from a competing customer or supplier, i.e. as the choice between cooperation with the focal partner or defection.

In the Prisoner's Dilemma game the players make their choices independently of each other in every single game. The players do, however, have knowledge of everything that has happened in every previous game. According to the model the players accordingly communicate with each other only through their actions and reactions.

Figure 1 shows a numerical example of the outcomes for the two firms in a single game of the four possible combinations of their choices. In the example it is assumed that the outcome for mutual cooperation is \( R=10 \) for both players. If one of the players defects and the other cooperates, the outcome for the defector is \( T=14 \) while the cooperator gets \( S=2 \). If both players defect they both get \( P=6 \).

The size order of the payoffs \( T>R>P>S \), and the condition that \((T+S)/2 < R\) for both of the players is according to the Prisoner's Dilemma requirement. It is not necessary, however, that the payoffs of the players are symmetrical as in the example or even comparable.
Figure 1. The supplier-customer relationship interpreted as a Prisoner's Dilemma game

The rational course of action in a single game is to defect. Whatever the customer does, the supplier is better off if he defects and vice versa. Since they both defect, they both get $P=6$ rather than $R=10$ which they would have obtained if they had both cooperated. Hence the dilemma.

Strategic Options in a Game of Indefinite Duration

Let us now assume that the supplier and the customer believe that the scenario of the previous section will be repeated for a number of future periods. For simplicity we assume that the anticipated payoffs associated with the four outcomes of the game are the same in every period. The scenario can then be
regarded as an iterated Prisoner’s Dilemma game, i.e. a game where every successive move is a choice between cooperation and defection. What are the strategic options of the players in such a game?

We define a strategy as ”a specification of what to do in any situation which may arise” (Axelrod 1984, p.14). The "situation" is determined by the past history of the game, i.e. by the previous succession of moves made by each of the players. In formulating a strategy a player has to consider not only the direct effect of each move but also the responses of the other player in his subsequent moves.

Assuming that each of the players assumes that the other player will act rationally, they have no incentive to cooperate if the game is played a finite number of times. That obviously holds for the last move of the game, as there can be no response to that move. But as both players can anticipate that the other player will defect in his last move, there is no reason to cooperate in the second last move either, and by extension the same holds for every move of the game (Rapaport and Chammah 1965).

But suppose the game is of indefinite duration. This does not mean that the game will last for ever, but that the players do not know the duration of the game. Neither of the parties can know in advance for how many periods he will be confronted with the kind of scenario described above. Exogenous changes in the environment might eliminate even the possibility of cooperation.

Let us define a combined ”discount parameter” w such that

\[ w = d \times p \]

\[ d = \frac{1}{1 + i} \]

where i is the rate of interest used in capital budgeting and d the corresponding discount parameter expressing the lower preference for future outcomes as compared to present ones. The other parameter, p, is reflecting the probability that the business relationship will continue for the next period at least, i.e. the probability that the game will go on for at least one more time (p is assumed to remain constant for the
entire length of the game unless otherwise indicated). The higher the value of $w$ the higher is the *expected present value* of future payoffs.

What are the **strategic** options of the players, if the game has an indefinite duration? That depends on the shadow which the future **casts** upon the present. As that shadow depends upon the size of the combined discount parameter $w$, two related propositions can be formulated (cf. Axelrod 1984, Chs. 1 and 3).

**Proposition 1:** If the combined discount parameter, $w$, is sufficiently low, the best strategy for a player is to **defect** in every move of the game.

**Proposition 2:** If the discount parameter, $w$, is sufficiently **high** there is no best strategy independently of the strategy used by the other player.

Let us first see why proposition 1 must hold. In a single game a player gets a higher payoff from defection than from cooperation regardless of the alternative chosen by the other player. The **difference** is equal to $(T - R)$ or to $(P - S)$, depending on the alternative chosen by the other player.

Let us assume that a player **defects** on his first move. Because of the response of the other player to this initial defection, the total value of his payoffs for all subsequent iterations of the game might be considerably less than if he had cooperated on his first move. But the payoffs of the subsequent iterations of the game are more heavily discounted than the payoff of the first game. So if the discount parameter is very low, no possible amount of future punishment can outweigh the advantage of- defecting on the first move. By the same kind of reasoning it follows that a player should defect on every following move, if the discount parameter is low enough.

This proposition is probably highly relevant to the question of business relationship stability, especially with regard to the component of the discount parameter representing the
probability of an interaction - a meeting between the partners - at each period of time. We suggest the generalization that the stability of a business relationship hinges upon the expectation of future meetings between the partners. If, for example, the supplier believes that the customer will not be in business for much longer, he will find it in his interest to seek out other customers even if the relationship is still profitable.

The first proposition is related to the second according to which there is no best strategy, independently of the strategy used by the other player, if the discount parameter is large enough. Two examples are sufficient to demonstrate the validity of the second proposition.

Let us call the players A and B. Suppose B has a strategy of always defecting (independently of what A does). Then there is no better strategy for A than to defect always as well. Suppose, however, that B instead has a strategy of permanent retaliation, that is B cooperates as long as A cooperates, but if there is a single defection by A, then B defects in every subsequent move. Given that strategy by B, and provided that the discount parameter is large enough, there is no better strategy for A than to cooperate in every move of the game. So there is no best strategy for A, independently of the strategy used by B.

If there is no best strategy, is it possible to say anything about strategic choice in an iterated Prisoner's Dilemma game when the discount parameter is large? It is still possible, however, to delimit a set of strategies which are superior to all others in the sense that they are both optimal in a collective sense and nonexploitable. A strategy has these characteristics if two criteria are met:

Criterion 1: The strategy has such characteristics that the outcome of the game is "pareto-optimal", if both players are using the strategy.
Criterion 2: The strategy is in "equilibrium with itself" (Axelrod refers to this property as "collective stability").

A "pareto-optimal" outcome is an outcome which is such that none of the players, by using another strategy, could get a higher value without lowering the total value obtained by the other player. If we assume that the payoffs of the two players are symmetrical (as in the numerical example) the criterion amounts to a maximization of the collective value of the game.

Any strategy, and only strategies, that are not the first to defect meet criterion 1. If both players use such a strategy, none of them will ever defect, and the collective value of the game is accordingly maximized.

But suppose a player uses a strategy of unconditional cooperation. That is, he cooperates regardless of the number of previous defections by the other player. Such a strategy clearly meets criterion 1, but it is also obvious that it is very easy to exploit. The purpose of the second criterion is to eliminate the possibility of exploitation. According to criterion 2 a strategy should be in "equilibrium with itself". By that is meant that if player A uses strategy X, player B can do no better than to use the same strategy himself, that is he cannot exploit player A by using another strategy.

For a strategy to meet criterion 2 it must defect whenever the total score of the other player threatens to be too large (The precise requirements are given in Axelrod, 1984, appendix B and the proof is given in Axelrod, 1981). For a strategy meeting criterion 1 criterion 2 implies that it must be provoked by the very first defection of the other player. For if it were not provoked by a defection on a particular move, the other player would certainly benefit by defecting only on that move.

There are still an innumerable number of strategies meeting both of these criteria. One such strategy, which is also very simple, is "tit for tat", that is to cooperate on the first move of the game and then do exactly the same as the other
player did on the previous move. Cooperation as well as defection are simply reciprocated.

The strength of that strategy has been demonstrated empirically in two computer tournaments based on the iterated Prisoner's Dilemma game. Each participant contributed a strategy of his own choosing. Every strategy met every other strategy as well as its twin. In spite of being the simplest strategy "tit for tat" got the highest total score in both of these tournaments (Axelrod 1984, Ch. 3).

It can be discussed to what extent these findings are applicable to real life business relationships. Evidently, the assumptions in the scenario are rather specific and cannot be considered generally valid as they are specified. But the underlying motive structure seems to correspond fairly well to real life relationships where the combined payoff from cooperation often is larger than the combined payoff when one or both of the parties defect, although the party who defects alone might get a very high payoff.

The assumption of the Prisoner's Dilemma game that the parties have to make their choices independently of each other seems to be different from real life situations where, in contrast, the choices are often made in interaction between the two. This assumption, which is usually part of Prisoner's Dilemma experiments, is, however, not critical with regard to the validity of the conclusions, since any party can defect until the exchange has been realized.

Cooperation can, according to the analysis, only be expected in games of indefinite duration. This is a critical assumption which seems to be fullfilled in many customer-supplier situations. Evidently there are exceptions, such as one-off purchases of equipment. Another exception might be when the customer's need, as often is the case in the automotive industry, is limited to the lifetime of a model. Even in such a situation it seems, however, reasonable to assume indefinite duration since the exact lifetime of the model is not known until it is replaced. Furthermore, in such a case the parties
also build a platform for cooperation regarding following models. In general our discussion is built on the simplifying assumption that the payoff structure is the same in all games in a business relationship scenario. The interaction approach to business relationships and empirical evidence suggest, however, that it is reasonable to assume some kind of history dependence as a consequence of mutual learning (Håkansson 1982). This would result in gradually increasing payoffs from cooperation.

Another assumption of the Prisoner's Dilemma game, although often implicit, is that it is isolated from other surrounding games. In our scenario the environment of the relationship is an unspecified set of suppliers and customers making competitive offers. Hill (1990) has, in an analysis of the transaction-cost approach, argued convincingly that the context of the relationship should be taken into account. In particular, he discusses a reputation effect through which an actor's behaviour in one game is generalized by other actors to other games. Thus, an actor who defects in one relationship will be considered as a defector by potential counterparts. This argument implies that even single games, such as a purchase of equipment will be similar to an iterated game. According to Hill's argument cooperative suppliers (or customers) are more likely to be selected by counterparts. Cooperative relationships are correspondingly more likely to be selected by the market, since they have a higher combined payoff.

Another kind of context dependence is suggested by the network approach to markets, according to which markets are networks of connected exchange relationships (Håkansson 1989, Laage-Hellman 1989, Forsgren and Johanson 1991). This view implies that relationship games are connected in the sense that payoffs in one game are dependent on behaviour in connected games. The consequences of connecting Prisoner's Dilemma games seems to be an interesting field of research. A starting point could be the experimental research about exchange networks (Cook and Emerson 1984, Markovsky, Willer and Pattton 1988, Willer and Andersson 1981).
Investments in Business Relationships

Consider two focal partners trading intermittently with each other and expecting a periodic income of 6 per period, i.e. an income equal to the non-cooperative solution of the Prisoner's Dilemma game illustrated in the preceding section. The parties have come to the conclusion, however, that they might both obtain a higher periodic income by making investments in a joint logistic system, which will facilitate the exchange, and trade the product exclusively with each other. Assume that both of them, if they cooperate, will obtain an income (before depreciation of the asset created by the project) of 10 per period, i.e. an income equal to the cooperative solution above. Assume also that the income in each period, after the investment project is carried through, will conform with the game structure described in the preceding section for as long as the relationship will last.

Obviously, the profitability of such a project, for each of the parties, depends not only on the possible changes in income, but also on the cost of the project and how that cost is distributed between the parties. Assuming that the parties have agreed on the distribution of the outlays associated with the project, and that the supplier (or the customer) can estimate his share of these outlays with reasonable accuracy, his profitability of the investment project can be analysed as a capital budgeting problem.

The profitability of the investment project is affected by some important variables, namely

- the strategy used by each of the parties in the multi-period Prisoner's Dilemma game,
- the length of the relationship, and
- the cost of capital as reflected by the rate of interest used in capital budgeting.

According to the previous analysis of a business relationship in terms of an iterated Prisoner's Dilemma game there is no best strategy, independently of the strategy used by the other
party, if the combined discount parameter is large enough. But it was also demonstrated that there are strategies which are both optimal in a collective sense and impossible to exploit. For that reason the supplier might assume that such a combination of strategies will produce a cooperative outcome for the entire length of his relationship with the customer. His income (before depreciation of the asset created by the project) will accordingly be $R = 10$ in every period of their relationship. We have assumed that the income in the absence of the investment project will conform with the non-cooperative solution of the Prisoner's Dilemma game, i.e. be $P = 6$ in each period. Assuming that the differences between the income figures correspond to differences between cash flows, the cash flows caused by the project will be $R - P = 4$ in each period.

The second variable, the length of the relationship, can, as demonstrated above, be captured by a parameter indicating the probability that the relationship is not discontinued in a particular period. It is assumed that this probability is the same for every period. In the period in which the relationship is discontinued, and every subsequent period, the supplier can expect an operating income equal to $P = 6$, i.e. the same income as he would have obtained without the project.

Given these assumptions the exercise in capital budgeting can be completed by defining the expected present value of the investment project as

\[ E = -0 + \frac{wC}{(1 - w)} \]

where

- $0 = \text{the outlays on the investment project made by the supplier},$
- $C = R - P = \text{the periodic cash flows caused by the project},$
- $w = d \times p = \text{the combined discount parameter},$
- $d = \frac{1}{1+i} = \text{the interest-based discount parameter}.$
i = the rate of interest used in capital budgeting

p = the parameter expressing the probability that the relationship is not discontinued in a particular period

The future casts its shadow on the expected present value of investments in business relationships not only through the interest-based discount parameter but also through the parameter expressing the probability that the relationship is not discontinued in a particular period. The size of the shadow also depends on the difference between the payoffs from cooperation and those from non-cooperation in every period.

The capital budgeting formula above will be used as the point of departure for an analysis of the valuation of the asset created by the project.

The Issue of Depreciation

Closely related to the issue of investments in business relationships is the issue of how the value of the asset created by the investment changes through time. It has been held that the capacity of such assets does not necessarily diminish with use, but might rather increase as a result of experiential learning (Johanson and Mattson 1985). How does this affect the change of the value of the asset and the proper depreciation charge on such assets?

Depreciation has been variously defined as decline in asset value and as a process of matching costs with expected benefits (e.g. Hendriksen 1982, pp 373 – 380). Both of these concepts are problematic, especially in relation to a stochastic prediction model. The former concept can, however, be related to a stochastic prediction model in a rather straightforward manner. For that reason we will first define depreciation as the decline in the expected present value of the asset in question. In the last section we will define depreciation in terms of the latter type of concept and analyse the differences.
We are now not concerned with normal accounting practise. In accounting practise the outlays for these assets are usually treated as expenses in the periods in which they are made. That is, the assets are fully depreciated at once. Theoretically there is a creation of an asset, however, and we are concerned with the depreciation, i.e. the change of value of that asset.

Even on the basis of a deterministic prediction model, i.e. a model based on single-valued expectations for each period, there might be an increase in the (discounted) present value of the asset, i.e. a negative depreciation charge. This would come about, however, only as a result of steeply increasing cash flows over some periods of the asset’s life. With a stochastic model, zero or negative depreciation charges might be appropriate under far more realistic circumstances.

The investment project described in the previous section is assumed to create a potentially stable business relationship, which can be interpreted in terms of a multi-period Prisoner’s Dilemma game. But as the outcome of a game depends on the actions of both parties, our investment model would have been one of genuine uncertainty, had we not "frozen" the outcome of the game. That is, we have assumed (based on the previous analysis) that the combination of strategies used produces a cooperative outcome lasting for the entire length of the business relationship. When the relationship ends, it ends because of unforeseen exogenous disturbances.

The model of the investment project is not deterministic. Assuming that the relationship might end, with a certain probability, at any period of time the model becomes stochastic. Such a model, based on two-valued expectations for each period, can be illustrated as in Figure 2 below.
According to Figure 2 one of the parties, let us say the supplier, makes his outlays on the investment project at the beginning of period 1. As long as the investment project continues, he receives incremental cash flows equal to 4 per period, i.e. equal to the difference between the periodic income of the cooperative solution (10) and the periodic income obtained in the absence of the investment project (6). The probability that the investment project will continue is 90 % for each period, i.e. there is a 81 % probability that the project will continue for at least two periods etc. In the period in which the project is discontinued, and every
following period, the incremental cash flows are equal to zero.

Let us now associate depreciation with the decline in the expected present value of the remaining cash flows caused by the investment. The expected present value at the beginning of the project, after the outlays on project have been made, is equal to

\[(Bq.2) \quad V_0 = \frac{C_{pd}}{1-p_d} + C_{pd}^2 d^2 + C_{pd}^3 d^3 + \ldots = \frac{C_{pd}}{1-p_d}\]

where C, p and d have the same meaning as before. In terms of the numerical example and with a (real) rate of interest equal to 5\%, then

\[V_0 = \frac{4 \times 0.9}{1.05} / (1 - 0.9/1.05) = 24\]

But since we now have a stochastic model of the cash flow consequences of the investment, the expected present value at the end of period 1 depends on which one of the branches in figure 2 we will follow in that period. If the relationship continues throughout the first period, the expectations at the end of the period will be the same as at the beginning (according to our model), and the expected present value will also be the same. On the other hand, if the relationship is discontinued in period 1, no further incremental cash flows are expected and the present value is equal to zero. We accordingly have an expected present value at the end of the period equal to

\[(Eq.3) \quad V_1 = \frac{C_{pd}}{1-p_d} = 24\]

if the relationship continues, and

\[(Eq.4) \quad V_1 = 0\]

if the relationship is discontinued

By comparing \(V_0\) and \(V_1\) we obtain the depreciation charge for period 1 under the two scenarios, i.e.
(Eq.5) \[ D_1 = 0 \]

if the relationship continues, and

(Eq.6) \[ D_1 = \frac{C_{pd}}{1-pd} = 24 \]

if the relationship is discontinued

If the relationship continues throughout period 1, the argument will be the same for period 2 etc. We come to the conclusion that the depreciation charge should be zero for as long as the asset is "held" by the entity, i.e. for as long as the business relationship is still in force. When the relationship ends the asset is, of course, written off completely.

It might be noted, however, that a deterministic model of the cash flow consequences of an investment and the stochastic model above are based on two extreme and opposite assumptions regarding the expected remaining lifetime of the asset. In the deterministic model the total lifetime of the asset is single-valued and the remaining lifetime accordingly diminishes with one year for every year that passes. In the stochastic model above the expected remaining lifetime of the asset remains at 9 years (the arithmetical mean of the probability distribution) for as long as the relationship is still in force.

Although expectations of remaining lifetime for an individual business relationship might change in any direction, it is probably reasonable in many cases to assume that the remaining lifetime of the relationship does not change as time goes by. There is some empirical evidence that relationships are mainly interrupted due to structural changes in the operations on which the relationships are based (Gadde and Mattsson 1987). There is also some evidence that business relationships often can accommodate substantial surrounding structural changes (Håkansson 1982). Hence, there is reason to assume that the remaining lifetime does not change. As a matter of fact, it can be argued that the characteristic feature of this asset is
that the relationship is confirmed each time the parties exchange and consequently prolong the remaining lifetime. The value of the asset is increased through use. In that case the life-time of the asset is not exogenously determined, as we have assumed above, but related to use in the opposite manner of that usually assumed.

In other cases, however, the general pattern may be more in accordance with the statistical pattern of life expectancies of individuals than with any of the two extreme assumptions above. The expected remaining lifetime of an individual decreases as he grows older, but it decreases at a slower rate than the passage of time. Business relationships which are dependent on model changes, as is often the case in the automotive industry, should perhaps be considered as subject to some kind of "aging process". Correspondingly, the expected remaining lifetime of such relationships may increase in connection with model changes if the two parties continue to trade with each other after the change.

It has been argued that business relationships often develop through a number of stages (Ford 1980; Dwyer, Schurr and Oh 1987). There is also some empirical evidence supporting this view (Hallen, Johanson and Seyed-Mohamed 1991). The general assumption behind the view is that there is an early stage in which the parties are establishing the relationship. During this stage the parties are uncertain concerning their future compatibility. After that the business between the two develops until it reaches a level, which can be seen as some kind of normal long term relationship. According to this view it seems reasonable to assume that the expected remaining lifetime of a relationship is rather small in the early stage. During the following development stage the expected lifetime will grow until the relationship reaches the long term stage, when it will be stable unless some specific events would change the expectations.
Concepts of Income and Windfall Gains

From the concept of economic income usually associated with Hicks two fundamentally different views on income measurement can be derived (Scott 1986). According to one of these views, the "gain concept of income", income is related to the beginning- and end-of-period values of the net assets of the entity. On the highest level of abstraction, it is related to the increase in the (discounted) present value of all future cash flows, i.e. the increase in the present value of all future net distributions to the owners of the entity.

According to the other view, the "standard stream concept of income", the income of an entity is the maximum amount that can be distributed to the owners without impairing the ability of the entity to distribute equal amounts in the future. The important point in the present context is that the latter concept is related to the purpose of using income numbers for predictions of future events (by finding suitable surrogates of this ideal measure).

The basic difference between the two concepts of income is that the first concept includes unexpected changes in the value of the net assets, whereas the second concept includes only changes in expectations regarding long run profitability. Assume that the expectation of future cash flows increased by 20 per year for an indefinite future. If the discount rate is 10%, the present value of the net assets would then increase by 200. But this "gain" of 200 would not be representative of the long run profitability of the entity. Such value changes, which do not influence the standard stream income, are called "windfall gains (or losses)".

In the present context the issue is whether the way we have measured depreciation in our stochastic model (i.e. zero depreciation during the entire lifetime of the business relationship) is consistent with income measures having a predictive power. Or might, perhaps, some part of the resulting income measure have the character of a "windfall gain".
We are now interested only in that share of the total income of the business entity attributable to the investment project in question including reinvestments of earnings from the project. In the previous section we measured the depreciation charge as the change in the expected present value of the cash flows associated with the asset created by the project. An income measure for the first period based on the "gain concept of income" \((I_{1,c})\) can accordingly be defined as the cash flow from the project minus the depreciation charge for the period, i.e. as

\[
(Eq.7) \quad I_{1,c} = C_1 - D_1
\]

where \(C_1\) is the cash flow and \(D_1\) the depreciation charge for the first period.

In the previous section it was demonstrated that if expectations do not change, the depreciation charge would be zero for as long as the relationship is still in force. The income measure for the first period would accordingly be equal to the cash flow from the project (4 in our numerical example).

But suppose the entity distributed this amount to its owners (together with the income associated with the other net assets). Assuming constant cash flows it would then be able to distribute the same amounts for the entire lifetime of the relationship. But sooner or later the relationship would end. Since it had then distributed all the earnings from the project and not reinvested any of them, it would have no means of maintaining the profit stream.

An income measure based on the "standard stream concept of income" would depend on the the cash flow from the project, the expected future yield of the project and the expected yield on the earnings that are reinvested. If we assume that all earnings that are reinvested yield a rate of return equal to the rate of interest used in capital budgeting \((i)\), the investment project would originally "support" an income equal to

\[
V_0 \times i
\]
where VO is the expected present value of the project after the original outlays are made. That is, according to the original expectations such an amount could be distributed ad infinitum. Since we have assumed that expectations are the same at the end of the period, if the relationship is still in force, an income measure for the first period based on a standard stream concept of income \( I_{1,s} \) can be computed as follows:

\[
(I_{1,s}) = (V_0 + C_1 - I_{1,s})i
\]

If an amount equal to \( I_{1,s} \) is distributed to the owners at the end of the period, then an amount equal to \( (C_1 - I_{1,s}) \) is reinvested. The equation states that the income measure should be equal to the originally expected income plus the yield of the earnings that are reinvested.

From (Eq.8) it follows that

\[
I_{1,s} = \frac{(V_0 + C_1)i}{1+i}
\]

In terms of our numerical example, where \( VO = 24 \), \( C_1 = 4 \) and \( i = 0.05 \), the income measure for the first period based on a standard stream concept of income would be equal to 1.33.

How do we explain the difference between the two income measures? The first measure, consistent with the capital maintenance concept of income, measures the earnings obtained from the asset (4) minus the decrease in the value of the asset (0). If none of the earnings were distributed, the value of the net assets would increase by 4. However, of that total increase only 1.33 represents the amount that can be distributed for an indefinite future (given the expectations at the end of the period). The remainder, 2.67, must be reinvested in order to maintain that level of distributions. This remainder can be regarded as a "windfall gain", as it reflects the fortunate fact that the relationship was not discontinued in this particular period (this fortunate fact also affects the second income measure, but only with the yield on the reinvestments).
The income measure might still be defined as

(Eq.9) \[ I_{1,s} = C_1 - D_{1,s} \]

where \( D_{1,s} \) is a measure of depreciation. But this measure would be based on a different concept of depreciation. It would not refer to the change in the expected present value of the asset, but to the amount of reinvestments necessary to maintain the profit stream. As such it would be an ideal measure for a matching concept of depreciation.

In the period in which the relationship ends the argument is reversed. An income measure based on a "gain concept of income" can now be defined as

(Eq.10) \[ I_{t,c} = R_{t-1}*i - D_{t,c} \]

where \( t \) is the period in which the relationship ends and \( R_{t-1} \) is the amount of capital accumulated at the beginning of the period from earlier reinvestments. The income measure is affected positively by this period's yield on the accumulated capital but is affected negatively by the fact that the relationship ends in this period. As a result there is no cash flow from the asset and the asset is written off completely by a depreciation charge equal to present value of the asset at the beginning of the period (24 in our numerical example).

An income measure consistent with a steady stream concept of income would, however, be equal to

(Eq.11) \[ I_{t,s} = R_{t-1}*i \]

Even though the asset created by the project is now worthless, it is possible to distribute an amount equal to the yield on the capital accumulated from earlier reinvestments and still leave a capital large enough for distributions of equal size in the future.
The **difference** between the two income measures is a "windfall loss" **reflecting** the unfortunate **fact** that the relationship happened to end in this **particular** period.

The upshot of the above argument is that one would **have** to be **careful** about the validity of income measures **based** on zero depreciation charges **during** the lifetime of the relationship and a complete write-off at the date of termination (which, by the way, would be the complete opposite of the conventional **procedure**). Part of such income measures are "windfall **gains"** and "windfall **losses"** respectively, which would **have** to be **taken into consideration** if the measures are used for predictive purposes.
Some Concluding Comments

Starting from the mixed-motive character of business relationship this article develops a model of business relationship as Prisoner's Dilemma games. Based on this model the article illustrates some aspects of investments in business relationships and the valuation of the assets created by these investments.

The article contributes to several fields of business research. First, the conceptualization of business relationships as Prisoner's Dilemma games should help us in understanding the nature of business relationships. In particular, it can be a step towards developing relationship economics and, since exchange relationships are often considered as basic elements in business networks, network economics. This points, however, to an important limitation of our analysis. A basic assumption of the standard Prisoner's Dilemma game is that it is isolated from other surrounding games. Business network models in contrast assume that exchange relationships are connected in various ways. It seems that ways to analyse connected Prisoner's Dilemma games have to be developed.

Second, and from the other point of view, the article shows a new field of application for game theory. As business relationships is a complex and multiplex phenomenon this seems to be a fruitful avenue for research based on game theory. The Prisoner's Dilemma game has been used in several areas of social research both inside and outside the economic area and seems to provide a mean for counteracting the fragmentation so prevalent in social research (Hardin 1982; Axelrod 1984). The present application indicates a way in which this game model can prevent a further fragmentation, at least of business research.

Third, the article points at the relevance of the Prisoner's Dilemma game for capital budgeting of business relationships. Most capital budgeting analyses are based on rather crude assumptions, usually based on competitive market prices, about the cash flows from investment projects. Our discussion
indicates an approach to a refinement of capital budgeting analyses of many investment projects in which a significant part of the income is expected to come from exchange with important customers.

Fourth, and this is the main purpose of the article, it contributes to the understanding of the value of some assets based on relationships with other finns. It provides a link between important concepts in marketing and accounting. Further development of that link seems urgent. In particular, it is necessary to analyse how various kinds of interdependences between relationship games affect the values of the relationship assets.

References


Hägg, I., and J. Johanson, eds, 1882, Företag i nätverk (Firms in Networks), Stockholm: SNS.


