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Option values and endogenous uncertainty in ESOPs, MBOs and asset-backed loans

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Abstract

We consider contracts to purchase assets by means of streams of payments over time, with the asset as security. These give the purchaser an option not present if all payment is made up front, the option of stopping payments and delivering the asset in satisfaction of the remaining debt. We argue that the value inherent in such options explains the attractions of asset-backed loans, employee stock option plans and MBOs.

Keywords: Option values; Endogenous uncertainty; Employee stock option plan

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1. Introduction

Options introduce uncertainty because they may not be exercised. In this paper we consider uncertainty which arises from contracts with an option-like structure. The inalienability of labor means that many labor supply contracts have such a structure: an agreement to supply labor in the future cannot be enforced, and so is a put option on the part of the supplier. Because of this, assets purchased by an undertaking to supply labor in the future have an option value that is additional to their actuarial value. This observation is important in understanding the role of employee stock option plans (ESOPs) and management buy-outs (MBOs). There have been many examples of employees apparently paying more than is reasonable, both in terms of cash outlay and in terms of the riskiness of the debt–equity position assumed, in order to gain control of their company via MBOs: indeed this was an element in the genesis of the junk bond market. We argue that this may in fact have been

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rational, given that for them ownership on the terms typical of an MBO has an option value in addition to its market value. Additional examples of contracts with this structure are provided by assets that have a sequential payment scheme, under which agents can renege on their obligation to make later payments and may choose to do so in certain states of nature. We shall show that asset-backed loans have this structure. In these cases, agents have the option of defaulting. In some cases, this option is not available to all investors, but is created by institutional rigidities: we elaborate on this point below. The fact that agents may choose to exercise an option and default on contracts introduces a source of endogenous uncertainty into the economy.

Such option-induced uncertainty arises in a wide range of economic and financial circumstances. We formalize the fact that contracts with this characteristic have an option value which is additional to their actuarial value (Theorem 1), which is computed here (Corollary 1). The implications of this observation for the valuation of compensation packages such as employee stock compensation plans and ESOPs is analyzed in Subsection 3.1. The role and profitability of MBOs, which exploit the difference between the value of stock to managers and to market investors, is the subject of Proposition 2, which shows that the value of stock to management contains an option value in addition to the actuarial value that the market will place on it. In the final section of the paper, we explain the default opportunities arising from asset-backed loans with sequential payments such as mortgages and shipping investments.

A precursor of the present paper is the work of Chichilnisky and Wu (1991). They provide a model of default by agents stemming from financial innovation: this produces uncertainty and prevents the completion of the markets. In Chichilniksy and Wu (1991), individuals face individual risks: the proportion of individuals in an unfavorable state cannot be predicted with certainty and is a source of risk to insurers. Due to the interdependent patterns of trade, individual default may propagate, and lead to a new equilibrium with default by a large proportion of the population. Such risks represent endogenous uncertainty.

In addition to the results presented in this paper, the issue of option values arising from institutional rigidities such as the inalienability of labor has been explored in Chichilnisky et al. (1993). The option-like structure of certain assets is a general equilibrium phenomenon which can have far reach consequences in a general equilibrium model with incomplete markets. Specifically, it is established in Chichilnisky et al. (1993) that default is a general equilibrium outcome which can arise from inalienable labor or from other institutional rigidities. Under quite general conditions, and with sophisticated settlement contracts to preclude default of the option-like assets, equilibrium with unprofitable investments can also be established. Moreover, due to the endogenous economic uncertainty generated, at equilibrium entrepreneurs finance labor-specific investments by issuing debt. In such a model a fundamental asymmetry arises between debt and equity, since debt financing unlike equity is characterized by sequential payments giving rise to default opportunities.

The treatment of corporate liabilities as options can be traced at least as far back as Black and Scholes (1973), who had the insight that holding a firm's equity is equivalent to holding a call option on its assets, where the exercise price is the value of the firm's debt. In addition, Meyers (1977) and Trigeorgis and Mason (1987) reviewed the options implicit in certain types of contracts, and raise issues similar in concept to those that we study here. Meyers (1984) also considers growth opportunities as call options. However, none of these works focuses on the inalienability of labor or on the implications of sequential payments for the default possibilities available to agents, nor do they note the relationship with general equilibrium analysis and endogenous uncertainty.[1]

The paper is organized as follows. In Section 2 we formalize the option value of credit and show that the presence of a deferred payment scheme (and the possibility of default) leads to a strict increase in the value of the asset purchased under such a scheme. In Section 3 we describe and formalize the applications stemming from Section 2. We show the corresponding propositions as they apply to employee compensation packages such as ESOPs, to MBOs and to mortgages. Finally, in Section 4 we offer some concluding remarks and describe the extension of the model to a general equilibrium economy with incomplete markets.

2. The option value of credit

Consider a two-period economy in which there are many possible second-period states, one of which is chosen at random. Uncertainty about the period-2 state is resolved at the beginning of the second period. The set of states is $S^* = \{0, 1, 2, \dots, S\}$. State 0 represents period 1 whereas states $1, \dots, S$ occur after uncertainty is resolved in the beginning of period 2. Asset markets meet in period 1 and assets pay in period 2. The asset return is state dependent and denoted by v_s, $s \in S = \{1, 2, \dots, S\}$. The interest rate is assumed to be zero throughout for simplicity. This means that in comparing payment schemes with a one-time payment with those having deferred payments, the comparison is not affected by the time value of money. In addition we assume throughout that all agents are risk-neutral. Asset returns are characterized by a probability distribution $\Phi: S \to [0, 1]$. Our analysis is based on the purchase of a specifc asset under one of two alternative payment schemes:

Scheme 1: Payment at purchase. The agent makes complete payment for the asset at $t = 0$. The return net of payments in states s, denoted by R_1^s, is given by $R_1^s = v_s - p_1$, where p_1 is the price of the asset. If E is the expectation operator, then $\mathrm{E}_{s\in S} R_1^s = R_1 = \mathrm{E}_{s\in S} v_s - p_1$.

Scheme 2: Deferred payments. The agent makes a partial payment for the asset at $t = 0$. The rest of the payment is made at $t = 2$, after uncertainty is resolved and the state s is known. However, the agent is not obliged to make the second payment. *S/he has the option of not making the second payment, forfeiting delivery of the asset and losing the first payment.* Under this payment scheme, the expected return on the asset net of payments is denoted by R_2. Given a price p_2 and assuming that the payment occurs in two installments, λ_{p_2} during the first period and the rest during the second, where $0 < \lambda < 1$, we have

$$\mathrm{E}_{s\in S} R_2^s = R_2 = -\lambda_{p_2} + \mathrm{E}_{s\in S}[\max(v_s - (1 - \lambda)p_2, 0)] .$$

[1] Suresh Sundaresan has suggested to us that there may also be a connection with the need to 'mark to market' futures contracts: the purpose of this could be interpreted as removing an option-like possibility from the party who is disadvantaged by price movements subsequent to the signing of the contract.

The time structure of the model is as follows:

(1) $t=0$: Asset trading and the selection of the payment scheme. Then uncertainty is resolved and the state is revealed.

(2) $t=1$: Assets deliver after the agent has selected whether or not to renege on his second payment under the second payment scheme.

Both payment schemes seem superficially equivalent in terms of their impact on the price and the expected returns of the asset. A simple example indicates, however, that this is not the case. Consider a three-state world, i.e. $S=\{1,2,3\}$ with each state equi-probable, i.e. $\pi_s=\frac{1}{3}$, $\forall s\in S$. An asset pays $v_1=6$, $v_2=2$, $v_3=1$ and has a non-arbitrage price of $p=3$. Under payment scheme 1, $R_1=\frac{1}{3}(6+2+1)-3=0$. However, under the second payment scheme, with $\lambda=\frac{1}{2}$ and $p=3$, $R_2=-\frac{1}{2}3+\frac{1}{3}(4.5+0.5+0)=\frac{1}{6}$. In this example the states in which the returns would be negative under payment scheme 1 are eliminated under scheme 2 because of the right to renege on the payment of the second installment. Indeed, this phenomenon is quite general, as our main result indicates. Theorem 1 states that the option value implicit in the deferred payment scheme increases the value of the asset purchased by that scheme:

Theorem 1. A default option in a payment scheme increases the value of an asset purchased under that scheme. Formally, given an asset price $p_1=p_2=p$, then $R_2>R_1$ provided that there exists $s\in S$ such that $v_s-(1-\lambda)p<0$, where λ is the fraction of the purchase price p paid in the first period and v_s is the return in state s.

Proof. We need to show that

$$\mathrm{E}_s \max(v_s-(1-\lambda)p,0)-\lambda p>\mathrm{E}_s v_s-p$$

or

$$\mathrm{E}_s \max(v_s-(1-\lambda)p,0)>\mathrm{E}_s(v_s-(1-\lambda)p)\,.$$

The latter statement is true as long as there exists $s\in S$ such that $v_s-(1-\lambda)p<0$. This follows from the fact that the expectation operator over the maximum picks only non-negative values and for $s\in S$ such that $v_s-(1-\lambda)p\geq 0$ we have

$$\mathrm{E}_s \max(v_s-(1-\lambda)p,0)=\mathrm{E}_s(v_s-(1-\lambda)p)\,.$$

This completes the proof. □

One interpretation of our result is that an asset with two distinct payment schemes corresponds to two different assets. In particular, the non-arbitrage price of an asset varies with the scheme under which payment is made, as Corollary 1 shows:

Corollary 1. The actuarial value of the asset under payment scheme 2, p_2, exceeds that under scheme 1, p_1, provided that there exists s such that $v_s-(1-\lambda)p_1<0$.

Proof. Consider p_1 such that $E_s v_s-p_1=0$. By the previous theorem,

$$-\lambda p_1 + \mathrm{E}_s \max[v_s - (1-\lambda)p_1, 0] > R_1 = \mathrm{E}_s v_s - p_1 ,$$

which implies that

$$-\lambda p_1 + \mathrm{E}_s \max[v_s - (1-\lambda)p_1, 0] > 0 .$$

Now we observe from Fubini's theorem that

$$\frac{\mathrm{d}(-\lambda p_1 + \mathrm{E}_s \max[v_s - (1-\lambda)p_1, 0])}{\mathrm{d}p_1} = \mathrm{E}_s \frac{\mathrm{d} \max[v_s - (1-\lambda)p_1, 0]}{\mathrm{d}p_1} - \lambda < 0 .$$

Therefore, since $R_2 > R_1$, $R_2 = 0$ at a value of p_2 such that $p_2 > p_1$. □

3. Applications

The underlying structure of the previous model is such that varying the payment regime generates assets with different payoff structures from the original asset. In fact, this structure characterizes a host of different financial instruments. In addition, it offers a useful interpretation of MBOs, and allows us to compute the maximum value that an intermediary can extract from an MBO. In this section we discuss and formalize applications that can be appropriately described by the previous model.

3.1. Employee stock payments or stock option payments

A standard ingredient of the compensation packages of senior managers is the offer of stocks or stock options in the firm. In particular, in addition to a fixed salary an employee is granted stocks and/or stock options, often via an ESOP. The insight that the previous model offers on such compensation arrangements is that in effect the stock or stock option is an asset purchased with sequential payments in the form of labor services on the part of the employee. Assuming that the employee has a particular opportunity cost c for working in the firm, s/he has the option of leaving the firm and seeking alternative employment whenever the state of nature is such that the return on the firm's stock is sufficiently low. This is equivalent to saying that the employee has an option on the stock (or stock option) with the exercise price being the opportunity cost of working in the firm. So in effect s/he holds a call option or, in the case of payment by stock options, a compound call option on the stock of the firm.

We consider first the case in which the employee is given a stock option in the firm. Let the expected return on the stock option in the firm be $\mathrm{E}_s R_1 = \mathrm{E}_s \max[p_s - k, 0]$, where p_s is the price of the stock and k the exercise price of the option. The employee will stay in the firm if and only if the expected return is greater than the opportunity cost, i.e., if $\mathrm{E}_s R_1 > c$, where c is the opportunity cost to the employee of remaining in the firm. Without loss of generality we assume that the employee receives the rest of the compensation at the beginning of the first period at $t = 0$. Therefore the expected return to the employee of the stock option, given the opportunity of leaving the firm, is

$$\mathrm{E}_s R_2 = \max[\mathrm{E}_s \max(p_s - k, 0), c] .$$

Proposition 1. Employee stock option payments have a value to the employees in excess of their market values. Formally, given the price of the stock p_s, $E_s R_2 > E_s R_1$ *provided that there exists an s such that* $E_s \max(p_s - k, 0) < c$.

Proof. We need to show that $\max[E_s \max(p_s - k, 0), c] > E_s \max(p_s - k, 0)$. Let $E_s \max(p_s - k, 0) = \gamma$ and the result follows. □

Therefore, an employee is willing to pay an additional premium above the market value of the stock option equal to $E_s(R_2 - R_1) = \rho$. The key issue here is the inalienability of the employee's labor. The employee cannot be obliged to work for the firm. The employee pays for the stock option by working in the first and second periods, and cannot be obliged to complete his or her payments and work in the second period if the state, which is then known, is such that this is not attractive. This unenforceability of labor supply contracts transforms the stock option held into a compound stock option which is more valuable to the employee than to an outside holder of the firm's equity. Proposition 1 suggests that paying employees by stock options may be an attractive strategy to shareholders: the shares transferred to employees are more valuable to them than they are to the shareholders.

Let us consider a simple example to clarify this proposition. Suppose that there exist three states of the world, with each equi-probable, i.e. $\pi_s = \frac{1}{3}$ for all s. The three possible prices of the stocks tomorrow are $p_1 = 120$, $p_2 = 110$ and $p_3 = 90$. Furthermore, suppose an option is written on the stock with exercise price $k = 100$ and the opportunity cost of labor is $c = 20$. Then we have $R_1 = \frac{1}{3}(20 + 10 + 0) = 10$. However, $R_2 = \max[\frac{1}{3}(20 + 10 + 0), 20] = 20$. The same principle applies in the case in which the employee is endowed with stocks in the firm rather than stock options. As long as the employee is allowed to leave in the second period and renege on the contract to work in return for stock, then the return on the stock is $E_s \max(p_s - c, 0)$. In particular, the stock the employee holds is an option with exercise price the opportunity cost of labor. In a straightforward manner one again can easily show that the stock held by the employee is more valuable to him than it would be if it was held by an outsider.

3.2. *Management buy-outs (MBOs)*

The structure described in Section 2 can provide insights into the financial structure of MBOs. As in the case of employee stock options, the assets of a firm when purchased by a deferred payment scheme, i.e. by working over several periods, are more valuable to the management than their market value indicates. As long as management's labor is inalienable and the employee cannot be held to a contract and has the choice of leaving the firm next period, then if s/he pays for a stock by working in the firm, in effect s/he holds a call option with exercise price the opportunity cost of labor. Implicit in this argument is the fact that a manager is able to seek and acquire alternative employment so that the opportunity cost of staying longer in the company is positive. Non-compete agreements, a common feature of many MBOs, can be regarded as a way of reducing the opportunity cost of labor and making it more likely that the employee will continue with the firm. To the extent that they are effective, they reduce the value of the employee's option. However, the legality of tight non-compete agreements is in question in the courts.

A company financing and arranging MBOs is therefore confronted with an arbitrage opportunity. An optimal strategy is to purchase the majority of stocks of a firm at market value and resell to the management, who are willing to pay a higher price because of the option-like structure built in by a deferred payment contract.

Let the return net of payment on a stock at a market price p be $\mathrm{E}_s R_1 = \mathrm{E}_s v_s - p$, where v_s is the asset return in the future. The management which is willing to purchase the stock at p will continue working in the firm if and only if $v_s - p > c$ for some $s \in S$. Otherwise, it will leave the firm and acquire alternative employment with opportunity cost c. Therefore the expected return for the management on the stock is $\mathrm{E}_s R_2 = \mathrm{E}_s \max(v_s - p, c)$.

Proposition 2. Stock in a company has a value to its management in excess of its market value. Formally, given an asset price p, then $\mathrm{E}_s R_2 > \mathrm{E}_s R_1$ provided that there exists an s such that $v_s - p < c$.

This follows immediately from Theorem 1.

Therefore an intermediary in an MBO can purchase the stock at p and resell it to the management at a price $p_2 > p$. In so doing, of course, it faces a risk. The management is purchasing the stock by working in the company. If the state of the world is such that the company is not sufficiently profitable for managers to wish to continue in it, then they cannot be forced to do so (because contracts for the supply of labor are unenforceable) and can renege on their part in the deal.

Our analysis suggests a motive for MBOs not previously noted. The reallocation of equity from shareholders to management is a transfer to those who, because of the terms on which they purchase it, value it more highly. The analysis also suggests that prices paid by employees for their companies, sometimes while they are in reorganization under chapter 11 of the bankruptcy code, may have been more rational than hitherto supposed. The prices paid have often been high by conventional standards, both in terms of market value and in terms of the risks employees have assumed through the financing structure. Their willingness to assume these risks was a contributing factor to the growth of the junk bond market. On occasions the prices paid have been rationalized because of the importance to the employees of preserving their jobs: this is in fact our argument from another perspective. A job, as we have remarked above, is a put option. So reference to the importance of preserving a job is saying that there is an option value to be taken into account.

3.3. *Asset-backed loans*

Asset backed loans are characterized by the sequential payment scheme designed in Section 2. An economic agent may select not to honor his or her contract in an unfavorable state and default on payments thereafter. If she or he does so, then s/he is forfeiting the asset by which the contract is backed. In particular, an investor may choose to default on a mortgage and surrender the asset altogether if the equity in the asset is negative. So, for example, if an investor borrows \$1 million to purchase a building, and the value of the building falls below \$1 million, it may be rational to transfer the building to the lender in cancellation of the debt. The mortgage contract providing finance for the building once again has an option-like structure caused by the sequential payment scheme that characterizes it. The buyer has the right to continue owning the building in exchange for making payments on the loans, but not the obligation to do so. When the loan is secured only on the property mortgaged, a standard case, then the creditor cannot touch other assets or endowments of the investor.

Let us consider a two-period time structure as in Section 2. Suppose a purchase of a building is financed by a mortgage in the amount of M. A fraction λ of the mortgage will be paid at $t = 0$ and the rest at $t = 2$ after uncertainty about the value of the building has been resolved. Let the value of the building be v_s. The market return of the project financed by the mortgage is $R_1 = \mathrm{E}_s v_s - M$. However, the return on the investment to the agent who is able to renege on his promise to repay the mortgage is $R_2 = -\lambda M + \mathrm{E}_s \max[v_s - (1-\lambda)M, 0]$. Using Theorem 1, $R_2 > R_1$.

An immediate conclusion is that mortgages are under-priced in the primary market as long as their option-like structure is not taken into account. This follows from the corollary of Section 2. Normally, they are priced under payment scheme 1 without incorporating the possibility of default on subsequent payments. This possibility raises their value because of the option-like structure. While this may not be important to holders of mortgages on their principal residences, it is undoubtedly a real option for owners of mortgage-financed second houses or real estate development projects. Press reports on the S&L crisis mentioned many cases of borrowers who had turned over to the S&L property bought with a loan currently greatly in excess of its market value, in cancellation of their debt. Similar observations can be made about any asset-backed loans. A related issue arises with mortgage-backed securities such as Ginny Maes and Fanny Maes: the underlying mortgage contracts give the borrower the right but not the obligation to make a continuing stream of payments, as prepayment of the mortgage principal is normally allowed in mortgage contracts. This option on the part of the borrower is normally factored into the price of a mortgage-backed security.

The same principle applies for shipping investments. A ship owner funds investment primarily from loans which are backed by the ship itself. In turn, the owner insures the fleet. If a vessel sinks, accidentally or otherwise, then the owner no longer has to make payments on it. The possibility of 'loss', plus insurance, therefore introduces an option-like structure into the contract for payment for the vessel. However, when multiple vessel losses occur simultaneously (as has been the case recently) the insurance payments are not sufficient to cover the loans and many insurance groups default. The vessel owner no longer has an option vis-à-vis the payments.

4. Conclusions and extensions

The wedge that is introduced between market value, and value to the owners, depends upon the option-like structure of the terms on which the assets are purchased. The option-like structure is caused by the sequential payment scheme of asset-backed securities, or by the inalienability of labor in the case of MBOs and compensation packages of employees. The option-like structure is the only cause of the value differential: our argument does not rely on an asymmetry of information between management and market investors, nor does it rely on transactions costs. We suggest that this phenomenon is far more general than the examples given and pertains to all cases in which institutional or legal rigidities exist.

The phenomenon studied here is really a general equilibrium phenomenon relating to the endogenous valuation of assets. In particular, the opportunity cost of labor as well as the values of assets that back securities should all be endogenously determined. Securities that have the previous option-like structure will play a role in determining these values. As a specific example, the introduction of a mortgage market in general equilibrium influences the value of land and real estate. Furthermore, the introduction of mortgages and mortgage-backed assets alters the set of possible states, i.e. the state space, and causes endogenous economic uncertainty. This is uncertainty about possible defaults on the part of an agent with an option-like contract. The general phenomenon of endogenous uncertainty has been studied in different contexts by Chichilnisky and Wu (1991), Chichilnisky et al. (1991, 1992), Hahn (1991), Henrotte (1992) and Kurz (1974, 1994).

In a general equilibrium framework with incomplete markets, default can be explained as a phenomenon stemming from optimizing choices by agents. This line of research has been undertaken by Dubey et al. (1989). Failure to repay debts or honor contracts is penalized according to a default parameter which enters directly the utility functions of agents, and default becomes an equilibrium phenomenon.

In contrast, the incomplete markets literature has not generally addressed default in economies where uncertainty depends on economic behavior. The only exception is the work of Chichilniksy and Wu (1991), referred to in the introduction. They provide a model in which financial innovation directly produces further uncertainty and prevents the completion of the markets. Central to their analysis is the endogenous generation of uncertainty caused by default.

There are also several implications of our present analysis for the study of default in a general equilibrium world in the presence of these option-like assets. The point is that unless slavery is permitted, one cannot oblige labor to perform the services promised in a contract. For instance, if Mr. A agrees with a gardener to mow his lawn in the future, then he cannot bind the gardener to honor the contract. Alternatively, an investor who finances a company cannot force an entrepreneur to implement the work plan agreed. Consequently, default might arise as a result of the inalienability of the entrepreneur's labor. In addition, endogenous economic uncertainty is introduced since assets whose dividends depend on the extent and effectiveness of labor participation increase the number of states. Specifically, assets of that type generate two additional states of nature, one in which the contract is honored and another in which the contract is not honored and default occurs.

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References

Black, F. and M. Scholes, 1973, The pricing of options and corporate liabilities, Journal of Political Economy 81, 637–659.

Chichilnisky, G., J. Dutta and G.M. Hela, 1991, Price uncertainty and derivative securities in general equilibrium, Columbia Business School Working Paper.

Chichilnisky, G., F.H. Hahn and G.M. Heal, 1992, Price uncertainty and incomplete markets, Columbia Business School Working Paper.

Chichilnisky, G. and H.M. Wu, 1991, Individual risk and endogenous uncertainty in incomplete asset markets, Discussion Paper, Columbia University Department of Economics and Stanford Institute for Theoretical Economics.

Chichilnisky, G., G.M. Heal and D.P. Tsomocos, 1993, Corporate financial policy and inalienability of labor: An incomplete markets approach with endogenous uncertainty, Working Paper.

Dubey, P., J. Geanakopolos and M. Shubik, 1989, Default and efficiency in a general equilibrium model with incomplete markets, C.F.D.P. 879R.

Hahn, F.H., 1991, A remark on incomplete market equilibrium, Paper circulated at Stanford Institute for Theoretical Economics.

Henrotte, P., 1992, Existence and optimality of equilibrium in markets with tradeable derivative securities, Technical Report 48, Stanford Institute for Theoretical Economics.

Kurz, M., 1974, The Kesten–Stigum model and the treatment of uncertainty in equilibrium theory, in: M.S. Balch et al., eds., Essays on economic behavior under uncertainty (North-Holland).

Kurz, M., 1994, On the structure and diversity of rational beliefs, Economic Theory, 4, 877–900.

Meyers, S.C., 1977, Determinants of corporate borrowing, Journal of Financial Economics 5, 147–175.

Meyers, S.C., 1984, Finance theory and financial strategy, Interfaces 14, no. 1, 126–137.

Trigeorgis, L. and S.P. Mason, 1987, Valuing managerial flexibility, Midland Corporate Finance Journal 5, 14–21.