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The Cost of Risky Debt in Cooperatives

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Abstract

This article values the debt of an input cooperative that procures a single commodity from farmers and then processes and markets the output, and an otherwise identical firm structured as an investor-owned firm (IOF) using the Black-Scholes option pricing model. The major conclusion of this article is that a cooperative can be designed to be safer for lenders, which implies a lower cost of debt, than an otherwise identical firm structured as an IOF. This conclusion is a logical consequence of the difference between the residual claims of the owners of cooperatives and of IOFs.

Key words Cooperative, Option pricing

Introduction

The Black-Scholes (1973) option pricing model has been applied to the pricing of corporate debt (Merton 1974) in an investor-owned firm (IOF), but not to the pricing of debt in a cooperative. This article applies the option pricing model to a cooperative. The important conclusion of this article is that a cooperative can be designed to be safer for lenders, which implies a lower cost of debt, than an otherwise identical firm structured as an IOF. This conclusion is a logical consequence of the difference between the residual claims of the owners of cooperatives and of IOFs.

My analysis will assume perfect capital markets and a firm that works for a single period. The first assumption enables the use of asset-pricing models that are standard in IOF literature: the Black-Scholes option pricing model and the capital asset pricing model (CAPM)[a]. The second assumption is for expository convenience: valuation of debt in a multi-period framework requires use of compound option pricing models that will needlessly complicate the core argument used here. I will, where necessary, invoke Indian cooperative legislation; however, the conclusions will have applicability beyond India.

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[a] The CAPM was developed independently by several authors. See Copeland, Weston, and Shastri (2005, pp.147-152) for proof and citations. The CAPM relates the expected return of a security 'r_i' to the expected return on the market 'r_M' and the risk-free rate 'r' as follows:
$r_i = r + (r_M - r)*\beta_i$ where 'β_i' is the systematic risk of security 'i'.

Option pricing models have previously been applied to the investment decision in cooperatives – the "real options approach" (Sporleder and Bailey 2001). This article applies option pricing to the capital structure decision in cooperatives. Pederson (1998), Umarov (2002), Srinivasan and Phansalkar (2003), Lerman and Parliament (1990), Parliament and Lerman (1993), and Russo et al. (2001) cover applications of related issues (cost of capital, valuation, and leverage) to the cooperative context. In the valuation of a cooperative, one approach is to adopt the corporate finance methodology and to isolate and value the "equity" component of the residual claim. For instance, a cooperative is first converted into an equivalent IOF (Umarov 2002) by assuming that the cooperative pays a market price for inputs, as an initial step in valuation. This conversion results in the cooperative's operating margin being comparable to that of industry and allows the use of benchmarks derived from corporate financial statements. These benchmarks are used to derive the cost of debt from corporate credit ratings and default spreads. My paper will offer an alternative to this approach.

Given that cooperatives come in many different flavors, I focus on an agricultural marketing firm that procures a single commodity (such as wheat) from farmers and then processes and markets the output as the core business that can be organized legally either as an IOF or as a cooperative. Organized as an IOF, the owners are the suppliers of equity. Organized as a cooperative, the owners are the member-farmers of the cooperative who supply the single commodity. Hansmann (1996, pp. 11-23) defines ownership by two sets of rights: formal control rights and the rights to residual earnings. In this article, the right to residual earnings (residual claim) is viewed as the central difference between an IOF and a cooperative, with formal control rights ignored.

In general, the residual claim in an IOF is vested with capital suppliers; whereas the residual claim in a cooperative can be vested with input suppliers (as in this article), with output purchasers (for example with farmers who buy fertilizer from a cooperative), or with suppliers of labor in an employee-managed cooperative. Usually (although not necessarily so) cooperative residual claimants, such as input suppliers, also bring in equity capital.

The difference between the residual claims of the two forms of organization can be understood in terms of end-of-period surplus distribution. Continuing with the marketing firm example, I assume that the commodity is procured and sold during a period. In the case of an IOF, any end-of-period surplus is either distributed to equity holders as dividends or retained on their behalf with the firm. An IOF may also make during-the-period distributions to residual claimants in the form of interim dividends. Such interim dividends are effectively "advances" in that they can be recovered from equity holders if the end-of-year surplus is inadequate.

Cooperatives can be classified (Cobia 1989) as "pooling" or "cost of goods sold – COGS". In the case of a pooling cooperative, interim payments can be made to input suppliers as a tentative price for supply. The period-end surplus can be distributed (either as a price bonus on supply or dividend on equity) or retained. In this context, the tentative price paid by a cooperative is an "advance", legally at par with "interim dividends" paid to equity holders by an IOF. This price can be recovered, in part or in full, if the year-end surplus is inadequate. In the COGS cooperative, the during-the-year payment is an "expense" legally at par with payments to outsiders (such as suppliers of consumables).

Other institutional features such as control rights (Hart and Moore 1998) that may be used to differentiate cooperatives and IOFs will not be dealt with in this paper. Issues relating to the cooperative form such as that of open or closed membership are finessed, as are issues of retained patronage distribution or transferable delivery rights (Moore and Noel 1995). Property rights issues in multi-period cooperatives, such as those analyzed in Jensen and Meckling (1979), will also be ignored (with a single period, no free-rider or horizon problems occur.) The debate between traditional and new generation cooperatives (Russo and Sabbatini 2005) is also immaterial here. These simplifications help me focus on the core issue addressed here: that the nature of residual claims that distinguishes a cooperative from an IOF alters the risk and therefore the cost of debt.

The rest of the article is organized as follows. The first section reviews the application of option pricing to the valuation of IOF debt. Subsequently, debt and owner claims in a cooperative are valued in an option pricing framework. A numerical illustration is then provided. The final section concludes the article.

Option Pricing Valuation of Risky Debt in the Investor-owned Firm

The standard option pricing model for valuing IOF debt (Merton 1974; Smith, 1979), makes the following assumptions:

The IOF has only two claims outstanding: zero-coupon unsecured debt with maturity (face) value 'F' maturing at the end of the period 'T', and equity that pays no dividend during this period. The equity is characterized by limited liability. No transaction costs are present, and the total value of the firm 'V' is unaffected by capital structure (the Modigliani-Miller (1958) theorem of capital structure irrelevance holds). A known constant risk-free rate 'r' exists. Finally, the underlying source of uncertainty is the firm's market value, which is log-normally distributed with standard deviation 'σ'.

With these assumptions, the valuation of debt in an IOF is a straight forward application of the Black-Scholes option pricing model (see Whaley 2006, pp. 419-424). Equity holders have an European call option on the value of the firm with an exercise price ‘F’, and the market value of equity ‘E’ is given by (1a) below:

$$E = V*N(d_1) - F*e^{rT}*N(d_2), \quad (1a)$$

where $d_1 = [\ln(V*e^{rT}/F) + 0.5*\sigma^2*T]/(\sigma* T^{0.5})$, $d_2 = d_1 - \sigma*T^{0.5}$; and N(.) is the cumulative distribution of a unit (with mean 0 and variance 1) normal variable.

The market value of debt ‘D’ is given by equation (1b) below:

$$D = V - E. \quad (1b)$$

Given the expected return of the firm ‘r_V’, the expected risk adjusted rates of return (RADRs) of equity (r_E) and of debt (r_D) of the IOF can be found as follows (see Whaley 2006, pp. 433-435):

$$r_E = r + (r_V - r)*\eta_E, \quad (2)$$

where the elasticity of equity with respect to firm value is given by $\eta_E = \Delta_E*V/E$; with the option delta of equity $\Delta_E = N(d_1)$.

$$r_D = r + (r_V - r)*\eta_D, \quad (3)$$

where the elasticity of debt with respect to firm value is given by $\eta_D = \Delta_D*V/D$; with the option delta of debt $\Delta_D = 1 - N(d_1) = N(-d_1)$.

These expected return equations assume that the continuous time CAPM assumptions (Merton 1973) hold[b].

Note that the focus of this debt valuation model is on apportioning the market value of the firm between the lenders and the residual claimants (the equity holders in an IOF). This market value itself reflects the net value (present value of revenue streams less the present value of expense streams). Implicit in this model is therefore the assumption either that cash operating expenses are settled in cash immediately (leaving no unsecured trade credit) or that such cash operating expenses have a higher priority than debt. The market value after netting off the present value of expenses from the present value of revenues is the “cake” available for distribution amongst lenders and residual claimants. I will assume throughout that the first explanation above, that all expenses (fixed and

[b] The Black-Scholes option pricing model and the CAPM yield consistent valuations when applied in the context of corporate liabilities – debt and equity. The results are also consistent with the Modigliani-Miller capital irrelevance proposition in a no-tax world (Copeland, Weston and Shastri 2005, pp. 581-587).

variable) are paid in cash immediately as and when incurred with no trade credit outstanding.

Risky Debt in the Cooperative and the Investor-Owned Firm

The assumptions below are intended to formalize the central difference between the IOF and cooperative (the residual claim) in "no-fat" models amenable to analysis. The assumptions for IOF are first stated, with modifications for each type of cooperative.

The Investor-Owned Firm

The IOF operates in a perfect capital market (Copeland, Weston and Shastri 2005, pp. 353-354) where assumptions of continuous time CAPM and Black-Scholes hold. The IOF has no corporate or personal taxes. No transaction costs exist, specifically agency costs are absent, and the IOF and cooperative have identical efficiencies. The IOF owner equity has limited liability and pays no dividend. The IOF operates for a single period. Additional assumptions listed below cover initial capital investment and salvage value; operations (revenues, variable cost, and fixed cost); and surplus distribution.

At time t=0, an investment 'I' in fixed assets is made; financed partly by zero-coupon debt with market value 'D' (maturing at t=1 with maturity value 'F'), with the remaining finance provided by the owners. Fixed assets have zero salvage value at t=1 (this assumption is only to simplify analysis).

A specific quantity of a single homogeneous commodity[c] is procured and sold in this single period. In practice, homogeneity can be taken care of by quality adjustments as in Jermolowicz, (1999): "Each producer-participant is paid the average price received for all product of like quality delivered during the duration of the pool. A member's share of the pool proceeds is determined by the volume of product contributed and may be adjusted for either premiums or discounts related to quality differences."

The underlying source of firm value uncertainty is the value[d] of the revenue stream which is log-normally distributed with standard deviation 'σ_{REV}'. As elaborated below, this assumption ensures that the firm value volatility satisfies the Black-Scholes requirement. The revenue stream also has systematic risk 'β_{REV}' and present value PV(REV).

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[c] Homogeneity ensures that I am effectively dealing with a single commodity (two grades of wheat, for instance would needlessly complicate analysis and not make a material change to my conclusions.)

[d] Since the quantity of commodity is fixed, the driver of the volatility and systematic risk of the revenue stream is state-contingent unit selling price.

The IOF pays commodity suppliers a constant fraction 'vc' of the state-contingent revenue realized, which is the only variable cost. Therefore, the systematic risk (beta) of the variable cost stream β_{VC} is equal to that of the revenue stream, and the present value of this stream, PV(VC) = vc*PV(REV).

The net cash flows (revenue less variable cost) will cover fixed costs 'FC' in all states of the world[e]. Thus, fixed costs can be discounted at the risk-free rate and have a present value PV(FC). The fixed cost proportion 'fc' is defined as fc = PV(FC)/PV(REV).

This revenue and cost structure results in a firm with value V = PV(REV) – vc*PV(REV) – PV(FC), which is the value available for distribution between the lender and the residual claimant. Since the volatility of the revenue stream was assumed to satisfy the Black-Scholes log-normality condition, the volatility[f] of firm value 'σ_V' in equation (4) will also satisfy the Black-Scholes log-normality condition:

$$\sigma_V = \sigma_{REV}/\{1 - fc/(1 - vc)\}. \quad (4)$$

The unlevered firm has systematic operating risk[g] given by:

$$\beta_V = \beta_{REV} /\{1 - fc/(1 - vc)\}. \quad (5)$$

Depending on the surplus thus available, lenders are paid in part or full at t=1. Any residual is paid to equity holders, at period-end, and the present value of the owner claim is E.

The Pooling Cooperative

Pooling cooperative members join at time t=0, and provide any initial equity in proportion to their expected patronage (supply of the commodity). This assumption ensures complete alignment of interest between members in their roles of suppliers of capital and suppliers of the commodity. For convenience, I assume that any payments/surplus distribution to cooperative members is made in proportion to the commodity supply (ignoring equity investments). Given the assumption of equity-commodity supply alignment, no loss of generality occurs

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[e] If net cash flow is not positive in all states of the world, then fixed cost may be in "default". This eventuality can be handled by treating it as an option, but the resulting complexity will detract from exposition.

[f] The firm value V = PV(REV) - vc*PV(REV) - PV(FC). The firm is a portfolio with a long position in an asset with value (1-vc)*PV(REV) and volatility σ_{REV}, and short in an asset with value PV(FC) that has zero-volatility and has zero-covariance with the first asset (both follow because fixed costs are risk-free). Thus the portfolio volatility $\sigma_V = \{(1 - vc)*PV(REV)\}/\{(1 - vc)*PV(REV) - PV(FC)\}* \sigma_{REV}$, which simplifies to the equation in the text.

[g] The systematic risk (β_V) of the unlevered IOF is a weighted-average of the systematic risks of the revenue, variable cost and fixed operating cost streams, and is given by: $\beta_V = \beta_{REV}*PV(REV)/V - vc*\beta_{REV}*PV(REV)/V - 0*PV(FC)/V$, which simplifies to the equation in the text.

on account of this assumption. Revenues are realized, and fixed costs serviced, as with the IOF. The owner claims have limited liability.[h] No advance payments are made to members (the equivalent of no dividends in the IOF).

This revenue and cost structure results in a firm with value V' = PV(REV) – PV(FC). Note that firm value for option pricing is defined (analogous to the IOF definition) as the value available for apportioning between lenders and the residual claimants. A note of caution: this firm value will be higher for cooperatives compared to IOFs since the contractual relation with the member (who provides both the commodity and equity capital) results in a larger residual claim. This result in itself should not be interpreted as the cooperative being more valuable than the IOF.As before, the volatility[i] of firm value 'σ_V'' satisfies the Black-Scholes log-normality condition:

$$\sigma_{V'} = \sigma_{REV}/\{1 - fc\}. \qquad (6)$$

The unlevered firm has systematic operating risk[j] given by:

$$\beta_{V'} = \beta_{REV}/\{1 - fc\}. \qquad (7)$$

Depending on the surplus thus available, lenders are paid in part or full at t=1. Cooperative members receive a state-contingent, end-of-period (t=1) distribution of the residual with a present value of E', referred to as owner claims.

The Cost-of-Goods-Sold Cooperative

The COGS cooperative is structured identically to the pooling cooperative except that members receive a fraction 'pp' of the revenue as a pre-emptive payoff[k] during the period, such that fixed costs are paid in full as described previously. Other than the pre-emptive payoff, no advance payments are made to members.

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[h] While the Raifeissen cooperatives (which inspired Indian cooperatives) traditionally had unlimited liability, most cooperatives in India function with limited liability. In fact, the Indian Multi-State Cooperative Act 2002 makes limited liability compulsory: Section 16 states that "No multi-state cooperative society with unlimited liability shall be registered after the commencement of this Act." Other Indian cooperative acts provide a choice between limited and unlimited liability. Indian cooperative legislation is available at: http://www.cdf-sahavikasa.net/show-page.php?page_id=13 (last accessed November 30, 2009).

[i] The value of the pooling cooperative V'= PV(REV) – PV(FC). Thus the portfolio volatility $\sigma_{V'}$= PV(REV)/{PV(REV) – PV(FC)}* σ_{REV}, which simplifies to the equation in the text.

[j] The systematic risk of the unlevered pooling cooperative ($\beta_{V'}$) is given by: $\beta_{V'}$*{PV(REV) - PV(FC)}/V'= β_{REV}*PV(REV)/V'- 0*PV(FC)/V', which simplifies to the equation in the text.

[k] Commodity cooperatives in India with sizeable market shares such as in milk or sugar are effectively COGS cooperatives, although they are pooling cooperatives if one were to strictly interpret legislation.

This revenue and cost structure results in a firm with value V" = PV(REV) – pp*PV(REV) – PV(FC), which is the value available for apportioning between lenders and the residual claimants. This definition recognizes that the cooperative members have two legally distinct relationships with the firm: as recipients of the pre-emptive payoff and as residual claimants. The volatility of the firm value '$\sigma_{V''}$' satisfies the Black-Scholes log-normality condition:

$$\sigma_{V''} = \sigma_{REV}/\{1 - fc/(1 - pp)\}. \qquad (8)$$

The unlevered firm has systematic operating risk given by:

$$\beta_{V''} = \beta_{REV} /\{1 - fc/(1 - pp)\}. \qquad (9)$$

Depending on the surplus thus available, lenders are paid in part or full at t=1. Cooperative members receive a state-contingent, end-of-period (t=1) distribution of the residual with a present value of E", referred to as owner claims.

The equations for expected rates of return of cooperative owner claims and cost of debt follow from the corresponding IOF equations. Table 1 summarizes valuations in IOF and cooperatives.

Table 1: Firm valuations, volatilities and systematic risks

	Firm value	**Volatility of firm value**	**Systematic risk of unlevered firm**
IOF	V=PV(REV)*(1-vc) –PV(FC)	$\sigma_V = \sigma_{REV}/\{1-fc/(1-vc)\}$	$\beta_V = \beta_{REV} /\{1-fc/(1-vc)\}$
Pooling Cooperative	V'=PV(REV) -PV(FC)	$\sigma_{V'} = \sigma_{REV}/\{1-fc\}$	$\beta_{V'} = \beta_{REV}/\{1-fc\}$
COGS Cooperative	V"=PV(REV)*(1-pp) –PV(FC)	$\sigma_{V''} = \sigma_{REV}/\{1-fc/(1-pp)\}$	$\beta_{V''} = \beta_{REV} /\{1-fc/(1-pp)\}$

The following conclusion can be drawn from table 1:If the fixed cost proportion fc=o, then all organization forms have identical volatilities of firm value and identical systematic risks of the unlevered firm. However, in general for positive variable cost, the IOF will have lower firm value (for option pricing) than the pooling cooperative (V < V'). The implication from equations (1a, 1b, 2 & 3) is that for a given face value of debt; the IOF will have a lower market value of debt, a higher cost of debt, and a higher cost of equity than the pooling cooperative (D<D', $r_D > r_{D'}$, and $r_E > r_{E'}$).

This relationship will also hold good between the IOF and the COGS cooperative as long as the pre-emptive payoff fraction ‘pp’ is lower than the variable cost fraction ‘vc’ of an IOF. The values of debt, cost of debt, and cost of equity of a COGS cooperative will lie between the corresponding values of an IOF and a pooling coop.

If the fixed cost proportion is non-zero and satisfies the assumption stated earlier that net cash flows adequately cover fixed costs, then the volatility of firm value and systematic risk of the unlevered firm of the IOF will be higher than the corresponding pooling cooperative values. Again as earlier, for a given face value, the IOF will have a lower market value of debt, a higher cost of debt, and a higher cost of equity than the pooling cooperative. Value and RADR differences will be magnified in the presence of fixed cost.

The presence of risky fixed costs will not alter the underlying logic, and can be handled computationally by treating fixed costs as risky claim senior to debt (Smith 1979).

Numerical Illustration of Risky Debt

Two numerical illustrations are provided. In the first, the costs of debt (for the IOF, pooling cooperative, and COGS cooperative) for a given maturity value of zero-coupon debt are compared. The second illustration extends this comparison to various levels of debt market value.

Cost of Debt for Given Maturity Value of Debt

A comparison of the cost of debt for a given maturity value of debt for various firm forms is shown in table 2 for a set of hypothetical assumptions. With these assumptions, first the value of the firm can be calculated; and then based on this, the volatility, systematic risk, and RADR of the unlevered firm can be determined. The table also shows the intermediate delta and elasticity values.

IOF debt has a risk-premium of 108 basis points while pooling cooperative debt is still risk free (at second decimal place). The COGS cooperative debt has a risk premium of 51 basis points. In absolute terms, the pooling cooperative debt is worth 4.15 more (57.07 – 52.92) than IOF debt, which is the value provided by cooperative owners to lenders. Thus, the wealth of cooperative owners is 4.15 less than the combined wealth of equity holders and input suppliers of an otherwise identical IOF. This wealth shift to lenders in a pooling cooperative is the direct consequence of input suppliers in the cooperative becoming junior claimants to lenders, making their claims less risky and, therefore, more valuable.

Table 2: Valuation of investor-owned firm and cooperatives with the same debt maturity value

	Volatility	**Unlevered Firm Systematic Risk**	**Value**	**Delta**	**Elasticity**	**RADR**
Investor-owned Firm						
Firm V	***60.00%***	***0.7500***	***100.00***			***10.25%***
Equity E	113.62%		47.08	89.15%	189.37%	14.94%
Debt D	12.30%		52.92	10.85%	20.50%	6.08%
Pooling Cooperative						
Firm V'	***44.44%***	***0.5556***	***450.00***			***8.89%***
Owner Claims E'	50.90%		392.93	100.00 %	114.53%	9.45%
Debt D'	0.00%		57.07	0.00%	0.00%	5.00%
Cost-of-goods-sold Cooperative						
Firm V"	***56.00%***	***0.7000***	***125.00***			***9.90%***
Owner Claims E"	95.88%		69.61	95.35%	171.22%	13.39%
Debt D"	5.87%		55.39	4.65%	10.49%	5.51%

RADR: Risk-adjusted Discount Rate

Market assumptions: Expected return on market 12%, and risk-free rate 5%

IOF assumptions: Present value of revenue 500, volatility of revenue 40%, systematic risk of revenue 0.50, variable cost proportion 70%, fixed cost proportion 10%, time =1 period, debt face (maturity) value 60

COGS Cooperative assumption: Pre-emptive payoff proportion 65%

Calculations: Firm value and volatility from table 1; firm RADR from systematic risk in table 1; equity values and debt value from equations (1a) and (1b) respectively; equity and debt RADRs; deltas and elasticities from equations (2) and (3) and related text below these equations

The COGS cooperative debt is worth 0.47 more (55.39 – 52.92) than the IOF debt. The pre-emptive payoff to owners makes lenders’ position riskier than in a pooling cooperative. However, with a pre-emptive payoff lower than the variable cost, the COGS firm is less risky for lenders than the IOF.

Table 2 also provides the RADR of owner claims in various firm forms. Given the perfect market assumption, the totality of value available for distribution to all claimants is the same for all firm forms, and is given by PV(REV). Of this value, fixed cost claimants receive the same amount PV(FC) in all forms. However as a consequence of the structure of residual claims, the value received by other claimants, and the appropriate risk, will differ across organizational forms. Specifically, the RADR of owner claims reflects the risk to the residual claimants in different organizational forms, and is the appropriate discount rate for valuing cash-flows to residual claimants.

Leverage and the Cost of Debt

Table 3 shows debt and equity values and RADRs of debt and equity for IOF and cooperative for various leverages. Leverage here is defined as the market value of debt divided by the value of the firm (as defined in table 1). For a given market value of debt, the cost of debt in a pooling cooperative is lower than the cost of debt in an IOF. Again, the cost of debt in a pooling cooperative with a given leverage is lower than the cost of debt in an IOF with the same leverage. In both relationships, the COGS cooperative has values between the pooling cooperative and the IOF.

Table 3: Leverage and valuation of investor-owned firm and cooperatives

	IOF			**Pooling Cooperative**			**COGS Cooperative**		
D	L	$\mathbf{r_d}$	$\mathbf{r_e}$	**L'**	r'_d	r'_e	**L"**	$\mathbf{r''_d}$	r''_e
0.00	0.00%	5.00%	10.25%	0.00	5.00%	8.89%	0.00	5.00%	9.90%
10.00	10.00%	5.00%	10.83%	0.02	5.00%	8.98%	0.08	5.00%	10.33%
20.00	20.00%	5.04%	11.55%	0.04	5.00%	9.07%	0.16	5.01%	10.83%
30.00	30.00%	5.19%	12.42%	0.07	5.00%	9.17%	0.24	5.05%	11.43%
40.00	40.00%	5.49%	13.42%	0.09	5.00%	9.27%	0.32	5.16%	12.12%
50.00	50.00%	5.93%	14.57%	0.11	5.00%	9.37%	0.40	5.37%	12.92%
60.00	60.00%	6.48%	15.91%	0.13	5.00%	9.49%	0.48	5.66%	13.81%
70.00	70.00%	7.14%	17.51%	0.16	5.00%	9.60%	0.56	6.03%	14.82%
80.00	80.00%	7.92%	19.56%	0.18	5.00%	9.73%	0.64	6.48%	15.98%

L (L' and L") leverage, D (D' and D'') value of debt, r_d (r'_d and r'_d) RADR of debt, r_e (r'_e and r'_e) RADR of equity (owner claims) in IOF (Pooling Cooperative and COGS Cooperative) respectively

Conclusion

This paper examines the central economic difference between a cooperative and an IOF and yields a major conclusion: that a cooperative can be designed to have lower risk to lenders than an IOF. This conclusion occurs because there may be states of the world in which for a given debt maturity value, debt payments in an IOF may be in default, with debt payments in a cooperative either being serviced fully or at lower levels of default. While a pooling cooperative will always have a lower cost of debt than an IOF, a COGS coop will have a lower cost of debt provided that the pre-emptive payoff is lower than the variable cost of an IOF. Operationally, this conclusion implies that a COGS cooperative can use a higher level of debt than an IOF with the cost of debt remaining the same, if it can assure lenders (say through a debt covenant) that the pre-emptive payoff will be capped. For instance, table 3 shows that debt with a market value of 80 in a COGS cooperative (with a pre-emptive payoff proportion of 65%) has the same cost (6.48%) as debt with a market value of 60 in an IOF (with a variable cost proportion of 70%).

This paper has three subsidiary implications:

1. Recognition that the value of the firm, as the value available for apportionment between lenders and residual claimants, results in a value for a cooperative that is different from traditional finance definition of debt plus equity

2. Following from implication 1, the leverage of a cooperative firm defined as the proportion of debt to such firm value will differ from leverages obtained using the IOF definition of debt to debt plus equity.

3. The appropriate RADR for owner claims is given by equation (2).

The implications of this paper for practice and research are that standard tools of corporate finance need adaptation before their application in the cooperative context. For instance, research on leverage in cooperatives[1] that uses the traditional IOF leverage definition will be valid in a COGS cooperative with a pre-emptive payoff that is not very different from an IOF's variable cost. However, in a pooling cooperative, or in a COGS with lower (or higher) pre-emptive payoff, the definition of leverage in (2) above may better capture the construct of indebtedness.

The protocols used in this paper would give cooperative lenders a different value from what Umarov obtains. The position here is that, in general, rather than convert a cooperative into an equivalent IOF by treating purchases from

[1] Such as Lerman and Parliament (1990), Parliament and Lerman (1993), and Russo et al. (2001)

cooperative members as "payment to outsiders"; the residual cash flows to members should be valued at the owners' RADR.

The application of Black-Scholes to the valuation of IOF debt and other corporate liabilities (see chapter 12 of Whaley 2006) is now an accepted part of a practitioner's toolkit, despite the somewhat onerous assumptions. This paper has assumed that corresponding assumptions can be made in a cooperative. A second limitation of this paper is that it has used a single-period model. A multiple-period model involving debt with periodic interest payment would be much less tractable, involving the valuation of compound options. However, such a model would not alter the core conclusion, that a cooperative can be designed to be less risky to lenders.

Clearly, this assumption implies that members take more risk, especially in a pooling cooperative. While pooling cooperatives do exist (US examples can be found in Jermolowicz 1999), many processing cooperatives have chosen to reduce risk to members by not structuring themselves in this fashion.

In the Indian context, lender practices are strongly influenced by financial analysis appropriate to IOFs[m]. The insights provided in this paper should not only help a cooperative understand its risk better, but also aid the lender to make a more appropriate risk assessment.

References

Black, F. and M. Scholes. 1973, "The Pricing of Options and Corporate Liabilities," *Journal of Finance*, 31: 351-367.

Chesnick, D.S. 2000, "Financial Management and Ratio Analysis for Cooperative Enterprises," USDA RBS Report#175

Cobia, D.W. ed. 1989, *Cooperatives in Agriculture*, Englewood Cliffs, N.J.: Prentice-Hall.

Copeland, T.E., J.F. Weston, and K. Shastri. 2005, *Financial Theory and Corporate Policy*, 4th ed. Boston: Pearson Addison-Wesley.

[m] This situation may be true in the US too. Chesnick (2000) argues that, "In other situations, the loan officer may not have a clear understand of the concept of pooling. The creditor may see low profitability ratios and deny the loan because they do not believe the cooperative can generate enough revenue. But a cooperative operating on a pooling basis may show higher cost of goods sold because of the way margins are distributed at the end of the year." Thus, an accounting treatment may mislead a loan officer into believing that a pooling coop has low profitability and is risky; whereas as argued in this paper, the pooling coop has a lower risk for lenders.

Hart, O. and J. Moore, 1998, "Cooperatives versus Outside Ownership," National Bureau of Economic Research, Working Paper 6421

Hansmann, H. 1996, *The Ownership of Enterprise*, Harvard University Press, Cambridge.

Jensen, M.C. and W.H. Meckling. 1979, "Rights and Production Functions: An Application to Labor-Managed Firms and Co-determination," *Journal of Business*, 52: 469-506.

Jermolowicz, A.A. 1999, "Cooperative Pooling Operations," USDA RBS Report#166.

Lerman, Z. and C. Parliament. 1990, "Comparative Performance of Food-Processing Co-operatives and Investor-owned Firms," *Staff Paper P90-3*, University of Minnesota, Department of Agricultural and Applied Economics.

Merton, R. C. 1973, "An Intertemporal Capital Asset Pricing Model," *Econometrica,* 41 (5): 867-887.

Merton, R.C. 1974, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, 29: 449-470.

Modigliani, F. and M.H. Miller. 1958, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review*, 48: 261-297.

Moore, C. and J. Noel. 1995, "Valuation of Transferable Deliverable Rights for Marketing Cooperatives," *Journal of Cooperatives*, 11: 39-50.

Pederson, G. 1998, "Cost Of Capital for Agricultural Cooperatives," USDA RBS Research Report 163.

Parliament, C. and Lerman, Z. 1993, "Risk and Equity in Agricultural Cooperatives," *Journal of Agricultural Cooperation*, 8: 1-14.

Russo, C. and M. Sabbatini. 2005,"Incentives to Efficient Investment Decisions in Agricultural Cooperatives," *XI International Congress of the European Association of Agricultural Economists*.

Russo, C., D. Witherspoon, C. Peterson, AND M. Sabbatini. 2001, "Effects of Managers' Power on Capital structure: A Study of Italian Agricultural Cooperatives," *International Food and Agribusiness Management Review*, 3: 27-39.

Smith, C. 1979, "Applications of Option Pricing Analysis," *Handbook of Financial Economics*, J.L. Bicksler (ed.) Amsterdam: North Holland.

Sporleder, L.T. and M.D. Bailey. 2001, "Using Real Options to Evaluate Producer Investment in New Generation Cooperatives," Paper presented in the American Agricultural Economics Association Annual Meeting, Chicago.

Srinivasan, R. and S.J. Phansalkar. 2003, "Residual Claims in Cooperatives: Design Issues," *The Annals of Public and Cooperative Economics*, 74, 3: 365-395.

Umarov, A.A. 2002"Equity Valuation in New Generation Cooperatives," *Unpublished Master's Thesis*, North Dakota State University of Agriculture and Applied Sciences.

Whaley, R. 2006, *Derivatives: Markets, Valuation, and Risk Management,* New Jersey: John Wiley.