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UNIVERSITY OF WOLLONGONG
DEPARTMENT OF ACCOUNTING AND FINANCE

WORKING PAPERS SERIES

**A NEGOTIATION APPROACH TO FINANCIAL
DECISIONS INVOLVING ACCOUNTING INFORMATION
USE**

by

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The University of Wollongong

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Introduction

The issue of how parties with diverse preferences make decisions under information asymmetry has been at the core of contemporary accounting research (Murnighan and Bazerman 1990). But surprisingly little research addresses the actual process by which such decisions are made. The process of choice negotiation for alternative accounting methods in both financial and management accounting has been explored in several areas of accounting information application such as transfer pricing (see Grabski 1985 for a review), management negotiation (Kolb 1983, Kolb and Sheppard 1983, collective bargaining (Cascio 1982, Foley and Maunders 1979, Amernic 1985, Elias 1990, Liberty and Zimmerman 1986).

The agency literature is a fertile source of application for negotiation. There is considerable evidence that managers and firm's will often lobby for changes in accounting methods that will benefit them in some ways (Deakin 1989). The smoothing of earnings stream is one example (Trueman and Titman 1988, Carslaw 1988), the negotiation of transfer pricing is another (Chalos and Haka 1991). Other examples include budget formation processes (Collins et al 1987), and attempts to increase remuneration through adopting beneficial accounting methods for the firm (Abdel-khalik et al 1987).

The choice problem in relation to alternative accounting methods, transfer pricing agreements and budgeting processes has been extensively analysed in both single person and principal-agent worlds. Such studies usually emphasise determinants of information value, ranking of accounting information system alternatives, and the assumption of an optimal solution or equilibria. Investigation into how these decisions are made in practice or about the process of decision making itself is still evolving.

But the analysis of decision making processes about accounting choices and the use of accounting information remains circumscribed. This is surprising, given the vast literature available in economic game theory which can be directed towards

bargaining theory and given the grounding of accounting in economic theory. One reason is suggested here. While economic theory has thoroughly explored negotiation and bargaining situations through game theory this analysis remains normative and equilibrium based in perspective, objective and rational in assumptions and mathematical in process. Normative models of choice and negotiation based on assumptions of wealth maximisation, rationality which primarily focus on the achievement of equilibrium or optimal bargaining situations through application of mathematical predicts face the criticism of limited practical application (Harsanyi, 1962).

Application to specific situations is especially difficult given the inherent complexity of negotiation situations. Adding several variables such as asymmetric information, second order optimality among several optimisation objectives, and multi person, multi period contexts quickly makes an analysis focused on derivation of optimisation or equilibrium and extremely complex mathematical or linear programming process.

Social psychology provides a more behavioural approach to decision making behaviour especially in the study of individual factors upon attitudes and outcomes (Liebert et al 1968, Hamner and Harnett 1975, Kahneman and Tversky 1982, Kressel and Pruitt 1985, Hubert and Neil 1987).

The challenge in the accounting decision making domain is to provide cointegration between the economic theory approach and the more behavioural perspective of the empirical investigation based upon case study approaches which emphasis the contextual nature of negotiation situations, the inherent complexity and irrationality of actual negotiations (for one attempt in the context of accounting information see Deakin 1989). Bridging of this gap has been implicitly attempted in either the application of specific aspects of economic theory to actual situations (Krepps 1982; see Chalos and Haka 1990 analysis of uncertainty and multiperiod influences in transfer pricing negotiations) or the use of experimental situations to

test the assumptions of normative models (for example, Roth and Malouf 1979, Roth and Murnighan 1982, Roth et al 1988, Roth and Schoumaker 1988).

The Problem Focus

This paper examines a relatively simple model of the negotiation process based upon the economic principles of maximisation of discounted cash flows found in financial investment analysis. The purpose is to emphasis several assumptions underlying an economic theoretics approach to negotiation and define a path to resolution which may be applicable to cases of accounting information choice problems. Although the model is naive in a game theoretics sense, it provides a realistic reflection of the actual decision process, reveals the path to optimisation without mathematical complexity, illustrates the derivation of optimal strategies and allows the integration of the process within traditional financial investment analysis.

In particular, the approach may be applied to situations of accounting information asymmetry with regard to financial investment decisions. A common investment practice is the sharing of participation in with commercial investment projects as a means of risk protection. McCrae (1995) uses options theory to provide a formal treatment of optimal risk sharing of investment ownership to ensure immunisation of returns. Since this process involves selling off part ownership of the project, the project proposer needs to negotiate project finance participation by another party. This process is likely to involve multi-period negotiation focused on the sharing of the stream of future benefits from the project. The present analysis assumes that negotiating investment within a single project is most likely a bilateral, multi-period decision process.

The discounted cash flow interpretation of the focal point of negotiations has several advantages. It is congruent with the theory underlying accounting theory about the value of information. It provides a common variable which can encompass the diverse preferences of the negotiating parties. It is sufficiently broad to incorporate different interpretations of wealth maximisation that may occur in

practice and is particularly applicable to multi-period analysis through the simple device of discounting. Finally it is easily translated into an expectations form, that is, future expectations about cash flows and their distribution.

Under bargaining theory, the process of information system acquisition involves a bargaining process consisting of a complex interactive sequence of offer and counter-offer rounds between two parties, usually in a duopoly situation. Each round constitutes an offer laid out by one party to be accepted or rejected by the other party who then makes an offer which may or may not differ from its previous offer. In the present context the acceptance of an offer initiates the institution of the information systems change. The bargaining process outcome will depend upon the risk-taking potential parties to the negotiation and upon the strategies adopted during the process.

The provision of the project to which the financing participation offers relate is treated as an activity of the project proposer (PP) who is responsible for controllable costs relating to finance of the project.. The project owner "sells" finance project finance participation to the prospective financier (PF) who is expected to operate in accordance with accepted principles of marginal cost/revenue analysis.. The objectives which participation in the project should satisfy in a portfolio or immunisation sense are a matter of policy decision for both the PP and the PF prior to negotiations. The PP and PF enters negotiations for acquisition of finance participation not knowing the other party's strategies.

Assumptions

Where the PF represents several parties, then the investors whose investment return requirements are serviced by participation in the project are represented by the PF convocation. The function of the convocation is to represent the main categories of investors to be serviced and formulate a consensus investment objectives which are translated in return requirements to be presented to the PP. The PF convocation then enters into negotiation with the PP to seek resolution, through a bargaining

sequence between the two parties, on the proportion of finance participation to be acquired by the PF.

The PP will typically offer alternative project finance proportions that result in different streams of future benefits to the PF. The PF convocation will typically make counter-offers on project finance participation in terms of the risk/return profile which suits the investors requirements.

Participation in project finance involves fairly immediate costs to the PF, but will increase the future 'earnings'. The PF convocation is faced with an overall cost constraint and a finite time horizon for participation in the project. Resolution about participation is required around the sharing of the discounted value of the project's future income (and cost) stream.

The situation under analysis incorporates the following assumptions:

(1) At each equi-interval points in time, the PP offers an incremental participation in the project finance for acceptance or rejection by the additional finance provider (who may be an individual or a convocation).

(2) The PF's acceptance of a current offer (x_n), implies receipt of the discounted present value of the incremental stream of information value represented by the offer. Rejection of x_n incurs an immediate cost c_n , for the additional period they will remain without the cash flow benefits from the project until the next offer is presented. This cost may vary over time; the analysis requires only that it is a non-decreasing function of the number of periods already past.

(3) Cash flow streams are discounted for the life of the project

(4) The PF must accept an offer within N periods. This is not restrictive since change will inevitably end in agreement (even if this is merely preservation of the status quo).

(5) The PP's offers are non-decreasing over time. That is ($x_{n+1} \geq x_n$). But there is a constant upper limit y to possible offers largely determined by constraints imposed on giving up project participation in excess of that proportion required to

provide acceptable immunisation levels against expected cash flows falling below given levels established by the owner. We analyse the limiting case where the owner will continue to give up participation until they can just break even on the deal.. Consequently any offer will be less than or equal to y .

(6) In any period (n), the PF convocation can make an estimate of the probability distribution for the PP offer in period ($N+1$) conditional on the amount of the present offer. The distribution is the same for each period but parameter values depend on the amount of present offer.

(7) The PF convocation's objective is to maximise the expected present value of the cash flow increment gained by accepting an offer.

Operation of the Model

The objective in running the model is to provide a relatively simple means of finding out which offer (if any) made by the PP should be accepted by the PF. To do this we let random variable V denote the amount of incremental cash flow benefits in dollar terms of the next offer to be made by the project provider and let $h(v|x)$ denote the conditional density function of the next offer. That is $h(v|x)$ is the density function of V , at each possible value of v , given that the present offer is x .

Let X_0 denote the PP's initial offer in period 0. We assume the probability density $h(v,x)$ is of the same form as $h(v|x_0)$ but distributed over the interval x - y rather than x_0 - y . That is, we assume the probability that the next offer will fall within any given fraction of the range x - y remains constant for all $x \in X$.

For any function of V , $L(V)$, let $E(L(V)|x)$ denote the conditional expected value of $L(V)$ given the present offer is x .

Then

$$E(V|x) = \int v h(v|x) dv \quad (1)$$

as long as $P(x_0 < v|y)$, $P(x_n < v|y)$ is constant.

A period n , ($n < N$) is the interval that begins with the n^{th} offer and terminates just before the $(n+1)$ offer. A decision rule for period n is a rule to accept/reject the n^{th} offer, all previous offers having been rejected.

A 'strategy' is a set of multi period decision rules. The only constraint is acceptance of x_N given offers for periods 1, 2, 3, ..., are rejected.

Under the above assumptions it can be demonstrated (Kraus and Melnick, 1972) that there is a unique 'optimal' strategy that gives an expected net present value at least as large as another strategy, and that it implies setting a minimum level, x_n to the increment of information value which management convocation will accept if it is offered in period n . A dynamic programming approach is used to demonstrate this.

With all offers expressed as dollars, let $k(x)$ denote the present value of accepting an offer of x .

$$k(x) = \sum_{i=n}^N [C_i / (1+r)^i] \quad (2)$$

Where r is the appropriate discount rate. Now let $S_n(x)$ be the expected present value in period n of following an optimal strategy for periods $n, n+1, \dots, N$.

In period n , the FP convocation has two choices. It can accept x and receive $k(x)$, in which case it receives:

$$k(x) = \sum_{i=n}^N C_i / (1+r)^i$$

Otherwise it can reject the offer, incur additional cost C_n and wait for the offer in period $n+1$, up to period $N-1$. The expected value of which is $E[S_{n+1}(v) x]$.

Following Bellman's (1957) principle of optimality, these alternatives may be expressed as:

For $n = 1, 2, \dots, N-1$

$$\text{Accept : } k(x) = \sum_{i=n}^N C_i / (1+r)^n$$

$$S_n(x) \text{ Max} \quad (3)$$

$$\text{Reject : } -C_n + [1/(1+r)] E(S_{n+1}(V|x)).$$

and

$$S_N(x)^* = k(x)^* \quad (4)$$

We may now solve (3) by using (2) and (4), for $n = N-1, N-2, N-3, \dots, 0$, in the usual 'backward iteration' process of dynamic programming. However this process is tedious algebraically, particularly if N is sizeable, since calculation of the number of periods remaining to acceptance requires the unconditional (marginal) density function for the offer in each period.

We now solve (3) for period $N-1$ to illustrate the form of the optimal decision rule. The basic linear programming function (3) is solved by using (2) and (4). This gives:

$$S_{N-1}(x) = \text{Max: } k(x)_{N-1}; -C_{N-1} + [1/(1+r)]E[V[(1+r)/r] x] \quad (5)$$

where $E[pV(1+r)/r]$ is the expected present value $N-1$ from following an optimal strategy for period N .

(5) reduces to:

$$S_{N-1P}(x) = \text{Max} (x [(1+r)/r], -C_{N-1} + [1/(1+r)] E(V|x)) \quad (6)$$

The critical value defining X_{N-1} is given by the point where the Accept /Reject values in (6) equate. That is where

$$k(x) = -C_{N-1} + (1/1+r) E(V|x) \quad (7)$$

at which point

$$E(V | x_{N-1}) = (1+r) x_{N-1} + r C_{N-1} \quad (8)$$

and the optimal decision rule for period N-1 is therefore

$$\begin{aligned} \text{Accept if } x \geq x_{N-1}^* \\ \text{Reject if } x < x_{N-1}^* \end{aligned} \quad (10)$$

where x_{N-1}^* is found by solving (6). The solution of (6) therefore is:

$$S_{N-1}(x) = \begin{cases} (\text{Accept} : k(x) \text{ for } x_{N-1}^* \leq x \leq y \\ (\text{Reject} : -C_{N-1} + (1/r)E(V|x) \text{ for } x < x_{N-1}^* \end{cases} \quad (11)$$

To find $S_n(x)$ in any period requires a backward interaction period to solve for

$$V_N(x), V_{N-1}(x) \dots, V_n(x)$$

As mentioned, this process is tedious algebraically and can be avoided, since Kraus and Melnick have shown by induction that (9) and (10) can be generalised for all periods.

For period n ($n=1, 2, \dots, N-1$), where the incremental value of the cash flows for the particular participation rate is x , then all previous offers being rejected, the optimal decision rule is:

$$\begin{aligned} \text{Accept if } x > x_n^* \\ \text{Reject if } x < x_n^* \end{aligned} \quad (12)$$

where x_n^* is the solution to

$$E(V x_n^*) = (1+r)x_n^* + rc_n \quad (13)$$

That is the FP convocation should accept the first offer for information capability mix which exceeds x_n^* where x_n^* satisfies (13).

A Good Strategy for the FP Convocation.

The perhaps surprising implication of (13) is that the critical value x_n^* for any period does not depend either on size of the offer in $(n-1)$, nor on the number of periods remaining to N . So that calculation of x_n^* becomes relatively simple.

Operation of (12) can be illustrated by a simple example. Assuming the account of the next offer of information value potential by the PP, given x is uniformly distributed between x and y , and $c_n = c$ for all n .

Then

$$E(v|x) = \begin{cases} [1/(y-x)] \text{ for } x < v < y \\ 0 \text{ Otherwise} \end{cases} \quad (14)$$

so that

$$E(V|x) = [v/(y-x)] dv = (x+y)/2 \quad (15)$$

So for the FP convocation, the optimal decision rule for period is given by (12) and (13). In this example, (13) gives

$$(x_n^*+y)/2 = (1+r) x_n^* + rc \quad (16)$$

and

$$x_n^* = [y-2rc]/(1+2r) \quad n = 9, 1, \dots, N-1 \quad (17)$$

Therefore the FP convocation should accept the first offer that equals or exceeds (17).

Discussion

The advent and wide application of farming out participation in project financing in return for a share of the cash flow return represents a relatively unexplored application of negotiation analysis within the accounting and finance literature. The objective of the analysis was to examine the decision process used in resolving project finance participation negotiations. To accomplish this, the major properties and associated variables likely to characterise the decision process have been suggested and modelled. The analysis employed a bargaining theory approach to information system selection.

A simple optimal strategy has been derived for the problem from (3). An explicit solution for periods N and $N-1$ has been demonstrated. The expected present value to the FP convocation of pursuing an optimal strategy can be found by solving the functional equation by typical backward iteration of mathematical programming.

Since the critical value x_n^* for period n is independent of the N , the FP convocation, in formulating an initial optimal strategy need not attempt to determine the number of periods N it can sustain a no decision policy. For even if N is unexpectedly reached, optimal strategies in prior periods are independent of N and so still optimal.

The PP's knowledge of the problem parameters, such as N , its own costs and revenues, are assumed to be captured in its the configuration of its project participation offers to the FP. In an immunisation context this is predicated upon the PP's desire to achieve immunisation against less than desirable cash flows below a determined level. Thus the PP is assumed not to modify its actions due to management convocations expected strategy under particular circumstances. If this

changes during the course of negotiations then the conditional expectation of the distribution of V needs to be re-calculated.

An interesting extension to this analysis is the incorporation of information asymmetry between the parties. Should the immunisation conditions desired by the PP imply farming out more than 50 per cent of project finance then either the PP must rely on lack of knowledge on the PF's part to allow such a resolution to occur, or the PP must seek out a potential PF for whom more than 50 per cent project participation has other benefits which offset the potential risk involved. These may arise from a number of sources.

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