University Grant Program Research Report

VENTURE CAPITAL FINANCING FOR
TECHNOLOGY-ORIENTED FIRMS

by

James C.T. Mao
Faculty of Commerce
and
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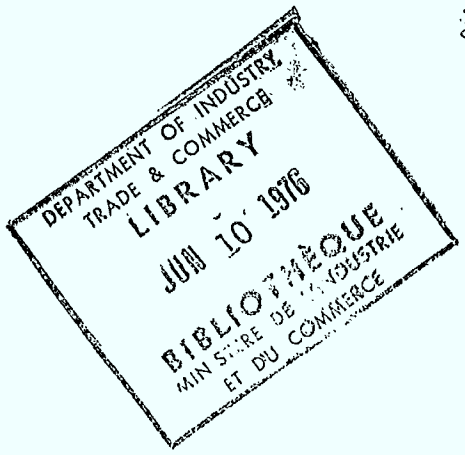
University of British Columbia.
December, 1974

Rapport de recherche sur le Programme de subventions aux universités

Industry, Trade and Commerce
Office of Science and Technology
Ottawa, Canada

Industrie et Commerce
Direction des sciences et de la technologie
Ottawa, Canada



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The views and opinions expressed in this report are those of the author and are not necessarily endorsed by the Department of Industry, Trade and Commerce.

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I

INTRODUCTION

Technological progress is the mainspring of economic growth. The rate at which Canada's economy will grow in the coming years depends largely on how effectively this country promotes the development of technology-oriented firms. Most of these firms, at least in their initial stages of development, are characterized by a high degree of investment risk. They must therefore obtain their financing from venture capitalists who specialize in making such high-risk investments. There is a growing, though still limited, body of literature on this subject, but compared with traditional methods of financing, information is still scarce. For the Canadian entrepreneur, a further problem is that much of the literature on venture capitalism is written by American authors using background material from the United States.

There are, however, two useful studies with Canadian orientation. They are Peter McQuillan and Howard Taylor's Sources of Venture Capital: A Canadian Guide, published by the Department of Industry, Trade and Commerce in 1973, and Russell M. Knight's The Supply of Venture Capital, a working paper published by the University of Western Ontario

in 1971.* Both of these studies have as their primary objective a survey of the sources of venture capital in Canada, to discover the types of investments preferred by venture capitalists, the terms on which funds are available, and the general methods of applying for these funds.

Both McQuillan and Taylor's and Knight's studies contain a wealth of factual information useful to any entrepreneur seeking venture capital. However, before the entrepreneur can decide which source of financing to use, he must be able to calculate the cost to him of any particular package of financing. Neither these two works, nor any other available studies on venture capital, address themselves to this subject. This is where the present study hopes to make a contribution, by showing the entrepreneur the necessary theory for calculating the cost of capital associated with the most commonly used methods of venture capital financing.

We shall not try to duplicate the other two studies, but in order to make this paper somewhat self-contained, we will include a short section on the suppliers of venture capital and their policies--how they operate, what their preferences are, their evaluation criteria, and how to apply for their funds. Following this, we shall take up, in order, the major instruments of venture capital financing: common stock, convertible bonds and exchangeable bonds. In

* There is now available an updated 1973 version.

each case we shall explain the nature of the instrument, typical contractural features, and a model for computing the cost of financing to the firm. Included also will be a short case history illustrating the basic principles of venture capital financing.

Since our theoretical model for determining the cost of capital requires a certain amount of computation, to minimize manual calculating we have written computer programs which can easily be applied by any firm with only minor adaptations. These have been included in an appendix, together with program testing, definition of variables and sample output.

II

OBTAINING VENTURE CAPITAL

What Is Venture Capital?

By venture capital we mean funds willing to take high risks in exchange for high return. All investments involve some degree of risk--even with bonds issued by the strongest corporation there is still the chance of defaulting, and Government of Canada bonds carry a purchasing power risk. In all cases investors must balance risk and return in the selection of investments. What distinguishes a venture capitalist from the typical investor is his preference for projects with a high degree of risk. It is difficult, and we shall not attempt to say, how risky an investment has to be to qualify for the designation, "venture capital financing". We will, however, point out that venture capitalists are engaged in investments whose risk is so great that the return required by these capitalists is usually higher than the range of return normally provided for in credit contracts. They will generally seek participation in the profits of a company on an equity basis, either through direct investments in the company's stock, or indirectly through debt instruments with equity features. When we discuss the instruments of venture capital financing,

therefore, we will exclude straight debt, and focus instead on pure equity or debt with equity features.

Investment Policies of Venture Capitalists

As mentioned above, there are two excellent studies of venture capitalism in Canada, one by McQuillan and Taylor, the other by Knight. As the former is more comprehensive and recent, we shall summarize its major findings.

McQuillan and Taylor include in their study a survey of 151 venture capitalists by P.L. Crane and J.V. Poapst,[1] in which the investment policies of these investors are discussed under the following headings:

(1) Industry preferences. All investors would consider a wide range of industries, with a large majority expressing interest in "general high-technology" industries.

(2) Stages of Companies' Development Accepted. Most investors would finance any stage of a company's development, with the greatest interest expressed in companies that are established but not yet making profits.

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[1] P.L. Crane and J.V. Poapst, "Appendix:" "A Quantitative Study of the Sources of Venture Capital in Canada," Peter McQuillan and Howard Taylor, Sources of Venture Capital: A Canadian Guide (Ottawa: Department of Industry, Trade and Commerce, 1973), pp. 129-47.

(3) Company Location. Most investors would finance companies both in Canada and abroad, but preferred the company to be as close as possible.

(4) Investment Size Sought. The majority preferred making investments in the $100,000 - 500,000 range or larger, but large minorities would consider smaller investments.

(5) Equity Participation Sought. A large majority would accept a minority position, and a smaller one a majority position.

(6) Monitoring Methods. Most venture capitalists would prefer either active representation on the board of directors, or provide regular management consultants.

(7) Skills Sought in and Offered to Companies. A majority of investors sought general management ability, marketing management, and technical research; and large majorities would offer either financial planning, counselling in mergers and acquisitions, or financial management.

(8) Maximum Holding Period. A large percentage preferred a range of four to six years, but the minimum was less than three and the maximum more than 10.

As well, Crane and Poapst survey 86 venture capitalists whose interests were confined to a single industry; however, no details were given.

What the Venture Capitalist Looks for in An Applicant[2,3]

The primary factor the venture capitalist looks for in an applicant is the quality of the management; in particular, the drive, talent and ingenuity of both the president and his associates. As well, he wants to discover the willingness of the company to work closely with the venture capitalists, and its interest in later going public or merging with another firm.

The second is the nature of the product of the company--its potential market, the growth possibilities of the company, and the uniqueness of the product.

The third factor is the financing of the company: the sum needed by the company, its use, the potential profits, the source and time of repayment, collateral, and the expected return on equity capital. Other points considered

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[2]Stanley M. Rubel, Guide to Venture Capital Sources, 1970-71 Edition (Chicago: Capital Publishing Corporation, 1970), pp. 17-18.

[3]S.D. Clark, "Structuring the Financing," Perspectives in Venture Capital (The SBIC Digest Special Issue 72-1, 1972), p. 12.

by the venture capitalist include the company's ability to obtain funds from other sources, and the effect of future growth on his own investment.

In making a decision whether or not to invest, the capitalist has in mind his goals for appreciation of his capital, and balances this against the growth possibilities of the company, together with the risk, attempting to work out a risk-reward ratio.

How to Approach Venture Capitalists[4]

The most important point is to prepare a statement covering all areas of interest to a venture capitalist. These include a history of the project or company, the corporate structure, including securities outstanding and names of majority stockholders, personal resumes of management personnel and key scientists and administrators, a description of the nature of the business in detail, including product lines, sales analyses and evaluation, the company's market, and its financial position, including tangible assets and projections for the future.

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[4]Rubel, pp. 19-24; and Leroy W. Sinclair, ed. Venture Capital (New York: Technimetrics, Inc., 1970), sheet 3, left half.

From there, describe in detail the financing sought, and what it will be used for, estimate possible earning power, profit and loss forecasts for the next two years (with reasons), and finally, include a list of other kinds of assistance that may be needed: accounting, marketing, etc.

With this information, as detailed as possible, the venture capitalist should have the basis for making a decision on the applicant's request.

III

INSTRUMENTS OF FINANCING: COMMON STOCK

There are three major instruments of venture capital financing. These are common stock, convertible bonds and exchangeable bonds. In this section we shall look at common stock, its nature and special features, and from there discuss the method of computing the cost of capital.

Common Stock: Nature and Features

When a group of investors participates in a corporation, it must agree on the apportionment of risk, return and control. Creditors and preferred stockholders have first claim on earnings and assets, but they have no control (except under special circumstances). Common stockholders are residual owners, with various rights relating to their position in the apportionment. We shall now outline those rights.

Earnings: Common stock is attractive to investors because of the residual earnings it is expected to generate. Residual earnings are the net earnings of a firm after all charges (operating expenses, interest charges, preferred dividends, and taxes) have been deducted. When sales are insufficient to meet these charges, residual earnings will be negative; but since most prior charges are fixed in

amount, any increase in sales will yield a disproportionately large increase in residual earnings. Common stockholders thus have the opportunity for maximum profit as well as maximum loss. It is the prospect of maximum profit that induces many investors to run the risk of common-stock investments.

Assets: In the event of liquidation, common stockholders have the right to participate in the pro rata distribution of assets after all prior claims have been met. Common stockholders should be aware of the distinction between the book value and the market value of assets. Book value is the value on the firm's balance sheet; market value is the amount for which the assets can actually be sold. Since book value is based on cost and market value on economic worth, the two need not be identical. When the two values differ, the resulting loss (or profit) is borne entirely by the common stockholders. Since most liquidations occur because assets no longer generate sufficient earnings, liquidation is more like to result in book losses than in book profits. A stockholder may realize a profit if he bought his shares at an average price below the actual liquidation value. Such situations are, however, quite rare.

Control over management: As residual owners, common stockholders have primary control over the management of

a corporation. They exercise this control through the right to vote for directors who oversee the operating management. It is the responsibility of the directors to set broad policies for operating management so that corporate affairs will be executed in the way that will maximize the firm's market value. Directors are usually elected at an annual stockholders' meeting, at which one may vote either in person or by proxy (a written statement authorizing someone else to vote in a specified way). Since most stockholders either return signed proxies or ignore the meeting altogether, the management is usually able to perpetuate its position even if it controls substantially less than 50 percent of the total voting stock.

Voting Procedures: These determine the minimum percentage of ownership needed to ensure the election of a given number of the board of directors. Each share normally has one vote per director; if nine directors are to be elected, the owner of 100 shares thus has 900 votes. There are two kinds of voting: straight and cumulative. Under straight voting, a stockholder cannot allocate to any candidate more than one vote per share held; our sample stockholder, for instance, could cast a maximum of 100 votes for one candidate. Clearly, straight voting permits no minority representation: a group controlling a simple majority can select the entire board of directors.

Cumulative voting, on the other hand, creates the possibility of minority representation. Under it a stockholder may cast all his votes (say, 900) for a single candidate, or may distribute his votes among any or all of the candidates. The maximum number of votes that a stockholder may cast for any candidate is limited only by the number of votes at his disposal.

Pre-emptive Right: This right gives current stockholders the first opportunity to subscribe on a pro rata basis to any new shares issued by the firm. If exercised, it enables a stockholder to maintain his proportionate interest in the earnings, assets and control of the company. If sold, the pre-emptive right protects the stockholder against any loss arising from the sale of new shares to outsiders at a discount from the market price.

The Cost of Common Equity

There are three ways in which a firm can sell new shares: to existing stockholders, to new stockholders, or to both groups. We shall present formulas for calculating the cost of common equity obtained through each of these three methods.

Symbols and Assumptions: Let us first define the symbols to be used in our analysis:

n_0 = number of shares outstanding before new financing

n_1 = number of new shares sold to existing stockholders

n_2 = number of new shares sold to new stockholders

n = number of shares outstanding after new financing

w = a simplified notation for $n_0 n_2/(nn_1 + n_0 n_2)$

C = total amount of equity capital raised

P = current market price of the company's shares

P' = price at which new shares are sold

k_e = cost of common equity capital to the firm

y = market capitalization rate (securities investors' required rate of return)

E = expected per-share earnings if new transaction is not undertaken

r = the uniform perpetual after-tax rate of return which the new equity capital is expected to earn

We shall assume that the new investment and financing will not alter the firm's risk characteristics. The latter assumption implies that the market-capitalization rate y is unaffected by the transaction; the impact of the new investment on the market value of the existing shares may therefore be measured simply by the size of the company's dollar earnings with and without the investment.

Break-even Analysis: The method used for determining the cost of common equity is essentially that of break-even analysis. Let us look at the firm of Educational Toys, Inc.,

which, with existing assets alone, is expected to generate adjusted annual earnings of $180,000 perpetually. The firm has 125,000 shares of common stock outstanding. These shares have a market value of $1,500,000, which implies that the security investors capitalize the earnings at 12 percent. In order to raise $250,000 of equity capital, the company issued 25,000 new shares at a price of $10 each, $2 below the market price of $12 a share. Current stockholders purchased 40 percent of the new issue (10,000 shares); and "outsiders" purchased the remaining 60 percent (15,000 shares). The existing stockholders were not given the pre-emptive right to subscribe to the new shares at a favored price; they purchased their new shares on the same terms as the outsiders. Given these facts, what is the cost of this common equity to the firm? That is, what is the minimum rate of return on the new investment at which the original stockholders will be at least as well off as they were before the new issue?

A key concept in this break-even analysis is "earnings dilution". When outsiders purchase 15,000 shares of the new issue they become entitled to 10 percent (because they own 15,000 of 150,000 shares) of every dollar of the firm's earnings. The extent to which the new stockholders are entitled to share in the earnings associated with the previously existing assets is the measure of the earnings

dilution suffered by the original stockholders. This earnings dilution is the price the original stockholders pay for the advantage of receiving 90 percent of the earnings of the new investment while contributing only 40 percent to its cost. Let us assume that the after-tax profit on the new investment is such that the firm receives a uniform perpetual annual return of r on the equity portion ($250,000) of the investment. For the original stockholders to be as well off as they were formerly, their share of the incremental earnings must compensate them not only for the 10-percent earnings dilution but also for the normal 12-percent return (the market-capitalization rate) which their new $100,000 investment would have earned had the funds been invested in other companies of comparable risk.

This break-even condition may be stated as an equation:

$$\underset{\text{Incremental earnings}}{(90\%)\ ($250,000)\ (r)} = \underset{\text{Earnings dilution}}{(10\%)\ ($180,000)} + \underset{\text{Normal return}}{(12\%)\ ($100,000)}$$

The value of r in this equation is the cost of common equity capital, since it is the minimum rate that the new investment must earn to enhance the wealth of the original stockholders. In this case, r---and hence k_e---is 13.33 percent.

General Formulas: The cost of common equity can also be calculated by using general formulas derived from the break-even condition. If we replace the numbers in the above equation by the symbols which represent them, we get:

$$\left(\frac{n_0+n_1}{n}\right)(Cr) = \left(\frac{n_2}{n}\right)(E\ n_0) + y(n_1\ P')$$

Incremental earnings | Earnings dilution | Normal return

To find the cost of common equity capital, we substitute k_e for r in the above equation and solve for it:

$$k_e = \frac{n_0 n_2}{(nn_1 + n_0 n_2)} \frac{P}{P'} y + \frac{nn_1}{(nn_1 + n_0 n_2)} y$$

Fortunately, this equation has rather simple economic interpretations.

Three possible cases may be distinguished. First, the entire issue may be sold to the original stockholders. In that case, $n_2 = 0$ and $n = n_0 + n_1$, so that the above equation reduces to:

$$k_e = y$$

That is, the cost of equity capital is the same as the market-capitalization rate. For the firm of Education Toys, this is 12 percent. Second, the entire issue may be sold to outsiders. In that case, $n_1 = 0$, $n = n_0 + n_2$, so that our original equation reduces to:

$$k_e = \frac{P}{P'} y$$

In this situation, k_e varies directly with the market-capitalization rate and inversely with the size of the discount at which the new shares are sold. In our example, since P is 20 percent higher than P', the cost of equity capital

would be 1.2 x 12 percent, or 14.4 percent. Third, the new issue may be divided between the existing stockholders and outsiders. In that case, the original equation cannot be simplified, but it can be written more succinctly as

$$k_e = w\frac{P}{P'}y + (1-w)y$$

where $w = \frac{n_0 n_2}{(nn_1 + n_0 n_2)}$. The cost of equity capital is now revealed as a weighted average of the costs in the other two cases. This relationship was not demonstrated by the break-even analysis. Working out the original equation with the data for Educational Toys' mixed financing, we get a cost of equity capital of 13.33 percent, the same value obtained by break-even analysis.

For easy reference, Table 1 summarizes the formulas for computing the cost of common equity, and shows their application to Educational Toys.

Table 1

Formulas for the Cost of Common Equity k_e When Market-Capitalization Rate y is Known

New Shares sold to:	Algebraic Expression	Application to Educational Toys
Existing Stockholders	y	12.0%
New Stockholders	$\frac{P}{P'}y$	14.4%
Both Groups	$w\frac{P}{P'}y + (1-w)y$	13.3%

IV

INSTRUMENTS OF FINANCING: CONVERTIBLE BONDS

The Nature of Convertible Bonds

A convertible bond is a hybrid security in that it is both a debt and an option on the firm's common stock. The fusion of the two parts creates an instrument combining the appreciation potential of stock with the safety of a bond. If the price of the underlying stock rises, the conversion option will cause the price of the convertible bond to rise as well. If the price of the stock stays level or falls, the bondholder is protected because the company has agreed to regard his instrument as a debt as long as he does not exercise his stock option.

The corporation, of course, derives its own benefits from the safety feature. Convertible bonds have special appeal to those investors who desire an intermediate position between common stock and straight bonds. Moreover, these bonds are attractive to financial institutions which are constrained by law in the amount of common stock they may hold. Issuing convertible bonds enables a corporation to expand the market for its securities and to reduce the overall cost of its capital.

A convertible bond, being a debt, specifies the principal amount owed, the coupon rate of interest, the call prices,

the annual sinking fund if any, the final maturity date, and the terms of the conversion provision. Using an American example, Uniroyal's 5 1/2%, 25-year convertible subordinated debentures, due in 1996, provide us with sample data for conversion terms:

Conversion price-- Each $25.375 of the principal amount of a Uniroyal bond may be exchanged for one share of Uniroyal common stock. The stock option is fused with the debt obligation since the conversion price is payable in bonds. Although the conversion price is usually fixed, as in this case, it occasionally increases over the life of the bond.

Conversion ratio-- The number of shares into which a bond is convertible varies uniquely and inversely with the conversion price. If each Uniroyal bond has a face value of $1,000, then each bond will buy 39.4 shares ($1,000 ÷ 25.375). This is the conversion ratio.

Conversion period- Uniroyal is typical in permitting conversion during the entire life

of the bond. In some cases, however, a company may limit the conversion period by postponing the initial conversion date or by terminating the conversion period before the bond maturity date.

Although conversion is the option of the bondholder, the corporation may, under certain conditions, advance the timing of conversion by exercising its call option. When a convertible bond is called, the bondholder may either turn in his bond in exchange for the call price or exchange his bond for stock. The market value of the stock received is the conversion value of the bond. If the conversion value is less than the call price, the bondholder will presumably redeem his bonds for cash. Redemption allows the corporation to save interest, to remove restrictive covenants, to return unneeded funds, or to prevent later conversion. If the conversion value is more than the call price, the bondholders will most probably convert their called bonds into stock. In such a situation, the corporation often calls the bonds in order to force immediate conversion.

Reasons for Use

Researchers have conducted questionnaire surveys of financial executives to find out specifically why corporations

issue convertible bonds. Although answers vary, two general reasons prevail. First, convertible bonds are used to raise common equity on a delayed-action basis. One company sold debentures convertible into common stock at a conversion price of $45; direct sale of common stock would have depressed market price, netting the company only $35 per share. From management's viewpoint, the firm was in effect selling its shares at $45 instead of $35. Second, the conversion feature is used to enhance the marketability of the company's debt and thus reduce its costs. A firm's capital structure may make straight-debt financing either impossible or too costly. By offering a conversion option as a sweetener, the firm can raise debt capital at a lower interest rate and in larger amounts than otherwise. And the bondholders, especially if they anticipate early conversion, may feel less need for stringent protective covenants than in straight-debt contracts.

These findings reveal the proper framework for analyzing convertible bonds as a financing alternative. If, for example, the bonds are used as indirect equity financing, the alternative is the immediate direct sale of common stock. The bonds are the more attractive alternative because they permit the firm to sell (even though contingently) to investors willing to pay a higher-than-current price in return for built-in safety. If the conversion option is

used to sweeten senior debt, the alternative is to sell straight debt now and an equity issue later. The use of the option implies that the firm would rather sell its stock indirectly now than directly later. The value of the option is what compensates the bondholder for the concessions he makes in the debt portion of the contract.

Even though convertibles enable a firm to sell common stock at higher future prices, many companies still sell common stock directly at lower current prices because future stock prices are difficult to predict. A firm issuing convertibles runs the risk that its stock price may not rise enough to make conversion profitable to the bondholders. If unfavorable market conditions keep a firm from forcing conversion even after some time, the issue is said to be "overhanging". It is possible that the market will reverse, enabling forced conversion. But meanwhile the overhanging convertibles tend to depress the stock price, making direct sale of common stock costly. The Celanese Corporation, to cite an example, sold an issue of convertible bonds in 1965. The issue is still outstanding in 1974 because share price never rose above the conversion-price. Some firms prefer to avoid the risk of an overhanging issue and the resulting loss in financial flexibility by selling common stock directly.

Valuation and Design of Convertible Bonds

A Valuation Model. Let us suppose that the firm of Laserex Ltd. offers an issue of 6.0%, 20-year bonds, exchangeable for common stock at a conversion price of $50; and that Laserex's common stock is currently selling at $42 per share. The market interest on non-convertible bonds of similar investment quality is 8 percent. The investor must appraise the bonds to decide how much he is willing to spend for them.

Four value concepts are relevant in appraising any convertible-bond issue:

1. Conversion value, or stock value, is the total market value of the common stock into which the bond is convertible. This value equals the conversion ratio multiplied by the market price of the common stock. Assuming each bond has a face value of $1,000, Laserex's conversion value is $840 (= 20 x $42) per bond at the time of issue.
2. Bond value is the market value of the convertible bond evaluated as a straight bond (i.e., as if there were no conversion provision). If straight bonds comparable to Laserex's are selling at prices that yield an 8-percent return, bond tables show that investors should pay no more than 80.2%

of par value for Laserex's bonds.

3. Theoretical, or floor value, is the conversion value or bond value, whichever is larger. The theoretical value of a Laserex convertible at the time of issue is $840.
4. Market premium is the amount by which market price exceeds theoretical value. Thus, Laserex's bonds, if issued at par, would carry a market premium of $160 per bond.

The coupon interest rate on the Laserex convertibles is 25 percent below the market rate. An investor will not purchase such a bond at par unless he expects the price of the Laserex shares to rise enough during his planning horizon to reward him for his sacrifice of current interest income. He realizes too that if the share price rises above conversion price, the firm could force conversion by calling the bonds. A called bond would reduce the investor's potential capital gain. Moreover, in reading the Wall Street Journal, the investor observes that in most forced conversions the conversion value is 20 to 60 percent above par. The outlook for the Laserex share price makes the investor think that forced conversion is most likely at the end of year 5. The investor thus takes five years as his planning horizon and forecasts probabilistically the Laserex share price at the end of that horizon, as

will be given by the market price of the bond. The bondholder forecasts a market price of $1,000, implying that the market will pay a premium of $100 over theoretical value--partly because of the potential for appreciation and partly because of the built-in safety. If share price is $25, the conversion value is less than the bond value of $827, which now becomes the theoretical price because $827 is the selling price of a 6%, 15-year straight bond when market interest is 8 percent. The investor forecasts a terminal value of $880, implying a premium of $53. Finally, if the share price is $10, the prospect of capital gains is so remote that there is no premium. The convertible now sells as a straight bond with a terminal value of $827.

In summary, the investor expects to receive $60 in interest each year for 5 years and then a terminal payment whose value is given by the probability distribution in preceeding table. Using as a discount rate his required return of, say, 8 percent per annum, we obtain $1,065 as the expected present value of the cash flows associated with the Laserex convertible bonds. The investor will probably consider the bonds attractively priced if they are offered at par.[5]

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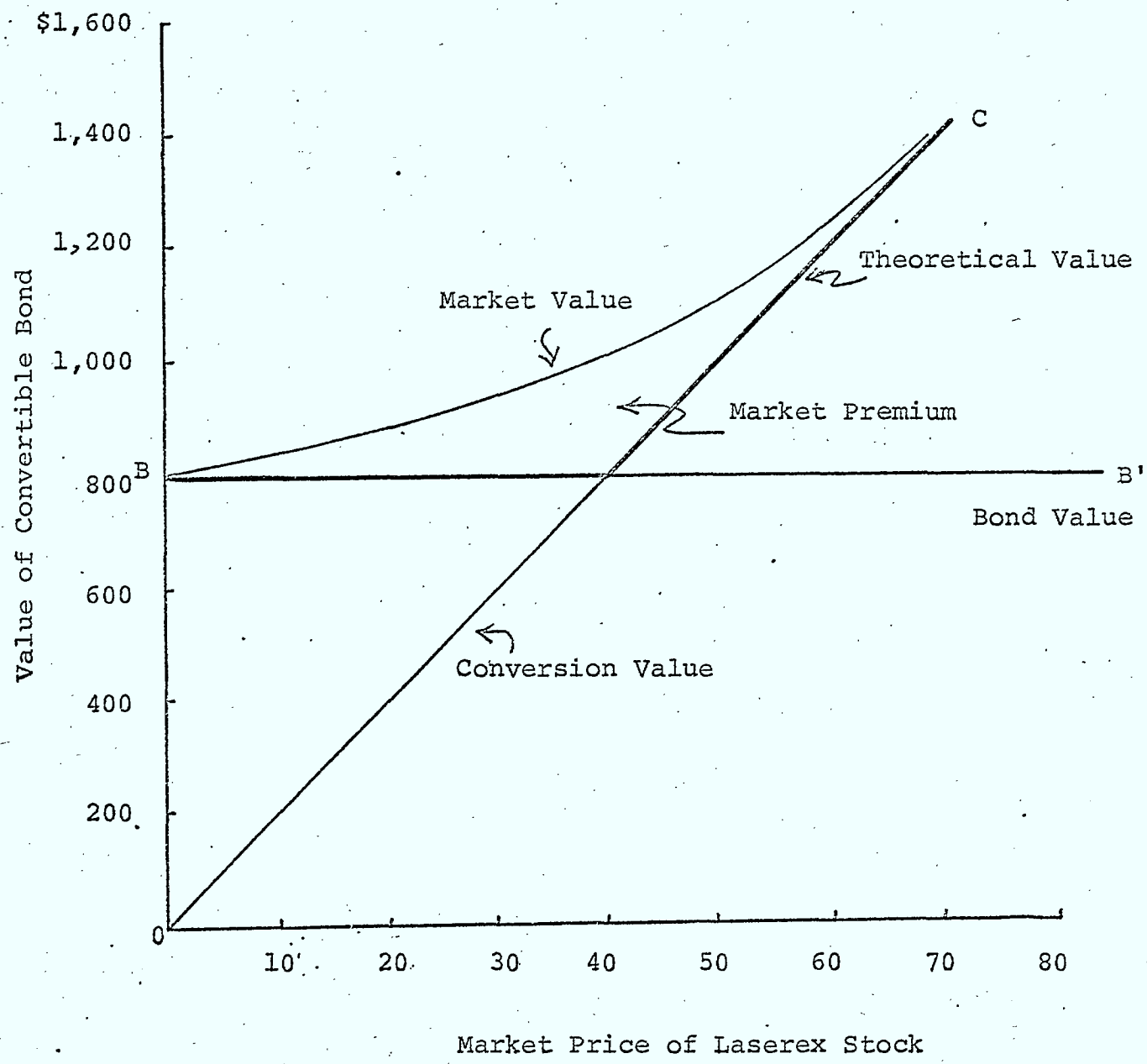
[5]A computer program for implementing this probabilistic valuation model is given in Appendix A.

The Design of Convertible Bonds. The key variables are coupon rate of interest and conversion price. To design a contract, the financial executive must know how changes in these variables will affect the market price of the bond. Our valuation model will be useful in this analysis.

Figure 1 depicts for Laserex convertible bonds the relationship between bond value, conversion value, and market value. Vertically, line OC expresses the conversion value of each bond as a function of the current market price of Laserex's shares. (The slope of OC equals the conversion ratio). Line BB' measures bond value--in this case, $802 at the time of issue. The heavily inked sections of lines BB' and OC express the theoretical value of each bond as a function of current share price. The market-price curve lies entirely above the corresponding theoretical prices. The vertical distance between theoretical value and market price gives the market premium. The premium is smallest at the ends of the share-price spectrum: when share price is low, the prospect of conversion is so remote that convertibles sell almost as straight bonds; when share price is high, the threat of forced conversion makes investors reluctant to pay substantial premiums.

Laserex convertible bonds have a coupon interest rate of 6 percent and a conversion price of $50. The financial executive should know what other combinations of interest

Figure 1 Valuation of Laserex Convertible Bonds



rate and conversion price would yield the same market valuation. What change in conversion price, for example, would be necessary to compensate for a reduction in coupon rate of interest? We know that a low coupon rate reduces the support provided by bond value so that an investor will expect a smaller terminal value; moreover, the increased downside risk may make the investor demand a higher overall rate of return. Each of these changes makes the entire market-price curve shift downward. This effect could be offset by a reduction of conversion price, depicted graphically by a counter-clockwise rotation of line OC. The lower conversion price will increase the probability of conversion as well as the size of possible gain from conversion.

Suppose that, by experimenting with the valuation model, the Laserex financial executive has found that the bonds would sell at par with any of three combinations of coupon interest rate and conversion price. The task of optimal design, then, is to decide which combination will result in the lowest cost of capital. To do so, he needs a theory for measuring the cost of convertible-bond financing. This we shall now take up.

The Cost of Financing

Before he can determine the cost of convertible-bond

financing, the financial executive must know how soon the corporation expects the bonds to be converted and the probable stock value at the time of conversion. He must also know whether the bonds are being issued in lieu of immediate stock financing or in anticipation of future stock financing.

Let us suppose that Laserex would like to sell common stock now, but, since the current stock price is too low, it is instead selling at par 6-percent convertible bonds. The firm expects, with a probability of .8, to force conversion at the end of year 5, at which time the shares are forecast to be selling at $62.50, or 25 percent above the $50 conversion price. The company sees a .2 probability that its stock will continue to be weak, causing the issue to overhang indefinitely.

Three additional facts will enable us to proceed to the calculation: the current market price of Laserex stock is $42, the rate of return required by the stockholders is 14 percent, and the marginal tax rate on corporate income is 50 percent.

Ignoring selling expenses, the firm receives par value for the 6%, 20-year convertible bonds. There is a .2 probability that the bonds will not be converted, in which case the effective after-tax rate of interest will be only 3 percent for the next 20 years. But an overhanging

convertible severely restricts a company's ability to raise more capital; the loss of financing flexibility, though not easily quantifiable, is a real cost. On the other hand, there is a probability of .8 that the bonds will be converted. In that case, Laserex will pay 3 percent interest for five years, after which the debt will be replaced by common stock. The cost k_e of this equity capital is calculated according to formulas already derived in the preceding section (see Table 1):

Stock sold to existing stockholders	$k_e = y$
Stock sold to new stockholders	$k_e = y\frac{P}{P'}$

where y is the stockholders' required rate of return, P is the current market price of the common stock, and P' is the price at which the new shares are sold.

For the Laserex issue, y is 14 percent; P' is $50 (the conversion price); and, since the convertibles are issued in lieu of immediate stock financing, P is $42, the current share price. With these data, the above equations yield 14 percent and 11.8 percent, respectively, as the values of k_e. If we assume that the new shares are purchased equally by existing and new stockholders, the cost of common equity is midway between the two values: 12.9 percent.

In other words, there is a .2 probability that the cost

to Laserex of the convertible bonds will be only 3 percent for the next 20 years. This also means that the company will be unable to attain its desired debt-to-equity ratio and will lose financial flexibility. There is a .8 probability that the bonds will be converted, in which case the company has an inexpensive source of debt capital for 5 years and can then convert this into equity at a lower cost than equity would entail now (12.9% vs. 14%).

Now let us change one of our assumptions: Laserex already has sufficient equity capital and is issuing the bonds in anticipation of future sales of common stock. Both P and P' in the second of the above equations must now be assigned their respective values at the time of conversion. Laserex forecasts that its share price will increase by some 50 percent over the next five years, so that P will be $60. The company receives $1,000 for each bond now, implying a share price of $50 if and when the bond is converted. Let us say that $50 has a future value to the firm of $66 at the end of year 5, so that P' is $66. Applying the second equation, we find that the cost for shares sold to outsiders is now 12.7 percent, or .9 percent higher than before. If all new shares are purchased by existing stockholders, the cost is still 14 percent. If the shares are purchased equally by outsiders and existing stockholders, the cost of equity has an intermediate value of 13.4 percent.

This figure, as well as the previous figure of 12.9 percent, illustrates that the reduction in the cost of equity financing by issuing convertible bonds varies with the different assumptions the company makes about the conversion and market prices of company shares and about the percentage of new shares sold to outsiders. By comparing various costs of capital the financial executive is able to design the best combination of coupon interest rate and conversion price for his convertible bonds.

V

INSTRUMENTS OF FINANCING: EXCHANGEABLE BONDS

The Nature of Exchangeable Bonds

Some companies sell bonds exchangeable for shares of other companies. For example, Dart Industries has an outstanding issue of 4 1/2%, 25-year subordinated debentures exchangeable for the common stock of Minnesota Mining and Manufacturing Company (3M). The Pittston Company has a similar issue exchangeable for shares of Brink's Inc.

The contractual features of an exchangeable bond are similar to those of a convertible bond. The indenture specifies the exchange price which is the value placed on the underlying stock for purposes of exchange. This price is usually about 20 percent above the current market price of the stock. The Dart debentures, for example, were issued with an exchange price of $93 on the 3M shares, even though the actual market price at the time was only $78. The indenture also contains an escrow agreement, under which the firm promises to turn over to an escrow agent enough shares of the stock to provide for the exchange of all bonds issued. The company, however, retains voting and dividend rights on all shares that have not yet been exchanged. The exchange right usually lasts through the life of the bond, though management may terminate it by

exercising its call option if the exchange value of the bond exceeds call price, as exchangeable bonds, like convertibles, are always callable.

The probabilistic model used to explain the valuation of convertibles applied equally to exchangeables. The investor must still consider the coupon rate of interest, the maturity of the bond, the terms of the exchange provision, his forecast of the future price of the underlying stock, and the likelihood of an early redemption call. There is, however, an important difference in tax treatment between the two. When conversion takes place, an investor need not recognize any immediate gain (or loss) for income tax purposes; but when exchange takes place, gain or loss must be recognized immediately. Convertible bonds, therefore, are somewhat more attractive to most investors.

Reasons for Use

Let us suppose that a company has decided to sell its stockholdings in another firm for cash. If the holding is large, the company will have to accept a discount in the selling price. Moreover, if there is a large capital gain, there may also be a large immediate tax bill. If, instead, the company floats an issue of exchangeable bonds, this indirect sale brings a higher price and a tax postponement.

The disadvantage, however, is that the sale of stock is not final but contingent upon future market developments: investors will exchange their bonds only if the market price of the shares rises above the exchange price.

The Dart Industries issue mentioned above provides a good example of the circumstances that make an exchangeable bond issue logical. In 1970, Dart sold its Riker Laboratories subsidiary to the 3M Company and acquired about 1.5 million shares (before the subsequent two-for-one split) of 3M. Much of the stock was sold immediately, but by the middle of 1972 Dart still held about 900,000 post-split shares. A share then selling for $78 had cost Dart only $43, so direct sale would have resulted in a large immediate tax bill. Dart therefore decided to sell its remaining 3M shares indirectly. It issued $60 million worth of 4 1/2%, 25-year bonds exchangeable into 3M shares at $93 a share. To provide for future exchange, 645,000 shares of 3M stock were put in escrow. In the meantime, of course, Dart retained for all unexchanged shares the right to vote and the right to receive the $1.85-per-share dividend. Even though Dart received cash for the bonds, it was thus enabled to postpone the recognition of capital gain on the 3M shares until the time of exchange.

The Cost of Financing

Let us use the Dart issue to illustrate how the cost of exchangeable bonds should be computed. We shall suppose that the Dart management has decided to sell 645,000 shares of 3M stock but has not yet determined whether to sell them directly or indirectly. The stock cost Dart, as we have said, $43 a share. The current market price is $78 but a block sale would realize only $73 a share. The income-tax and capital-gains-tax rates are .5 and .3 respectively. If the company chooses to sell indirectly, the company will issue $60 million worth of 4 1/4%, 25-year debentures, exchangeable into 3M shares at $93 per share. Dart plans to force exchange if the stock price reaches $113. The firm forecasts a .9 probability that this price will be reached at the end of year 5 and a .1 probability that the stock price will never exceed the exchange price of $93. In the latter case there would be no exchange, but Dart would be unable to sell its shares until they were released from escrow at the end of year 25. The price realizable at that time would be, perhaps, $63 per share. In the meantime, of course, Dart would retain its right to the $1.85-per-share cash dividend.

If the sale is direct, through a secondary offering, Dart would receive net proceeds of $46,504,500:

Gross proceed (645,000 x $73)	$47,085,000
Capital-gains-tax (645,000 x $30 x .3)	- 5,805,000
	$41,280,000

If the sale is indirect, through exchangeable bonds, however, Dart will receive $60 million now, with no immediate tax. But as long as the bonds are outstanding, there is a net annual cash outflow of $171,244:

Interest expense ($60 million x 4.25%)	$2,550,000	
Reduction in income tax ($2,550,000 x .5)	-1,275,000	$1,275,000
Dividend income (645,000 x $1.85)	$1,193,250	
Increase in income tax ($1,193,250 x .15 x .5)	89,404	1,103,756
Difference		$ 171,244

There is a .9 probability that the bonds will be exchanged at the end of year 5. If the market price at the time of the exchange is the predicted $113, Dart will realize a total capital gain of $45,150,000, with an immediate tax of $13,545,000. There is a .1 probability that no exchange will take place. The company would then expect to receive $63 a share at the end of year 25, for a total proceed--after capital-gains-tax--of $36,750,000.

These data enable us to calculate the annual cash flows associated with both the direct and indirect methods of sales. Whereas there is only one set of figures (Column 1, Table 3) for the direct sale of 3M stock, there are two sets of figures (Columns 2 and 3, Table 3) for the indirect sale,

Column 2 with probability of .1 and Column 3 with probability of .9. Subtracting the cash flows of the direct method from those of the indirect method, we get the figures in Columns (4) and (5), which also have probabilities, .1 and .9, respectively. An exchangeable-bond issue would in effect, therefore, provide Dart with about $18.7 million of immediate financing. There is a .9 probability that this financing will last five years, at an annual cost of -5.25 percent. This cost is computed by finding the discount rate that gives the net present value of the cash flow series a value of zero.[6] There is a .1 probability that the financing will last 25 years, at an annual cost of 1.65 percent. The expected cost is only -4.54 percent. The use of exchangeable bonds in this case is clearly justified since the expected cost of capital is in fact negative.

---

[6]A computer program for computing the cost of exchangeable bonds in given in Appendix B.

Table 3 Cash Flows for Measuring the Cost of Dart Industries' Exchangeable Bonds

Year	Direct Sales of 3M Stock	Indirect Sale of 3M Stock (Via Exchangeable Bonds)		Difference Between Direct and Indirect Sales	
		Prob = .1	Prob = .9	Prob = .1	Prob = .9
	(1)	(2)	(3)	(4)=(2)-(1)	(5)=(3)-(1)
0	$41,280,000.00	$60,000,000.00	$60,000,000.00	-18,720,010.00	-18,720,010.00
1	0.00	-171,244.00	-171,244.00	-171,244.00	-171,244.00
2	0.00	-171,244.00	-171,244.00	-171,244.00	-171,244.00
3	0.00	-171,244.00	-171,244.00	-171,244.00	-171,244.00
4	0.00	-171,244.00	-171,244.00	-171,244.00	-171,244.00
5	0.00	-13,716,240.00	-171,244.00	-13,716,240.00	-171,244.00
6	0.00	0.00	-171,244.00	0.00	-171,244.00
7	0.00	0.00	-171,244.00	0.00	-171,244.00
8	0.00	0.00	-171,244.00	0.00	-171,244.00
9	0.00	0.00	-171,244.00	0.00	-171,244.00
10	0.00	0.00	-171,244.00	0.00	-171,244.00
11	0.00	0.00	-171,244.00	0.00	-171,244.00
12	0.00	0.00	-171,244.00	0.00	-171,244.00
13	0.00	0.00	-171,244.00	0.00	-171,244.00
14	0.00	0.00	-171,244.00	0.00	-171,244.00
15	0.00	0.00	-171,244.00	0.00	-171,244.00
16	0.00	0.00	-171,244.00	0.00	-171,244.00
17	0.00	0.00	-171,244.00	0.00	-171,244.00
18	0.00	0.00	-171,244.00	0.00	-171,244.00
19	0.00	0.00	-171,244.00	0.00	-171,244.00
20	0.00	0.00	-171,244.00	0.00	-171,244.00
21	0.00	0.00	-171,244.00	0.00	-171,244.00
22	0.00	0.00	-171,244.00	0.00	-171,244.00
23	0.00	0.00	-171,244.00	0.00	-171,244.00
24	0.00	0.00	-171,244.00	0.00	-171,244.00
25	0.00	0.00	-23,406,240.00	0.00	-23,406,240.00

EFFECTIVE COST OF MONEY WITH PROB 0.90 = -0.0523
EFFECTIVE COST OF MONEY WITH PROB 0.10 = 0.0169

EXPECTED EFFECTIVE COST OF MONEY = -0.0454

VI

GENERAL PRINCIPLES AND A CASE STUDY

General Principles

Once a venture capitalist is satisfied with three things: the integrity and competence of a firm's management; the validity of its profit-making idea; and its competitive position; he must decide which financing vehicle to employ in committing his funds. As we have seen, the wish for an above-normal return preclude straight-debt financing at a fixed rate of interest. Invariably, the capitalist will seek equity participation by investing in common stock or in debentures convertible into common stock or in a straight loan with warrants entitling him to buy common stock at a fixed price. Although we did not take up warrants in this paper, the principles of analysis are similar to those covering convertible securities. Venture capitalists generally prefer debt financing with equity features to straight equity investments. The reason for this is that should the firm decline and need to be sold, the capitalists, as creditors, will have prior claims on assets. The firm's owners may also wish to use convertibles and warrants, though for a different reason: the fixed price assigned to common stock for conversion purposes or for purchase with warrants is usually higher than the market price. The sale of common

stock at a figure above the current price reduces the dilution of ownership, a feature especially important to small, growing companies.

To bargain effectively, the management of a venture capital firm must formulate its objectives clearly. Terms will be reached only if the two sides can agree on the value of the business with and without the new financing and on the division of the incremental value of the firm. Valuation is difficult as there is usually little or no operating record on which to base the projection of future earnings. Moreover, the management naturally wishes to retain operating control, and this could create a problem if the management turns out to be incompetent. A financing agreement may be structured in several ways; but in all cases each side must keep its control and valuation objectives clearly in mind.

A Case Study

Greater Washington Investors, a venture capital firm, was approached in 1968 by two General Electric engineers who needed financing for a new firm to make computer memory devices. After investigating the engineers and their proposal, Greater Washington agreed to invest $520,000; $120,000 was for start-up and the balance for future expansion.

The financial structuring of the investment had five

main features:

1. Greater Washington immediately invested $120,000, for which it received 600,000 shares, or 60 percent of the total equity. The two principals were required to invest $80,000, for which they received 400,000 shares, or 40 percent of the equity.
2. Management was to receive a low salary during the development period, but as an incentive was to be given an option to purchase stock at 60 cents a share.
3. The additional $400,000, when utilized, was to be a straight loan with the interest rising with time. Of the total amount, $300,000 was to be available at any time, and $100,000 only after the firm achieved certain specific goals outlined in the operating plan. If default were to occur, the loan would become convertible into common stock. Greater Washington would then own enough of the equity to negotiate a merger, if necessary, to protect its investment.
4. The two principals were given operating control; but Greater Washington retained, through the Board of Directors, the power to veto certain major corporate decisions.
5. If any of the three founders quit the venture, the

others had the right to purchase his shares.

In this particular agreement, we see generally how a venture capitalist firm shares risk, control and return with the present management of a company.

APPENDIX A

VALUATION OF CONVERTIBLE BOND: PROBABILISTIC MODEL

DEFINITION OF VARIABLES

I - Coupon rate of interest

R - Investors' required rate of return

N - Planning horizon, in years

TV(1) - 1st possible value of bond at end of year N

TV(2) - 2nd possible value of bond at end of year N

TV(3) - 3rd possible value of bond at end of year N

TV(4) - 4th possible value of bond at end of year N

TV(5) - 5th possible value of bond at end of year N

P(1) - Probability of TV(1)

P(2) - Probability of TV(2)

P(3) - Probability of TV(3)

P(4) - Probability of TV(4)

P(5) - Probability of TV(5)

PVOIP - Present value of interest payments during planning horizon

EXPV - Expected present value of TV(1), ..., TV(5)

TOTAL - Market price of bond

Evaluation of Convertible Bond: Probabilistic Model

INPUT

The first card contains the five Terminal Values, followed by the five corresponding Probabilities.

Subsequent cards contain the values of I,R,N.

The end of data is designated by a/* in columns one and two:

Card 1: TV(1), TV(2), TV(3), TV(4), TV(5), P(1), P(2), P(3), P(4), P(5) (10F8.2)

Card 2: I,R,N (2F10.2,I4)

Card 3: I,R,N (2F10.2,I4)

.
.
.

last card: /* (cols 1,2)

EXAMPLE

column:

```
          1         10        20        30        40        50
CARD 1:   1500.     1250.     1000.     880.      830.      .3        .35

          60        70        80
          .2        .1        .05

          1         10        20        30        40        50
CARD 2:   .03       .04       10

CARD 3:   .06       .08       5

CARD 4:   /*
```

```
      $WATFIV
    1       DIMENSION TV(5),P(5)
    2       REAL I
    3       READ(5,101)TV,P
    4   101 FORMAT(10F8.2)
    5     5 READ(5,100,END=999)I,R,N
    6   100 FORMAT(2F10.2,I4)
    7       PVOIP=0.0
    8       DO 10 J=1,N
    9    10 PVOIP=PVOIP + (I*1000.)/((1.+R)**J)
   10       SUM=0.0
   11       DO 20 J=1,5
   12    20 SUM=SUM+TV(J)*P(J)
   13       EXPV=SUM/((1.+R)**N)
   14       TOTAL = EXPV + PVOIP
   15       WRITE(6,300)I,R,N,PVOIP,EXPV,TOTAL
   16   300 FORMAT(/,' I=',F10.5,' R=',F10.5,' N=',I4,//,' PRESENT VALUE OF IN
           1TEREST PAYMENTS DURING PLANNING HORIZON=',F14.4,//,' EXPECTED PRES
           2ENT VALUE OF TERMINAL VALUE AT END OF HORIZON=',F14.4,//' TOTAL VA
           3LUE =',F14.4)
   17       GO TO 5
   18   999 STOP
   19       END
```

```
        $DATA
I=    C.03000 R=    0.04000 N=  10
PRESENT VALUE OF INTEREST PAYMENTS DURING PLANNING HORIZON=      243.3269
EXPECTED PRESENT VALUE OF TERMINAL VALUE AT END OF HORIZON=      822.1616
TOTAL VALUE =     1065.4880
I=    C.06000 R=    0.08000 N=   5
PRESENT VALUE OF INTEREST PAYMENTS DURING PLANNING HORIZON=      239.5627
EXPECTED PRESENT VALUE OF TERMINAL VALUE AT END OF HORIZON=      828.2700
TOTAL VALUE =     1067.8320
CORE USAGE       OBJECT CODE=     1080 BYTES,ARRAY AREA=       40 BYTES,TOTAL AREA AVAILABLE=  196768
COMPILE TIME=     0.08 SEC,EXECUTION TIME=     0.04 SEC,  WATFIV - VERSION 1 LEVEL 1 JANUARY  1970
```

APPENDIX B

EXCHANGEABLE BONDS: COST OF CAPITAL

DEFINITION OF VARIABLES

REAL - Current realizable price of underlying stock

COST - Per-share cost of underlying stock

FIT - Income tax rate

CGR - Capital gains tax rate

PERC - Coupon interest rate on exchangeable bonds

PRICE A - Price at which the stock will be selling at end of NYEAR2 (denoted as event A)

PRICE B - Price at which the stock will be selling at end of NYEAR1 (denoted as event B)

NYEAR1 - Company's planning horizon in years

NYEAR2 - Maturity of exchangeable bonds, in years

PROB1 - Probability of event A

PROB2 - Probability of event B

SHARES - Number of shares of underlying stock

BONDP - Total proceeds from sale of exchangeable bonds

DIV - Dividend, in dollars, per share of underlying stock

DREC - Vector containing cash flows under "direct method"

ADREC1 - Vector containing "indirect" cash flows, assuming event A

ADREC2 - Vector containing "indirect" cash flows, assuming event B

DIFF1 - Vector containing difference between DREC and ADREC1

DIFF2 - Vector containing difference between DREC and ADREC2

OUTFLO - Interest on exchangeable bond less dividends on underlying stock, both after - tax

CGTAX - Capital gains tax under event B at end of NYEAR1, when bonds are exchanged for stock

PRONET - Proceeds from sale of underlying stock at end of NYEAR2, net of capital gains tax

IRR1 - Effective cost of money (DIFF1)

IRR2 - Effective cost of money (DIFF2)

EXIRR - Expected effective cost of money

Exchangeable Bonds Program

INPUT

Card 1: REAL, COST, FIT, CGR, PERC, PRICE1, PRICE2, PROB1, PROB2, SHARES, BONDP, DIV (8F10,2)

Card 2: NYEAR1, NYEAR2 (2I4)

```
$WATFIV
      REAL IRR1,IRR2
      DIMENSION DIFF1(250),DIFF2(250),DREC(250),ADREC1(250),ADREC2(250)
      READ(5,100)REAL,COST,FIT,CGR,PERC,PRICEA,PRICEB,PROB1,PROB2,SHARES
     1,BONDP,DIV
  100 FORMAT(8F10.2)
      READ(5,101)NYEAR1,NYEAR2
  101 FORMAT(2I4)
      DO 10 I=1,250
      DREC(I)=0.0
      ADREC1(I)=0.0
   10 ADREC2(I)=0.0
      DREC(1)=SHARES*REAL-SHARES*(REAL-COST)*CGR
      ADREC1(1)=BONDP
      ADREC2(1)=BONDP
      OUTFLO=BONDP*PERC*(1.0-FIT)-SHARES*DIV*(1.0-.15*FIT)
      CGTAX=SHARES*(PRICEB-COST)*CGR
      PRONET=SHARES*PRICEA-SHARES*(PRICEA-COST)*CGR
      DO 20 I=2,NYEAR1
   20 ADREC1(I)=-OUTFLO
      ADREC1(NYEAR1+1)=-OUTFLO-CGTAX
      DO 30 I=2,NYEAR2
   30 ADREC2(I)=-OUTFLO
      ADREC2(NYEAR2+1)=-OUTFLO-BONDP+PRONET
      N1=NYEAR2+1
      DO 40 I=1,N1
      DIFF1(I)=DREC(I)-ADREC1(I)
   40 DIFF2(I)=DREC(I)-ADREC2(I)
      WRITE(6,200)PROB1,PROB2,PROB1,PROB2
  200 FORMAT(' YEAR',20X,'DIRECT',20X,'INDIRECT',39X,'DIFFERENCE',/,
     139X,'PROB',F10.4,2X,'PROB',F10.4,20X'PROB',F10.4,2X,'PROB',F10.4)
      DO 50 I=1,N1
      J=I-1
   50 WRITE(6,300)J,DREC(I),ADREC1(I),ADREC2(I),DIFF1(I),DIFF2(I)
  300 FORMAT(1X,I3,16X,F14.2,5X,F14.2,2X,F14.2,18X,F14.2,2X,F14.2)
      CALL IRR(DIFF1,NYEAR1,RR)
      IRR1=RR
      CALL IRR(DIFF2,NYEAR2,RR)
      IRR2=RR
      EXIRR=PROB1*IRR1+PROB2*IRR2
      WRITE(6,700)PROB1,IRR1,PROB2,IRR2,EXIRR
  700 FORMAT(//,' EFFECTIVE COST OF MONEY WITH PROB',F7.2,'=',F10.4,
     1/' EFFECTIVE COST OF MONEY WITH PROB',F7.2,'=',F10.4,//,' EXPECTED
     2 EFFECTIVE COST OF MONEY=',F10.4)
      STOP
      END
```

```
      SUBROUTINE IRR(A,N,R)
      DIMENSION A(1)
      LOGICAL L
      N1=N+1
      XINC=.2
      L=.FALSE.
   70 FORMAT(6X,F12.3/)
      R=-XINC
  105 CONTINUE
  110 CONTINUE
C **** TO FIND THE VALUE OF IRR (R) PROGRAM USES INCREMENTAL TECHNIQUE.
      R=R+XINC
  115 SN=A(N1)
      Z=1.0
      DO 120 I=2,N1
      J=N1-I+1
      Z=Z*(1.+R)
  120 SN=SN+A(J)*Z
      IF (SN.LE.0.0) GO TO 150
      IF (.NOT.L) GO TO 250
      TEMP=ABS(R+XINC)
      IF(TEMP.EQ.0.0)GO TO 300
      TEM=XINC/(ABS(R+XINC))
      IF (TEM.LT..002) GO TO 150
  300 CONTINUE
      XINC=XINC/2.
      GO TO 250
  150 IF (SN.GE.0.0) GO TO 220
      IF (R.LE.0.0) GO TO 200
      XINC=XINC/2.
  200 R=R-XINC
      L=.TRUE.
      GO TO 115
  220 CONTINUE
      GO TO 1000
  250 CONTINUE
      TEMP=ABS(R+XINC)
      IF(TEMP.EQ.0.0)GO TO 110
      TE4=XINC/(ABS(R+XINC))
      IF (TE4.GE..002) GO TO 110
 1000 RETURN
      END
```

INDIRECT			DIFFERENCE		
)C00	PROB	0.1000	PROB	0.9000	PROB 0.1000
).00	60000000.00		-18720010.00		-18720010.00
).00	-171244.00		171244.00		171244.00
).00	-171244.00		171244.00		171244.00
).00	-171244.00		171244.00		171244.00
).00	-171244.00		171244.00		171244.00
).00	-171244.00		13716240.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
).00	-171244.00		0.00		171244.00
0.00	-171244.00		0.00		171244.00
0.00	-23406240.00		0.00		23406240.00

523
169

Y AREA= 5000 BYTES,TOTAL AREA AVAILABLE= 196768 BYTES

).19 SEC, WATFIV - VERSION 1 LEVEL 1 JANUARY 1970 DATE= 74/225

Addendum

VENTURE CAPITAL FINANCING: THREE CASE STUDIES

My case studies provided many interesting findings about venture capital financing. Broad generalizations, however, are difficult because too many varying factors are involved in each situation. The natures of the companies, though all high technology, differ considerably; their products, history and prospects all vary; and perhaps most importantly, the personalities and aspirations of both the founders and the financiers to whom they turned for funds are very different in each case.

Company A

The company was begun as a manufacturer of photomasks (used in the semiconductor industry) in 1968 from which came a holding company (Company "A"), while the original manufacturing concern became a wholly-owned subsidiary. The first company began with 17 individuals backing the three principals (including the present President & Chairman) with $265,000, for which they received common stock at $1.33 a share. Most of these individuals had, significantly, invested previously in an Ontario company controlled by the

President of Company A, and felt that they were investing not so much in the company, but the man himself. Not long after this, the three principals decided a broader scope for their activities was needed, so they formed a holding company with $302,000 raised from the sale of $1 convertible preferred stock, most of which was acquired by the original investors. Subsequently, the holding company acquired the original manufacturing firm through an exchange of stock at a ratio of 1.33 to one.

Later on, the holding company went public through an offering (handled without any investment bankers) of 200,000 shares at $2.50 each. The stock was trading at around $4.50 when all the convertible preferred shares were called in, for either $1 cash or one common share. This effectively doubled the number of common shares outstanding, as well as simplifying the capital structure.

Earlier, the company had turned to three small venture capital firms to finance the purchase of another subsidiary, which was accomplished through the sale to these firms of $500,000 worth of $4 preferred stock. However, it should be kept in mind that most of initial financing of Company A was provided by private individuals investing primarily in the ability of the President (for whom, incidentally, the company is named). They received preferred shares giving them priority status in case of liquidation, but because of

their faith in the President they gave him a free hand in all management decisions.

Company B

The situation with Company B, on the other hand, was very different. The firm was founded in 1969 when three principals, two engineers and a promoter, came to the present President (referred to hereafter as the Investor) with an idea for a sterilization process through radiation, with obvious application for pollution control, among other things. Ten thousand shares of stock were sold to the Investor and his partners at $16 each, while a further 13,000, discounted to $13.54 each (for services rendered) were issued to the three principals, for their personal notes.

In 1970, when the first unit was installed (an "Ionizer Oxidizer"), and was said to "work beautiful," the stock was split three-for-one, and a further 24,000 shares at $16 each were sold. The notes of the three principals were paid by selling some of their post-split shares to the Investor and his group. Subsequently, however, trouble arose, caused primarily (according to the Investor) by the incompetence, if not the dishonesty, of the three principals, all of whom have by now left the Company's employ. In

September, 1973, the Investor took over as President (after having invested over $700,000 of his own money), and with the help of the present Vice-President, "turned the company around," through hard work and dedication, though at the time the Company was virtually bankrupt. He did this primarily through intense marketing of the Company's products, helped by his own contact in industry.

In this particular case, the Investor allowed the original management of the Company (the three principals) to run things until it was almost too late. It was only under his direct control, and through his hard work, that the Company began to be successful; and this was only after the founders of the concern (all non-business-oriented people) had been jettisoned.

Company C

The financial history of this company, a manufacturer of commercial gas lasers, shows some interesting variations on normal methods of financing. It was founded in 1963 by five private individuals, who put up about $250,000, as a research-oriented firm, doing work on quantum physics with government funding. Not long afterwards, it entered into a joint-venture with a much larger manufacturing concern to develop a commercial gas laser. When this was accom-

plished two years later, the venture was ended and Company C went into the market on its own with its product.

At this point (1965), the original investors, together with some new people, invested more money in the company, receiving subordinated convertible debentures, making them senior creditors to the original stockholders (mostly the same individuals, of course), but subordinate to certain classes of senior debt. For several years, the company was able to survive with these funds, plus operating profits, but soon more funds were needed to finance expansion. At this point, in 1968, the company went to outside venture capitalists for the first time, selling a private investment group of 15 individuals $500,000 worth of subordinated convertible debentures, on which the conversion rate improved as time went on. Before this new issue was sold, the old issue of debentures was called in and exchanged for common stock. The next year, a mortgage was taken out on the firm's building (the company's first formal debt), and then in 1970, they went to outside capital a second time, selling $1 million worth of common stock to an insurance company and the partners of two brokerage firms. A year later, the company made a public offering of its stock, primarily to increase the liquidity of its stockholders, though $800,000 was raised as well. The next year (1972)

it began a series of acquisitions of related or complementary companies.

Company C's original sources of financing, then, consisted first, of private individuals holding common stock, then funds from the government and from the joint-venture with the larger manufacturing firm, and finally from outside capitalists and the holder of the mortgage on the building (an insurance company). This shows clearly the wide variety of financial sources available to a company which has a product for which there is a demonstrable demand, and which has a management imaginative and capable enough to seek out these sources.

Some Observations

The above analysis of these three companies, along with information based on interviews with executives of other companies (not reported here) enables us to make some useful observations.

Financing Instruments. Because of the high risk involved, venture capitalists demand equity participation in a company. Straight debt financing is rarely used because it limits the rate of return to a fixed percentage. The form of equity participation may be either common stock or some kind of convertible security. The latter instru-

ment is frequently preferred because it provides equity participation through the conversion feature, and at the same time, gives the investor a superior position (preferred status in the case of preferred stock and creditor claim in the case of bonds) in case of financial difficulties.

Common stock gives investors voting control, but even with convertible debt or preferred financing, some investors may exercise an active role in decision-making by demanding a management appointment.

Control. The actual day-to-day control of a company's operations can be in the hands of the founders or the venture capitalists, depending on the personality of either group. In the case of Company A above, the reputation and record of the President was such that the ivestors were quite content to let him run the operation with minimal interference from them; while in Company B's case, the major investor allowed the founders to run the concern, putting up money all the while, until they almost took it into the ground. Control of a firm, therefore, is an individual question, depending very much on the nature of a company and its principals, and the attitude of its backers. If a founder has demonstrated ability in management, the investors are usually better off to give him full rein. If, on the other hand, there is some doubt about this, the

investors can achieve some supervision either indirectly through voting or directly by demanding management positions.

Sources of Venture Capital. Original backers of venture projects are frequently private individuals, sometimes loosely organized into investment groups, able to provide enough money to get the company started, by purchasing common stock. Only after the companies were on their feet were other sources of funds, using more complex financial instruments, tapped. These individuals were usually wealthy, able to risk their money in relatively dangerous ventures. What attracted them was, particularly in the case of large single investors with some management and business experience, the "challenge," as the President of Company B put it. The potential financial returns were obviously great, but it was something more than that: the sense of being "in on the ground floor" of something, of watching something grow and develop. (This is the reason, perhaps, for the attraction that firms developing technologically sophisticated and innovative products have for this kind of investors.)

Although private individuals are very important in the development of these companies, the trend is toward institutionalization of venture capital investments through firms specializing in such activities. These can be either subsidiaries of financial institutions, or divisions of

large manufacturing companies, or special agencies sponsored by the government. Because of the wide diversity of the sources of venture capital, any firm seeking such financing should consider all possible sources when embarking on a project.

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