

## CHAPTER 7 Additional Issues in Valuation

### A. Index Models

Simple observation of security markets reveals a strong tendency for stock returns to be affected by common factors, particularly the market portfolio. From a mathematical perspective, these factors represent a source of covariance or correlation between returns of pairs of stock. The single index model specifies a single source of covariance among security returns  $R_{i,t}$ , and denotes security returns as a linear function of this factor or index  $I_t$ :

$$(1) \quad R_{it} = \alpha_i + \beta_i I_t + \varepsilon_{it}$$

where  $\alpha_i$  represents that portion of the return of security  $i$  that is constant and independent of the index  $I_t$ ,  $\beta_i$  represents the sensitivity of security  $i$  to index  $I$  and  $\varepsilon_{it}$  represents the portion of security  $i$ 's return which is security specific and unrelated to the index or to returns of other securities. The index models are simply regression models that presume that security returns are a linear function of one or more (in the case of multi-index models) indices. If index models can be used to generate security returns, then the process for obtaining security variances and covariances with respect to one another will be much simplified.

The Single Index Model has several uses:

1. To reduce the number of inputs and computations required for portfolio analysis. In particular, the Single Index Model will be useful for deriving forecasts for security and portfolio expected return, variance and covariance.
2. To build and apply equilibrium models such as the Capital Asset Pricing Model and Arbitrage Pricing Theory.
3. To adjust for risk in event studies and back-testing programs.
4. To derive risk-adjusted discount rates for stock valuation models.

The Single Index Model is based on the following series of assumptions:

1. As indicated above, security returns are linear in a common index as follows:

$$R_{it} = \alpha_i + \beta_i I_t + \varepsilon_{it}$$

2. The parameters of the index model  $\alpha_i$  and  $\beta_i$  are computed through a linear regression procedure such that the risk premium is purely a function of the index, not security specific risk. That is,  $E(\varepsilon_{it})=0$ . Furthermore, it will be assumed that security specific risk is unrelated to the value of the index; that is,  $E(\varepsilon_{it}I_t)=0=Cov(\varepsilon_{it}, I_t)$ .
3. The index represents the only source of covariance between asset returns. That is,  $E(\varepsilon_{it} \times \varepsilon_{jt})=0$ .

Based on the Single Index Model, we may reflect the expected return of a security  $i$  or portfolio  $p$  as follows:

$$(2) \quad [R_i] = \alpha_i + \beta_i E[I]$$

$$(2a) \quad [R_p] = \alpha_p + \beta_p E[I]$$

where the parameters for the portfolio are simply a weighted average of the parameters for the individual securities.

### Derivation Box 1

Here, we derive an expression for stock risk based on the Single Index Model. For sake of notational convenience, we use the expectations operator  $E[*]$  to replace the summation notation  $\sum_{i=1}^m [*]P_i$ . That is, for expected security return and variance, we have:

$$(A) \quad E[R_i] = \sum_{j=1}^m [R_i]P_i = \alpha_i + \beta_i \sum_{j=1}^m [I_j P_i]$$

$$(B) \quad \sigma_i^2 = E[(\alpha_i + \beta_i I + \varepsilon_i) - (\alpha_i + \beta_i E[I])]^2 = E[\beta_i(I - E[I]) + \varepsilon_i]^2$$

We can complete the square of Equation A and write security variance as:

$$(C) \quad \sigma_i^2 = E[(\beta_i^2(I - E[I])^2 + \varepsilon_i^2 + 2\beta_i(I - E[I]))]$$

Because the covariance between the index and firm specific returns is assumed to be zero above ( $E[(\varepsilon_{it}-0)(I-E[I])] = 0$ ), the cross product terms drop out:

$$(D) \quad \sigma_i^2 = E[(\beta_i^2(I - E[I])^2 + \varepsilon_i^2)] = \beta_i^2 E(I - E[I])^2 + E(\varepsilon_i - 0)$$

Due to our definition of variance, and that the expected unsystematic risk premium (error) equals zero, Equation C simplifies to:

$$(E) \quad \sigma_i^2 = \beta_i^2 \sigma_I^2 + \sigma_{\varepsilon_i}^2$$

This expression has a particularly useful intuition: security variance is the sum of systematic or index induced variance  $\beta_i^2 \sigma_I^2$  and firm specific variance  $\sigma_{\varepsilon_i}^2$ . Firm specific risk  $\sigma_{\varepsilon_i}^2$  will tend towards zero in a well-diversified portfolio such that portfolio variance is expressed:

$$(3) \quad \sigma_p^2 = \beta_p^2 \sigma_I^2$$

Based on the Single Index Model, we write the variance of a stock's returns as follows:

$$(3) \quad \sigma_p^2 = \beta_p^2 \sigma_I^2$$

The Single Index Model can be used to substantially reduce the number of computations for covariances required for portfolio risk analysis. Similarly, we can define covariance as follows:

$$(4) \quad \sigma_{i,j} = E[(R_i - E[R_i])(R_j - E[R_j])]$$

$$(5) \quad \sigma_{i,j} = \beta_i \beta_j \sigma_I^2$$

If our covariance calculations were to be based on 60 months of time series returns, we would compute a single beta value for each of  $n$  securities in a portfolio and a variance for the index itself. Thus, we could compute all  $(n^2-n)/2$  covariances from  $n$  betas and one variance. When  $n$  is large, the time to complete these computations will be substantially less than the time to compute  $(n^2-n)/2$  covariances from 60 months of raw returns data.

In most cases, the single index model relies on an index representing market returns. The most frequently used index for academic studies is the S&P 500, but other indices such as those provided by the exchanges, Value Line and Russell may be used as well.

### Adjusted Betas

Historical betas are most frequently estimated on the basis of covariances and variance drawn from sixty months of historical security returns. However, historical returns and their volatility are not necessarily the best indicators of future betas. Corporate circumstances change over time as do the markets evaluation of those circumstances. Furthermore, any historical beta estimate would be subject to sampling and measurement error. Blume [1975] has shown a tendency for betas to drift towards 1 over time. He proposed a correction for this tendency to drift towards one:

$$(6) \quad \beta_{i,F} = \gamma_0 + \gamma_1 \beta_{i,H}$$

where  $\beta_{i,F}$  is the forecasted beta for a future five year period and  $\beta_{i,H}$  is the historical beta estimated using the procedure described above. The coefficients  $\gamma_0$  and  $\gamma_1$  are determined by performing a regression of five-year betas against betas estimated over the immediately preceding five-year period. For example, the beta estimates  $\beta_{i,F}$  for the period 1955-1961 based on beta estimates for 1948-1954  $\beta_{i,H}$  were obtained from adjustment coefficients  $\gamma_0 = .343$  and  $\gamma_1 = .677$ . Note that the coefficients will normally sum to approximately one. Other adjustment procedures exist as well, including that proposed by Vasicek [1973].

### Fundamental Betas

Beaver, Kettler and Scholes [1970] and numerous papers authored by Barr Rosenberg, including Rosenberg and James [1976], have proposed estimating betas from firm fundamental factors including ratios. The advantage to this methodology is that the "fundamental beta" is not based on historical returns data but on current financial statement data supplemented with other current and relevant information. The fundamental beta forecast  $\beta_{i,F}$  is determined as a function of m firm fundamental factors  $x_i$ :

$$(7) \quad \beta_{i,F} = \gamma_0 + \gamma_1 x_{i,1} + \gamma_{i,2} + \dots + \gamma_{i,m}$$

The fundamental factors might include financial ratios such as debt-equity ratios, liquidity ratios and return measures. Other factors that might be considered relevant include firm size, tenure of C.E.O., volatility of industry, etc. The coefficients are determined on the basis of a regression of historical betas on historical values for the various fundamental factors. The regression coefficients from the historical regression across stocks are then used as weightings in Equation 7. Fundamental betas are frequently calculated by specialty financial service firms such as BARRA Associates (affiliated with MSCI) or units of firms such as Wells Fargo.

### Multi-Index Models

The Multi-Index Model enables the analyst to attribute multiple sources of covariance between security returns. The multi-index model can be used to estimate security returns, expected returns, variances and covariances as follows:

$$(13) \quad R_{it} = \alpha_i + \beta_{i,1} I_{t,1} + \beta_{i,2} I_{t,2} + \dots + \beta_{i,m} I_{t,m} + \varepsilon_{i,t}$$

$$(14) \quad E[R_i] = \alpha_i + \beta_{i,1} E[I_1] + \beta_{i,2} E[I_2] + \dots + \beta_{i,m} E[I_m]$$

$$(15) \quad \sigma_i^2 = \beta_{i,1}^2 \sigma_{I(1)}^2 + \beta_{i,2}^2 \sigma_{I(2)}^2 + \dots + \beta_{i,m}^2 \sigma_{I(m)}^2 + \sigma_{\varepsilon_i}^2$$

$$(16) \quad \sigma_{i,j} = \beta_{i,1} \beta_{j,1} \sigma_{I(1)}^2 + \beta_{i,2} \beta_{j,2} \sigma_{I(2)}^2 + \dots + \beta_{i,m} \beta_{j,m} \sigma_{I(m)}^2 + \sigma_{\varepsilon_i}^2$$

Derivations for these measures are identical to those for the Single Index Model after adjusting the original statistical measures for the additional indices.

One important problem from a practical perspective concerns how to obtain indices for the Multiple Index Model. Selection of these indices should be based upon the sources of co-movement among security returns. Potential indices might include market index returns, interest rates, commodity prices, financial ratios, firm size, and volatility of industry. Any economic or fundamental factor might qualify as an index if it captures a significant portion of the co-movement among security prices.

Financial analysts will generally pay particular attention to those ratios that significantly deviate from what might be considered to be in a normal range. Such

deviations might be indicative of particular strengths or weaknesses of the company. However, if a statistical analysis is to be performed on the ratio data (e.g., to find the statistical relationship between debt-equity ratios and stock returns), non-normally distributed cross-sectional or time-series data may cause analytical difficulties as many statistical tools are based on the assumption of normality of data. Extreme observations are likely to cause the most difficulties. There are several possible means for dealing with ratio data non-normality:

1. Eliminate extreme observations from the sample set. This strategy obviously involves a loss of information. A variation of this method is to simply change the extreme observations to new values falling closer to the normal range.
2. Transform data points (e.g., original values to logs of original values) to achieve normality of transforms. Such transformations often will not be possible (for example, when one or more of the original observations is negative).
3. Ignore the normality of data and treat the data as though it were normally distributed. This may result in inaccurate results. For example, extreme observations will bias an Ordinary Least Squares Regression.
4. Use non-parametric statistical tools such as a Spearman Rank Correlation, which do not require the normality assumption.

## B. Real Options and Equity

Much of the value of many companies can be interpreted as earnings potential. Firms are constantly making decisions to add or delete activities, product lines, markets, etc. from their operations. The abilities to continue to pursue these opportunities are important options to the firm and represent important sources of value to the firm. These options manifest themselves in many ways and, because of their contingent natures, are usually valued somewhat differently from other cash flows. Real options are written on physical assets, as opposed to financial options, which are written on financial securities such as stock. Managerial power to make decisions that affect project values are the underlying source for real option values. In some instances, individual components of the firm can be valued using real option methodology, in others the firm as a whole should be valued using the option methodology. In fact, in many instances, the premium of firm market values over book values can be partly explained by real option values not accounted for in accounting statements.

### Example: Simple Option to Build

Suppose that a retailer has the opportunity to buy building site (land only) for \$3,000,000. The retailer can erect a building on this site in two years for \$5,000,000. The \$5,000,000 will be paid in two years; the building will be open for sales in three years. After-tax profits generated by this building will total \$200,000 or \$700,000 three years from now. Each outcome is equally likely and will be known within two years, before the building decision. The profits, regardless of which outcome actually occurs, will grow at a compound annual rate of 3% forever. Cash flows are all discounted at 8%. What is the NPV of this project to the retailer?

$$NPV = -3,000,000 - \frac{5,000,000}{(1 + .08)^2} + \frac{.5 \times 200,000 + .5 \times 700,000}{(.08 - .03)(1 + .08)^4} = 671,425$$

This NPV analysis ignores the fact that the retailer is not obliged to invest in the building in two years. If the profit outcome is the lower of the two possibilities, the retailer will opt not to build. What is the value of this building option if the land can be sold in two years for \$3,500,000?

First, if in two years, the retailer knows that the profit outcome will be the stronger of the two potential outcomes, the investment to build will occur:

$$NPV = -3,000,000 - \frac{5,000,000}{(1 + .08)^2} + \frac{700,000}{(.08 - .03)(1 + .08)^4} = 3,003,724$$

whereas, the investment will not be undertaken in the weaker profit scenario since its NPV would not justify continuing to hold the land or invest \$5,000,000 into the building. So, once it is determined that the building will not be erected, the land is sold:

$$NPV = -3,000,000 + \frac{3,500,000}{(1 + .08)^2} = 686$$

Since each scenario is equally likely, the value of the project is  $.5 \times 3,003,724 + .5 \times (686) = 1,502,205$ . Thus, the option to decide on the building adds substantial value to the project:  $1,502,205 - 671,425 = 830,780$ . Thus, \$830,780 is the value of the option to build.

### The Certainty Equivalence Model

Since the firm's equity risk and overall capital risk is greater than its debt risk, discount rates derived from cost of equity and overall cost of capital are said to be risk adjusted. However, many types of projects have risks that are not resolved until the project terminates. In this case, the analyst should not use a discount rate to adjust for risk because an exponent reflecting time will be used to compound the risk-adjusted discount rate. No risk is resolved until the project terminates, but the time exponent compounding the discount rate will diminish as time goes by. For example, if a target firm had invested in a federal government lottery for oil drilling rights, no uncertainty associated with the cash flows for the drilling project initiation would be resolved until the results of the lottery are known. Thus, the discounting mechanism should not allow for smaller risk discounts as the lottery date draws closer.

The Certainty Equivalence Model provides us with an alternative approach for dealing with this risk resolution problem. Suppose that an acquiring firm were to bid \$100 thousand now for a target firm whose only asset was a government lottery with an expected payoff of \$150 thousand in three years when the lottery is actually resolved. Since all of the risk resolution occurs in the third year, no risk adjustments will be taken in years one and two. However, management has determined that the risk of this investment is such that if the lottery were to be held immediately, the drilling rights with the expected payoff of \$150,000 ( $E[CF_t]$ ) would be worth \$130,000. Management associates a risk premium ( $PRE_t$ ) of \$20,000 with this lottery winning; that is, \$20,000 is deducted from the expected value of the lottery to determine its risk-adjusted value.<sup>1</sup> This means that \$130,000 is the certainty equivalence ( $CEQ_t$ ) of the \$150,000 risky payoff. The certainty equivalence of the \$150,000 expected payoff in three years is still \$130,000. However, an adjustment must still be made for the time value of money. Suppose that the riskless rate of return is 10 percent. The NPV associated with the lottery entry can be found as follows:

$$(9) \quad NPV = \sum_{t=0}^n \frac{E[CF_t] - Pr e_t}{(1 + r_f)^t} = \sum_{t=0}^n \frac{CEQ_t}{(1 + r_f)^t}$$

$$NPV = -100,000 + \frac{150,000 - 20,000}{(1 + .1)^3} = -100,000 + \frac{130,000}{(1 + .1)^3} = -100,000 + 97,670.92 = -2,329.08$$

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<sup>1</sup> There are many ways to estimate this risk premium, including with the CAPM. If CAPM is used,  $Pre = \lambda COV(CF_t, r_m)$  where  $\lambda = E[R_m - r_f] / \sigma_m^2$  and  $COV(CF_t, r_m)$  is the historical covariance between asset cash flows and returns on the market portfolio.

Thus, risk adjustments have been made in the numerator of the discounting function where it is not affected by  $t$  and the time value of money adjustments would be made in the denominator.

One excellent application of the CEQ Model is in the analysis of real options. Real options analysis acknowledges that acquisitions may provide the acquiring firm with additional options, including project abandonment, expansions and deferrals, additional investments, timing, etc. In some instances, such options can be evaluated with standard option pricing methodology; in other instances, a very straightforward probability/scenario analysis can be used.

Example: New Product Development

Consider Banner Medical Devices, which is in the process of developing a new implantable device to deliver insulin to diabetic patients. The up-front investment for initiating R&D on this product is \$10,000,000. It is not known now whether the device will be as functional as is hoped. However, it is expected that this initial phase of the product development will be completed in five years. The Banner R&D Department expects that there is now a fifty percent chance that the development efforts will be successful, though this uncertainty will not change for five years when the R&D outcome is known. If the Banner development efforts are unsuccessful, the new product line will be worthless. If the development phase is successful, Banner will invest another \$50 million five years from now to test market the new product for one year. The firm's management believes that, conditional on the development phase having been successful, there is a ninety percent chance that the test-marketing plan will be successful and will suggest that the new device should be produced and marketed in the medical profession. Hence, management projects a 45% probability that Banner will enter into the production and marketing phase. At this point (six years from now), the firm will invest another \$30 million in plant and equipment to produce the delivery system. Net cash flows after expenses, and taxes from the sale of the system are expected to be \$18 million each year forever, starting six years from now. This data is summarized in Table 10.

**Table 10:  
Banner Expected Cash Flows and Present Values**

<u>time (t)</u>	<u>CF(t)</u>	<u>Prob.</u>	<u>E[CF(t)]</u>	<u>PV Assuming Risk Neutrality</u>
0	-10,000,000	1	-10,000,000	-10,000,000.00
1-4	0	1	0	0
5	-50,000,000	.50	-25,000,000	-15,523,033.07
6	-30,000,000	.45	-13,500,000	-7,620,398.05
6 -	18,000,000	.45	8,100,000	45,722,388.33
<b>Totals</b>				<b>12,578,957.20</b>

Thus, our first step in finding the product line NPV is to determine expected cash flows for each year. First, the initial investment is \$10,000,000. Second, since there is only a fifty percent chance that the development efforts will be successful, the expected



value of the disbursement for the test-marketing plan is \$25 million (\$50 million  $\times$  .5). Similarly, the probability that the firm will invest \$30 million in plant and equipment six years from now is  $(.50 \times .90) = .45$ . Thus, the expected value of this outlay is \$30 million  $\times$  .45 = \$13.5 million. Finally, the expected value of the net annual cash flow from the sale of the new product is \$18 million  $\times$  .45 = \$8.1 million, starting six years from now.

Next, we determine the present values of these expected cash flows. The present value of this five-year deferred investment in test marketing is  $\$25,000,000/1.1^5 = \$15,523,033.07$ . The present value of the six-year deferred investment into plant and equipment is  $\$30,000,000/1.1^6 = \$13,500,000/1.1^6 = \$7,620,398.05$ . The present value of the revenue perpetuity expected value deferred until six years from now is  $(\$8.1 \text{ million}/.1)/1.1^6 = \$45,722,388.33$ .

Next, we will determine Certainty Equivalents. Suppose that management has determined that it will deduct a risk premium of 5 percent from all expected values for cash flows affected by the risk associated with the R&D phase of the project's development. Furthermore, management will deduct an additional 2 percent from expected cash flows affected by the uncertainty about the test-marketing phase. The certainty equivalent for each expected present value is  $.95 \times .98 \times PV$ . This results in a total Certainty Equivalence NPV equal to \$10,726,071.53, which is greater than zero and suggests that this option to market a new product line has significant value.

**Table 11:  
Banner CEQ**

<b>Time (t)</b>	<b>PV Assuming Risk Neutrality</b>	<b>% Risk Reduction</b>	<b>PV Certainty Equivalents</b>
0	-10,000,000.00	0	-10,000,000.00
1-4	0	0	0
5	-15,523,033.08	.05	-14,746,881.42
6	-7,620,398.06	.05, .02	-7,094,590.59
6-	<u>45,722,388.33</u>	.05, .02	<u>42,567,543.54</u>
Totals NPV	12,578,957.20		10,726,071.53 = CEQ

### Real Option Analysis, Takeovers and Other Options

Takeovers frequently provide for some degree of flexibility, which can have significant value. This flexibility is often in the form of an option to do something such as abandon the project early or to transfer assets to some other type of use. Consider, for example, a plot of vacant land on which its owner may choose (but is not obligated) to build. A second example might be a machine whose use might be transferred to another product line. In addition, real options analysis can be used to value insurance contracts of various types. These options, when relevant, should be valued as part of the takeover. To describe how to value these options, we will need to consider standard option contracts and how they are valued.

The option pricing methodology may be applied to a wide array of valuation problems. Many types of financial problems deal with options of some type to make investments (interpreted rather broadly), to forego investment opportunities or to "bail" out of previously made investments. "Long" positions in options add to firm value; "short" positions reduce firm value. Unfortunately, financial managers sometimes refer to many real options as "intangibles," without being able to properly value them. It is very useful to be able to properly analyze a situation, determine whether an option of some type exists to buy or sell, which party in a contracting scenario is long or short in the option and to use the option pricing methodology to evaluate the positions. The following represent just a few of the situations where the option pricing methodology might be useful in valuation analysis or capital budgeting more generally:

- Timing investment decisions such as investment deferral
- Options to contract or expand projects
- Project abandonment options
- Options to re-apply project technology elsewhere
- Options to extend projects
- Controlling risk with options and futures contracts
- Project insurance
- Lease agreements with option to buy
- Valuing leveraged firms, spin-offs, subsidiaries, etc.
- Valuing risky debt
- Options to switch production technologies or exchange assets
- Estimating failure or default probability
- Loan guarantees
- Valuing hybrid securities used for project financing

Appendix C to Chapter 4 provides an introduction to options and to options pricing. Here, we will apply the Black-Scholes Options Pricing Model below to several real options examples:

$$(1) \quad c_0 = S_0 N(d_1) - \frac{X}{e^{r_f T}} N(d_2)$$

$$(2) \quad d_1 = \frac{\ln(S_0 / X) + (r_f + .5\sigma^2)T}{\sigma\sqrt{T}}$$

$$(3) \quad d_2 = d_1 - \sigma\sqrt{T}$$

#### Real Options Analysis: Asset Abandonment Option Example

Consider a titanium producer that has the opportunity to take over a mining company for \$21 million. The primary assets of the acquisition are a titanium mine in Florida and mining-related equipment. The mining equipment, if not used, can be sold

now for \$12,000,000 or at any time over the next  $t$  years to another mining company for  $\$12,000,000 e^{.05 \times t}$ . The mine itself will be worthless if it is abandoned, but the equipment could be sold for  $\$12,000,000 e^{.05 \times t}$ . As of now, it is not known what the yield of the mine will be. A five-year study by geologists will be undertaken to determine this. Five years from now, the mine's prospects will be fully revealed by the study. Hence, in five years, a decision will be made as to initiating mining operations. The mine will be abandoned and the equipment sold for  $\$12,000,000 e^{.05 \times 5} = \$15,408,305$  if the yield is revealed to be less than  $\$12,000,000 e^{.05 \times 5}$ . In this case, the yield of the mine would simply not be large enough to justify using the mine equipment and it would make more sense to abandon the mine and sell the equipment. Geologists currently believe that the present value of the mine's expected lifetime yield is \$20,000,000, but this value will not be certain until after the five-year study. The level of uncertainty concerning the mine's yield is high. Nevertheless, geologists estimate that there is a 65.86 percent chance that this present value will range from \$14.16 million to \$25.84 million, implying a payout standard deviation of \$5,840,000.<sup>23</sup> Thus, the mine's return standard deviation is .292 based on the expected value of \$20 million and a normal distribution of payouts. The actual yield of the mine could be much lower or much higher, though the standard deviation of the yield does reflect this uncertainty. The mining equipment will be used until it is worthless unless the mine is abandoned and the equipment is sold. Thus, the cost of producing titanium from the mine is using the equipment until it is worthless. Thus, the company value if it does produce from the mine equals the yield from the mine; the equipment would ultimately have zero value since it would be fully used. The current riskless return rate is 5 percent, the same as the anticipated annual increase in the equipment value. Is this mining company worth \$21 million if the NPV of the present value of the expected yield of the mine is only \$20 million? What is the value of the mining company?

There are two ways to look at this problem. First, the mining company can be modeled as having mining equipment and a call option to extract ore from the mine in five years. If the company chooses to extract the ore, it uses up its mining equipment. Then, the exercise price of this call to extract ore is the future value of the mining equipment to be used, 15,408,305 and the call's expiration is 5 years. Option details are summarized as follows:

$$\begin{array}{ll} T = 5 & r_f = .05 \\ X = 15,408,305 & S_0 = 20,000,000 \\ \sigma = .292 & \sigma^2 = .0853 \end{array}$$

Our first steps to value the call option are to find  $d_1$  from Equation (2) and  $d_2$  from Equation (3):

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<sup>23</sup> If payouts are normally distributed, there is a 65.86% probability that the yield will be within one standard deviation of the mean. The mean or expected yield is \$20 million and the standard deviation is \$5.84 million. The return is expressed as a proportion of \$20 million. If the mine yield were \$14.16 million, it would be 29.2% less than the mine's expected yield; if the mine yield were \$25.84 million, it would be 29.2% more than the expected yield.

$$d_1 = \frac{\ln(20,000,000 / 15,408,305) + (.05 + .5 \times .0853) \times 5}{.292 \times \sqrt{5}} = 1.108823$$

$$d_2 = 1.108823 - .292 \times \sqrt{5} = .455891$$

Next, by either using a z-table or by using an appropriate polynomial estimating function from a statistics manual, we find normal density functions for  $d_1$  and  $d_2$ :

$$N(d_1) = .866247 \qquad N(d_2) = .675766$$

We use  $N(d_1)$  and  $N(d_2)$  in Equation 1 to value the call option to produce the mine as follows:

$$c_0 = 20,000,000 \times .866247 - \frac{15,408,305}{2.7182818^{-.05 \times 5}} \times .675766 = 9,215,743$$

The value of the call option to produce titanium is \$9,215,743. Add this value to the \$12,000,000 current value of the mining equipment to determine the value of the target mining company to be \$21,215,743.

There is a second way to consider the option value of the mine. At present, the expected yield of the mine is \$20 million, and the firm has the option to abandon the mine if its yield is ultimately proven to be less than the value of the equipment to extract the ore. If the mine is ultimately abandoned, the firm will sell the mining equipment for its future value of \$15,408,305. Abandoning the mine to realize sales proceeds from the sale of mining equipment is analogous to exercising a put option on the mine for the value of the mining equipment. Thus, the value of the target firm equals \$20 million plus the value of a put option to abandon it for \$15,408,305. We will value this put using the put-call parity relation from the appendix to Chapter 4:

$$p_0 = c_0 + Xe^{-r_f T} - S_0$$

$$p_0 = 9,215,743 + 15,408,305 \times 2.7182818^{-.05 \times 5} - 20,000,000 = 1,215,743$$

Thus, the value of the put option to abandon the mine equals \$1,215,743. The mine has an expected value of \$20,000,000, so that the total value of the target firm is \$21,215,743. This is the same value as we obtained when we valued the target as the sum of equipment value plus the call to extract ore from the mine. The value of the target firm equals \$21,215,743, making it a worthy purchase at a price of \$20 million.

#### Real Options Analysis: Corporate Securities as Options

Here, we discuss how one might value the equity and debt securities of a leveraged firm as combinations of options and riskless debt and how takeovers and coinsurance might affect these option values. Corporate law provides for limited liability

for corporate shareholders. This limits the obligation of shareholders to creditors to the amount that shareholders have invested in the equity of the firm. Limited shareholder liability provides a valuable option to shareholders and is costly to creditors. This limited liability feature of the typical corporation increases shareholder wealth when managers increase risk-taking by managers. This increased risk-taking increases shareholder wealth by enabling shareholders to benefit from highly successful ventures. While creditors do not share proportionately in the gains of the successful venture, they do stand to lose if the risky ventures are unsuccessful. Hence, shareholders are the primary beneficiaries of a successful venture; creditors lose disproportionately in unsuccessful ventures. This increases shareholder wealth at the expense of creditors.

Key to this analysis is the notion that shareholders can be thought to have a long position on a call option on the firm's assets. If the firm does well, shareholders exercise their right to purchase the firm's assets by paying off creditors. The face value of debt (along with accrued interest) can be regarded as the exercise price of the shareholder call option on the firm's assets. The shareholder call option to purchase the firm's assets is exercised when it is realized that the firm has performed well enough such that the value of those assets exceeds the face value of debt along with accrued interest representing the exercise price of the call option. If the firm performs poorly enough such that the value of assets is exceeded by the value of the creditor obligation, shareholders default and leave the assets to creditors. In effect, they decline their right to purchase the firm's assets. Hence, shareholders can be thought to have a call option on the firm's assets that is exercised only if the firm performs well and shareholders opt to assume control of the firm's assets by settling obligations to creditors.

Now, let us consider the creditor's position. Creditors expect to receive a fixed payment. This is analogous to riskless debt. However, creditors understand that if the firm performs poorly, they must accept control of the firm's assets in exchange for indemnifying shareholder obligations. Hence, they agree to accept the firm's assets if shareholders wish to put the firm's assets to them. The creditor position is analogous to a short position in a put. Creditors must take control of the firm's assets if shareholders do not want them; otherwise, shareholders have no obligation. The exercise price associated with this put is the value (face value plus accrued interest) of the shareholder obligation to them.

The option positions described above suggest that a leveraged firm's assets can be modeled using the put-call parity formula (See the Chapter 4 appendix) as follows:

$$(4) \quad S_0 = c_0 + Xe^{-r_f T} - p_0$$

where:

- $S_0$  = the total value of the firm's assets
- $c_0$  = the value of the firm's equity, a long position on a call on the firm's assets
- $Xe^{-r_f T} - p_0$  = the value of the firm's debt, reflecting two positions:
- $Xe^{-r_f T}$  = the present value of riskless debt maturing at time T

$p_0$  = the risk reduction in the firm debt value; a short position in a put on assets

Thus, we model the firm as though bondholders own the firm's assets. Shares of stock becomes call options for shareholders to purchase the firm's assets from bondholders by paying the face value  $X$  of debt, which is, in effect, the exercise price of the call option on assets. Bondholders maintain short positions on puts to retain control of the firm's assets by forgiving shareholder obligations to them.

### Real Options, Takeovers and the Coinsurance Effect

The co-insurance effect concerns the ability of creditors of each of two combining firms to obtain repayment protection from the shareholders of both firms. In effect, when two firms combine, shareholders of both firms combine their resources to repay creditors of both firms. Thus, in a merger or other combination, shareholders of each firm are not only responsible for debt repayment of their own firm, they are also jointly responsible for the debt of the counterpart firm. Creditors receive additional protection in business combinations while shareholders assume additional responsibilities to repay debt. This coinsurance represents a transfer of wealth from shareholders to creditors. If the combination of businesses increases the diversification of the combining firms as should be expected, overall asset risk is reduced. Hence, takeover combinations can be "two edge swords" for shareholders of leveraged firms. This reduced asset risk decreases shareholder wealth, who maintain call options on the firm's assets. This wealth is transferred to creditors whose short positions in puts also benefit from reduced asset risk.

### Limited Liability Equity: An Example

Consider a grocery distributor with \$25,000,000 in assets that has the opportunity to take over a supermarket chain with \$20,000,000 in assets. The distributor has \$20,000,000 in zero coupon debt maturing in two years and the supermarket has \$15,000,000 in zero coupon debt maturing in two years. Assume that all Black-Scholes assumptions apply to each of the two firms and their securities. The standard deviations of asset returns for the distributor and supermarket are, respectively, .4 and .5. The riskless return rate is currently .04. What will be the debt and equity values for each of the two firms?

In this example, we will treat equity securities as though they are call options on firm assets, enabling shareholders to take control of the firm by paying creditors the face value of debt. If asset value is less than the face value of debt, shareholders abandon their option to take over the firm's assets. This limited shareholder liability requires debt to be risky. In effect, creditors must forgive debt payments if shareholders wish to abandon the firm (this is bankruptcy), leaving creditors holding the firm's assets. Hence, creditors, with their risky debt, hold a combination of riskless debt and a short position on a put on the assets of the firm. Thus, in effect, creditors have agreed to purchase the firm's assets by forgiving debt should shareholders wish to file for bankruptcy.

We will re-define the terms that we use in the Black-Scholes Model for this example. From the problem statement, we have the following for the distributor:

$$\begin{array}{ll} T = 2 & r_f = .04 \\ X = 20,000,000 & S_0 = 25,000,000 \\ \sigma = .4 & \sigma^2 = .16 \end{array}$$

Inputs for the supermarket chain are:

$$\begin{array}{ll} T = 2 & r_f = .04 \\ X = 15,000,000 & S_0 = 20,000,000 \\ \sigma = .5 & \sigma^2 = .25 \end{array}$$

We will start by estimating values for  $c_0$  for each firm as follows. Our first steps are to find  $d_1$  from Equation (4) and  $d_2$  from Equation (5) for the distributor:

$$d_1 = \{\ln(25/20) + (.04 + .5 \times .16) \times 2\} \div \{.4 \times 2^{.5}\} = .81873$$

$$d_2 = d_1 - .4 \times 2^{.5} = .253044$$

Next, we find normal density functions for  $d_1$  and  $d_2$ :

$$N(d_1) = .7935 \quad N(d_2) = .5998$$

Finally, we use  $N(d_1)$  and  $N(d_1)$  in Equation (3) to value the equity:

$$c_0 = 25,000,000(.7935) - [20,000,000 \times .923] \times .5998 = 8,763,008 = \text{equity value}$$

Next, we use put-call parity to value the short put position maintained by creditors:

$$p_0 = 8,763,008 + (20,000,000 \times .923) - 25,000,000 = \$2,225,335$$

Hence, with the risk adjustment, the value of the distributor's risky debt is  $20,000,000e^{-.04 \times 2} - \$2,225,335 = 18,462,328 - \$2,225,335 = \$16,236,992$ . Note that debt and equity values sum to asset value.

We will repeat the calculations for the supermarket chain:

$$d_1 = \{\ln(20/15) + (.04 + .5 \times .25) \times 2\} \div \{.5 \times 2^{.5}\} = .8735 \quad N(d_1) = .8088$$

$$d_2 = .8735 - .5 \times 2^{.5} = .1664 \quad N(d_2) = .5661$$

$$c_0 = 20,000,000(.8088) - [15,000,000 \times .923] \times .5661 = 8,337,781 = \text{equity value}$$

Next, we use put-call parity to value the short put position maintained by creditors:

$$p_0 = 8,337,781 + (15,000,000 \times .923) - 20,000,000 = \$2,184,526$$

Hence, with the risk adjustment, the value of the chain's limited liability debt is  $\$15,000,000e^{-.04 \times 2} - 2,184,526 = 13,846,746 - \$2,184,526 = \$11,662,219$ .

### Limited Liability Equity, Takeovers and Coinsurance: An Example

Now, suppose that the two firms described above are to combine. The correlation coefficient between asset returns for the two firms is .3. What will be post-merger debt and equity values of the combined firm? Do shareholders and bondholders benefit from the combination? To answer these, we will repeat the calculations above for the combined firm. However, we will first need to determine the standard deviation of the combined firm's assets. Since the firm's returns are not perfectly correlated, the merger will reduce the risk levels of the firms. First, note that the combined firm's assets will total \$45,000,000, fraction 5/9 from the distributor (d) and 4/9 from the supermarket chain (s). Also note that the correlation coefficient between returns on their assets is .3. Using a simple two-security risk equation, we find that the combined firm standard deviation of returns equals .3583:

$$\sigma_p = \sqrt{(w_d^2 \sigma_d^2) + (w_s^2 \sigma_s^2) + 2(w_d w_s \sigma_d \sigma_s \rho_{d,s})}$$

$$\sigma_p = \sqrt{(.556^2 \cdot .16) + (.444^2 \cdot .25) + 2(.556 \cdot .444 \cdot .4 \cdot .5 \cdot .3)} = .3583$$

Notice that the return standard deviation for the combined firm is less than those for either of the two firms operating as separate entities. Now, with the new standard deviation, we repeat the valuation calculations. Inputs for the combined firm are:

$T = 2$	$r_f = .04$
$X = 35,000,000$	$S_0 = 45,000,000$
$\sigma = .3583$	$\sigma^2 = .1284$

$$d_1 = \{\ln(45/35) + (.04 + .5 \times .1284) \times 2\} \div \{.3583 \times 2^{.5}\} = .9072 \quad N(d_1) = .8178$$

$$d_2 = .9072 - .3583 \times 2^{.5} = .4004 \quad N(d_2) = .6555$$

$$c_0 = 45,000,000(.8178) - [35,000,000 \times .923] \times .6555 = 15,621,743 = \text{equity value}$$

Next, we use put-call parity to value the short put position maintained by creditors:

$$p_0 = 15,621,743 - 45,000,000 + (35,000,000 \times 1.083) = \$2,930,815$$

Thus, with the risk adjustment, the value of the combined chain's limited liability debt is  $\$35,000,000e^{-.04 \times 2} - 2,930,815 = 32,309,074 - \$2,930,815 = \$29,378,257$ . Note that the combined firm equity, \$15,621,743, is \$1,479,046 less than their combined separate values of  $\$8,763,008 + \$8,337,781 = \$17,010,789$ . This \$1,479,046 wealth



reduction to shareholders was transferred to creditors. The total debt value prior to the takeover was \$27,899,210; it is now \$29,378,256 = \$45,000,000 - \$15,621,743. Hence, the takeover reduced combined firm risk, reducing shareholder wealth and transferring it to creditors.

While business combinations of leveraged firms certainly involve wealth transfers from shareholders to creditors, it is not clear from statistical data whether market values actually change as suggested in our example. One complication that frequently arises in business combinations is that the risk reduction increases firms' debt capacities. This in turn leads many firms to borrow more when they engage in takeover activity, resulting in offsetting the wealth transfer effects.

### **C. Valuing a Merger**

The relative valuation and discounted cash flow models value the firm as an ongoing and perhaps stand-alone concern. However, many public companies are potential takeover candidates whose shares should ultimately be valued as such. That is, the market may value a company based on its value as a takeover candidate, and this value may well exceed its value as a stand-alone concern. Takeovers present special problems for valuation. First, if control of the target firm is an issue, valuing the stock requires an assessment of the voting rights for shares. The voting rights value (discussed in greater detail later) may reflect the firm's post-acquisition value. In addition, the takeover is likely to involve synergies between the two companies, tax effects, real options and other considerations.

#### **Takeover Valuation: Illustration**

In 2006, the Washington Electronics Corporation bought out the stock of the Adams Wire Company. Adams was a smaller company than Washington with projected annual revenues of \$800,000 for 2006. Prior to the takeover, Washington Company managers projected \$500,000 annual cost levels for the Adams Company; however, the proposed takeover was expected to reduce these annual costs by \$100,000. All revenues, costs and cost reductions were projected to grow at the 10 percent rate of inflation indefinitely. Both companies operated in the 40 percent corporate marginal income tax bracket. To complete the merger, shareholders of the former Adams Company were compensated with \$4,200,000 in Washington Company common stock and cash. Washington Company management determined that the appropriate discount rate for cash flows resulting from the merger was 15 percent. Was Washington's decision to take over the Adams Company appropriate given the facts and projections that were available in 2006?

The NPV technique can be used quite easily to evaluate this merger. Cash flows and the appropriate discount rate are the important factors in the NPV analysis. Cash flows generated by this merger can be classified into two streams: the initial \$4,200,000 investment and a growing perpetuity (since the purchased company has an indefinite life expectancy) reflecting the cash flows resulting from revenues, costs and corporate income taxes. The Earnings Before Taxes generated by this perpetuity in 2006 were projected to be \$400,000:

$$(\$800,000 - \$500,000 + \$100,000) = \$400,000$$

Because corporate income taxes must be paid on this \$400,000 increase in gross profits, Washington's taxes must increase by \$160,000 (40% \* \$400,000). Therefore, Washington's net cash flows (after taxes) will increase by \$240,000:

$$[\$400,000 * (1 - .40)] = \$240,000$$

These net cash flows were projected to grow at a rate of 10 percent per year indefinitely. They were to be discounted at a rate of 15 percent in a growing perpetuity model. The value of this growing perpetuity is \$4,800,000:

$$PV_{gp} = \frac{240,000}{.15 - .10}$$

Therefore, the net present value of this takeover was \$600,000, indicating that it was a wise investment for the Washington Corporation:

$$NPV = -\$4,200,000 + \$4,800,000 = \$600,000$$

**Table 3:  
Takeover Decision Example**

Rev <sub>1</sub>	=	\$800,000	P <sub>0</sub>	=	\$4,200,000	τ	=	.40
Costs <sub>1</sub>	=	\$500,000	k	=	.15			
Synergies <sub>1</sub>	=	\$100,000	g	=	.10			

$$NPV = -4,200,000 + \frac{[800,000 - 500,000 + 100,000][1 - .4]}{.15 - .10} = 600,000$$

Since NPV > 0, the takeover was expected to be profitable for Washington shareholders.

Application: The 2004 Vodafone Takeover Bid for AT&T Wireless

In February 2004, Vodafone made a \$38.5 billion takeover offer for AT&T Wireless (AWE) for \$14 per share. While the offer was ultimately rejected for a \$42 billion competing offer from Cingular, the takeover might have been valued by Vodafone as described in this section. First, consider standardized income statements and year-end balance sheets for each company for 2003 given in Table 5.

**Table 5:  
Vodafone and AT&T Wireless 2003 Accounting Statements**

<u>Vodafone Income Statement</u>			<u>AT&amp;T Wireless Income Statement</u>		
2003		(\$000's)	2003		(\$000's)
	Rate	<u>VOD: 2003</u>		Rate	<u>AWE: 2003</u>
Sales		\$ 47,962,000	Sales		\$ 16,695,000
COGS	0.59	<u>\$ 28,258,000</u>	COGS	0.41	<u>\$ 6,803,000</u>
Gross Margin		\$ 19,704,000	Gross Margin		\$ 9,892,000
Fixed Cost		\$ 12,705,000	Fixed Cost		\$ 5,470,000
Depreciation		<u>\$ 25,117,000</u>	Depreciation		<u>\$ 3,209,000</u>
EBIT		\$ (18,118,000)	EBIT		\$ 1,213,000
Interest		<u>\$ 2,277,000</u>	Interest	0	<u>\$ 789,000</u>
EBT		\$ (20,395,000)	EBT		\$ 424,000
Income Taxes	0.21	<u>\$ (4,188,000)</u>	Income Taxes	0.26	<u>\$ 112,000</u>
NIAT		\$ (16,207,000)	NIAT		\$ 312,000
Preferred Stock Div.		\$ -	Preferred Stock Div.		\$ 13,000

NI to Common Stock	\$ (16,207,000)	NI to Common Stock	\$ 299,000
# of shares	6,820,000	# of shares	2,720,000
EPS	-\$2.38	EPS	\$0.11

**Vodafone Balance Sheet**

<b>Dec. 31, 2003</b>	(S000's)
Current Assets	\$ 13,565,000
Fixed Assets	<u>\$262,831,000</u>
Total Assets	\$276,396,000
Debt	\$ 54,648,000
Preferred Equity	\$ -
Common Equity	<u>\$221,748,000</u>
Capital	\$276,396,000

**AT&T Wireless Balance Sheet**

<b>Dec. 31, 2003</b>	(S000's)
Current Assets	\$ 7,815,000
Fixed Assets	<u>\$39,987,000</u>
Total Assets	\$ 47,802,000
Debt	\$ 19,298,000
Preferred Equity	\$ 7,841,000
Common Equity	<u>\$ 20,663,000</u>
Capital	\$ 47,802,000

To start the process of valuing AT&T cash flows, we will simply combine the two company income statements:

**Combined Company Income Statement: 2003**

No Synergies	(S000's)
	<b><u>VOD: 2003</u></b>
Sales	\$ 64,657,000
COGS	\$ 35,061,000
Gross Margin	\$ 29,596,000
Fixed Cost	\$ 18,175,000
Depreciation	\$ 28,326,000
EBIT	\$ (16,905,000)
Interest	\$ 3,066,000
EBT	\$ (19,971,000)
Income Taxes	\$ (4,076,000)
NIAT	\$ (15,895,000)
Preferred Stock Div.	\$ 13,000
NI to Common Stock	\$ (15,908,000)

Now, we will assume that the takeover will result in operating synergies for the combined firm. Assume that the takeover will enable each firm to better penetrate each other's markets and that total revenues will increase by 1 percent per year. Further, assume that cost efficiencies will reduce Cost of Goods Sold and Fixed Costs (excluding depreciation) by 1 percent. We will assume that depreciation, interest payments and preferred dividends will be unaffected. We will also assume a tax rate of 21 percent on combined firm earnings or losses. We restate the combined firm income statement with operating synergies in Table 6.

**Table 6:  
Vodafone and AT&T Wireless 2003 Combined Accounting Statements with Synergies**

**Combined Company Income Statement:  
2003**

With Synergies	(\$000's)	
	<b><u>VOD: 2003</u></b>	<b><u>Assume:</u></b>
Sales	\$ 65,303,570	1% increase in total sales
COGS	\$ 35,057,494	1% decrease in CGS/Sales
Gross Margin	\$ 30,246,076	
Fixed Cost	\$ 17,993,250	1% decrease in FC
Depreciation	\$ 28,326,000	
EBIT	\$(16,073,174)	
Interest	\$ 3,066,000	
EBT	\$(19,139,174)	
Income Taxes	\$ (3,906,228)	<u>21% Rate</u>
NIAT	\$(15,232,946)	
Preferred Stock Div.	\$ 13,000	
NI to Common Stock	\$(15,245,946)	

Note that the sales level in this revised combined income statement is simply the sales level without the synergies times 1.01. The revised COGS is determined as follows:

$$(35,061,000/64,657,000) \times 65,303,570 \times .99 = 35,057,494$$

Next, we use the combined firm income statement with synergies to compute cash flow differences from the original statement for Vodafone. Hence, we will subtract from each of the income statement items from the combined firm after the takeover (Table 6) original 2003 Vodafone income statement items (Table 5). These differences are computed in Table 7.

**Table 7:**  
**Vodafone Income Statement Changes Due to Takeover**

<b><u>Differences in Vodafone Income</u></b>	
<b><u>Statement: 2003</u></b>	
With Synergies	(\$000's)
	<b><u>VOD: 2003</u></b>
Sales	\$ 17,341,570
COGS	\$ 6,799,494
Gross Margin	\$ 10,542,076
Fixed Cost	\$ 5,288,250
Depreciation	\$ 3,209,000
EBIT	\$ 2,044,826
Interest	\$ 789,000
EBT	\$ 1,255,826
Income Taxes	\$ 281,772
NIAT	\$ 974,054
Preferred Stock Div.	\$ 13,000
NI to Common Stock	\$ 961,054

Next, we will begin the process of valuing the cash flows. We will assume that revenues, costs of goods sold and fixed costs will grow at an annual compound growth rate of 4

percent for each year for five years after 2003 and then at an annual rate of 1 percent forever. Hence, a two-stage growth model will apply to the valuation of these cash flows and associated tax implications. The cash flow (in 000's) for 2004 is computed as follows:

$$CF_{2004} = CF_{2003} (1+.04) = (\$17,341,570 - \$6,799,494 - \$5,288,250) (1 - .21) (1 + .04) = \$4,316,544$$

The value of this stream, assuming a 10 percent discount rate and based on the two-stage perpetual valuation model is computed (in 000's) as follows:

$$V_0 = \$4,316,544 \left( \frac{1}{.1 - .04} - \frac{(1 + .04)^5}{(.1 - .04)(1 + .1)^5} \right) + \$4,316,544 \left( \frac{(1 + .04)^{5-1} (1 + .01)}{(.1 - .01)(1 + .1)^5} \right) = \$52,781,036.24$$

Next, we value the cash flows associated with depreciation, interest payments, preferred stock dividends and any associated tax implications. We will assume that each of these factors is constant. Hence, we use a standard perpetuity model to value them (in 000's):

$$PV = [\$3,209,000 * .21 - \$789,000 * (1-.21) - \$13,000] / .1 = \$375,800$$

which implies a total PV (in 000's) for the merger of  $\$52,781,036.24 + \$375,800 = \$53,156,836$ , significantly higher than the either of the prices that were offered by Vodafone or Cingular.

#### **D. The Firm's Potential as an MBO Opportunity**

The relative valuation and discounted cash flow models value the firm as an ongoing concern. However, many public companies experience what is known as a value gap, that is, are less valuable than what they might be operating under a different ownership structure or management team. When a firm is a potential target for a takeover, LBO or MBO, its post-acquisition or restructured value should be considered in the valuation process.

A going private transaction transforms the public company into a private firm. A leveraged buyout is simply a highly leveraged acquisition and delisting of a publicly traded company, where much of the acquisition is financed with debt. Typically, the acquirer creates a shell corporation for the purpose of executing the buyout that is to be financed mostly with bank loans and bond issues. In many cases, the target is either a publicly traded firm or one of its units prior to the LBO, and becomes a privately held firm after the LBO. The transaction is generally initiated by another publicly traded firm such as Berkshire Hathaway, a private equity firm such as Ripplewood, the Blackstone Group or Silver Lake Partners, a buyout firm such as Kohlberg, Kravis, Roberts and Company (KKR) or by the management of the target firm. An investment bank or a merchant bank, such as KKR will frequently facilitate the LBO transaction by raising money from investors and forming the shell company that actually executes the transaction. In many instances, target firm management teams will initiate the LBO in what is called a management buyout.

The volume of U.S. LBO transactions peaked in 1989 at \$65.7 billion and fell to \$9.6 billion by 1992 before peaking again at \$62 billion in 1999. U.K. LBO transaction volume also peaked in 1989, dropped in the early 1990s then increased to over GBP30 billion during the period 1997-2003. The market for junk bonds, the growing economy and the need to restructure "empire building" conglomerates are often credited for the boom of LBO transactions in the 1980s. In addition, the spectacular profits associated with the 1982 Gibson Greeting Cards LBO seem to have motivated many later LBO transactions. In this highly leveraged 1982 transaction, a group led by Wesray Capital bought Gibson from RCA for \$58 million in cash and the assumption of 22.6 million in liabilities, contributing only \$1 million of its own capital. Without any significant changes in the company, the reverse LBO transaction (recapitalizing as a public company) only 18 months later netted \$290 million in profits, the lion's share going to the LBO acquirers. For example, one of the Wesray principals, former U.S. Treasury Secretary William Simon who was later affiliated with the Blackstone Group, personally profited with \$66 million in cash and stock on his investment of \$330,000. Gibson experienced large losses and generally poor performance over the fifteen years following the IPO. In fact, many of the companies restructured by LBOs in the mid- to late 1980's later defaulted or even failed. Others restructured further as a result of their highly leveraged capital structures. Public outcries against going private transactions, anti-takeover regulations and a recession have been blamed for the reduction of LBOs in the early 1990s.

Among the firms taken private in LBO transactions have been RJR Nabisco (for \$24.6 billion), Federated Stores, Pillsbury, Safeway Stores, Uniroyal, Toys “R” Us, Denny's and Beatrice Foods. The largest U.K LBO was MEPC Plc, which went public in 2000 for GBP3.5 billion. The volume of LBO transactions in Continental Europe is clearly much less than for the U.S. and the U.K. for a variety of reasons, including firm ownership structure and differences in regulations.

Why should a firm be a target for an LBO or other going private transaction? Given that the LBO transaction is costly and time-consuming, and that the public firm has better access to equity funding in stock markets, better media exposure for public firms and facilitated diversification and option-based compensation for managers, the motivation for a going private transaction must be very strong. One very important motivation is that incumbent managers of many public firms simply fail to maximize shareholder wealth, and in many instances, have strong incentives not to do so. Many LBOs are initiated due to what has been referred to as a large "value gap," the difference between the target's value as a going concern under the policies of incumbent management and the expected higher value of the stock under the acquirer's management team. Acquirers in the LBO believe that they can substantially increase the values of their targets by restructuring and installing new management policies. For example, LBOs frequently force firms to sell and avoid unprofitable investments, reduce waste, and improve efficiency so that the firm is able to fulfill interest obligations on debt. These improvements can reduce or eliminate the “value gap,” enhancing shareholder wealth. In addition, LBOs involve substantial increases in debt financing, increasing levels of tax-deductible interest payments thereby reducing corporate income tax obligations (Kaplan [1989]). However, these tax savings may be more than offset by income taxes at the personal level by investors who are forced to realize capital gains from the sales of their shares. Other factors leading to LBO initiation include using the LBO as a takeover defense and to transfer wealth from bondholders and employees to shareholders. Finally, the LBO can reduce the firm’s visibility in the eyes of regulators and the public and free an operating unit or division from the management of a parent firm.

Companies that are restructured by an LBO often realize improved efficiency and overall performance, largely due to the increased shareholdings of the management team and the close monitoring of the LBO firm which funded the buy out. In fact, LBO target firm shareholders typically earn substantial abnormal returns as a result of the LBO. While in many cases, a portion of these returns may be attributable to improved firm performance, Travlos and Cornett [1993] find that wealth is transferred from bondholders to shareholders as a result of the increased borrowing, contradicting the earlier Lehn and Poulsen study finding no losses accruing to bondholders. Muscarella and Vetsuypens [1990] find that going-private transactions do not cause employee layoffs while Kaplan [1989b] reports that median employment actually rises by 0.9 percent. Lichtenberg and Siegel [1990] find that total factor productivity growth on the plant level improved by 8.3 percent over industry means during three-year periods following going-private transactions. Thus, it appears that improvements in productivity and wealth transfers may help explain LBO profits and the use of LBOs on corporate restructuring.



In a number of more recent transactions, private equity groups have borrowed to finance purchases of large firms, then after gaining control, used the recapitalized firms to pay themselves substantial dividends. For example, in 2004, the Blackstone Group purchased the Celanese Corporation for \$3.4 billion. Of this total purchase sum, Blackstone put up \$650 million of its own money. Within a year of taking control, the Blackstone Group received \$1.3 billion from Celanese in dividends, twice what it invested in the transaction.<sup>4</sup> In addition to the dividends, the Blackstone received management and other fees from Celanese, reportedly over \$45 million. Thomas H. Lee Partners, Bain Capital, Providence Equity Partners and Edgar Bronfman, Jr. received a total of \$1.43 million in dividends by May 2005 from their 2004 \$1.25 billion investment in the Warner Music Group. These transactions have created some controversy as to what proportion of the large dividends are paid from the cash flows from improved operations versus debt used to finance the transactions.

A management buyout is simply an acquisition of a firm by its management. The MBO is typically a leveraged going private transaction (LBO) and sometimes involves only a unit of a larger firm. The MBO often provides the managers of a unit or division of a larger firm an opportunity to own their employer. This opportunity may be particularly beneficial to managers who feel that they are hamstrung by parent firm managers who do not understand the business of their units. Most MBOs have substantial equity participation and structural assistance from a financial institution, frequently an LBO firm such as KKR or a private equity firm such as Blackstone. The majority of MBOs are highly leveraged, as lenders frequently provide the majority of financing for the restructuring. However, managers usually retain an important proportion of residual gains or losses, an obviously crucial motivator. Alternatively, a Management buy in (MBI) occurs when an outside management team acquires the firm or unit and takes it private. The MBI of an entire firm is typically a hostile transaction, occurring where the firm experiences a wide value gap under the incumbent management team. The MBI is also perceived to be more risky because the upper management team is normally replaced.

Among the typical motivations for an MBO are:

1. A unit or division of the firm is no longer seen as a core competence by the parent or is otherwise simply not wanted. Later in this chapter, we will discuss performance improvements for firms that divest themselves of units unrelated to their core competencies. In addition, the parent firm may not wish to sell the unwanted unit to a competitor and may prefer to maintain an established relationship with the MBO firm. In many instances, parent firms and their divested units have working knowledge of and relationships with one another that should be retained. Furthermore, the MBO transaction may be faster and less complex than finding and closing with another buyer.
2. Managers wish to exploit a perceived "value gap," and are motivated to do so by realizing profits themselves.
3. A company is in financial distress and needs the cash generated by the MBO.

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<sup>4</sup> *Wall Street Journal*, January 5, 2006, p.C1

*Example: MBO of Aesica from German Chemical Giant BASF*

Aesica Pharmaceuticals, formerly an operating unit of the German chemical giant BASF AG, manufactures active pharmaceutical ingredients (APIs) that are exported worldwide to drug producers. Aesica, based in Cramlington near Newcastle in Northeast England, was formed to enable the management of the 138-employee unit from BASF to buy out the unit. During the prior year, Aesica realized approximately £35 million in revenues and was considered to have a strong product portfolio, including the anti-depressants Paroxetine HCl Anhydrate, Dothiepin and a non-steroidal anti-inflammatory Flurbiprofen.

Dr. Robert Hardy, managing director for the BASF plc Cramlington Division, headed the management team buying out the unit and became Aesica's CEO. Most of the management team and technical expertise was retained after the transaction. The MBO transaction was completed in September 2004, with LDC (Lloyds Development Capital), the private equity arm of Lloyds TSB Group, leading the deal, providing significant equity capital and arranging for substantial debt financing. LDC took a significant equity stake in the business. Additional funding for the deal was provided through a grant from an English regional development agency, One North East and Barclays, with both providing intermediate- and long-term debt and working capital funding. The Northumberland County Council supported the transaction to safeguard the 138 jobs at the facility and in hopes of creating 33 new jobs.

Within a short period after completing the MBO, Aesica seemed well poised for growth. It signed a 10-year deal with the U.S.-based Myriad Pharmaceuticals to supply R-Flur biprofen, an active pharmaceutical ingredient for Myriad's investigative anti-Alzheimer's drug Flurizan. Commenting on this, Dr. Hardy said that the deal was a great achievement, given that it was just five months after Aesica was created. Observers of the firm noted that there would be a good chance for Aesica's work force to grow significantly if demand for its Flurizan product in the clinical testing stage would be as strong as expected. Regardless, Aesica had already employed several new staff for ongoing projects and was planning additional hires.

BASF's sale of the unit was part of a strategy to improve its production site structure in Europe and to enable BASF's Fine Chemicals Division to concentrate its contract manufacturing activities on its site in Minden, Germany. In addition, BASF continued its ongoing relationship with Aesica, which outsourced its information technology operations to BASF IT Services in a three-year contract worth several million euros.

LDC is a British private equity firm that facilitates MBOs, institutional buy-outs (IBOs) and provides development capital (replacement, expansion and acquisition) to U.K. companies. LDC invests in what it regards to be ambitious entrepreneurial management teams seeking between £2m and £50m of equity on transactions ranging up to £100 million. LDC has participated in numerous MBO transactions, including the Britton Group, HFS, Rosebys, Comdirect and American Golf. Craig Wilkinson, Investment Director at LDC, said, "Aesica is a well invested business that boasts plenty

of growth potential within its existing product portfolio. We are backing a strong management team with an excellent knowledge of the business and its markets. The buyout gives Aesica the flexibility required to make the most of the opportunities that lie ahead. We look forward to supporting the business through a period of significant growth.”

## **E. Governance, Votes and Valuation**

Corporate governance matters to shareholders. Quality management teams and effective corporate governance mechanisms promote increasing shareholder wealth. Appraising managerial quality and assessing the corporate governance mechanisms are essential components of the firm valuation process. Share values will certainly be affected by the distribution of power and votes among shareholders and the market will assess apparent motivations of shareholders when determining share values.

### Valuing Votes

Corporate governance is the direction of the discretionary activities of the firm where the firm's non-discretionary activities are determined by law, the charter of the corporation and its bylaws. Discretionary activities are planned by management or determined by the participants in a corporate election. These discretionary activities can be used to create, transfer or destroy wealth, so the governance and voting mechanisms of the firm are important and valuable. Since management (or the corporate board) itself typically is selected by election, corporate voting ultimately determines the discretionary activity of the firm and will have value reflected in share prices. Because voting rights are the primary mechanisms for obtaining corporate control and deciding the discretionary activity of the firm, votes may be regarded as valued assets, and determination of their value is important to incumbent and rival management teams. Since voting power is not proportional to relative shareholdings among investors, valuing votes associated with shares of stock is often somewhat complicated.

A model for valuation of votes might be based on the value the security-holder places on controlling the outcome of an election and his estimate of the likelihood that his purchase of an additional vote will determine that election outcome. The value the investor places on control is a function of the difference between his expected wealth levels under each of two potential election outcomes. Thus, a vote is more valuable to an investor when one election outcome makes him wealthier than another election outcome. The estimate of the probability that purchasing an additional vote will influence the election outcome is dependent on the change in the voter's power as a result of purchasing an additional vote. Thus, a vote is more valuable when it increases the probability that the election outcome is more favorable to an investor. The value of a vote to an investor might be modeled as follows:

$$(1) \quad E[W] = P \times V$$

where  $V$  represents the difference in his wealth level given a favorable versus an unfavorable election outcome. The purchase of the vote by the investor increases the probability of a favorable election outcome.  $P$  represents the increase in probability of a favorable election result that the vote's acquisition provides. Suppose, for example, Investor X believes that if a takeover is approved, his wealth is increased by \$1000. Further suppose that controlling an additional vote would increase the probability of a vote for the takeover by .066. Then, the value to X of the purchase of a single vote is \$66

=  $.066 \times \$1000$ . This vote value can be added to the cash flow value of the share to determine share value.

### Share Classes And Recapitalizations

Share classification enables firms to distinguish different share classes according to the number of votes associated with each share. For example, dual share classes enable firms to designate a different numbers of votes per share for each of two share classes. Many firms, particularly those with families wishing to retain control, issue a second class of equity shares when they go public. The family retains superior class shares and control and sells shares with lesser voting rights to the general public. This practice is particularly common in Europe and South America.

One U.S. company with dual share classes is the Apollo Group, Inc, a for-profit provider of degrees and adult learning and the owner of the University of Phoenix and the College for Financial Planning. As of August 31, 2005, the company had outstanding 188 million shares of Class A shares with no voting rights and 477 thousand shares of Class B voting common stock. Most non-voting shares are traded on NASDAQ. The Class B voting shares were held by John G. Sperling, the company's founder, Peter V. Sperling, his son and Senior Vice President, the John G. Sperling and Peter V. Sperling Voting Trusts. A very small fraction of voting shares were owned by Todd Nelson, company CEO. With less than one-tenth of 1% ownership of outstanding shares, the Class B shares maintained 100% of company voting power.

Some publicly-traded firms will recapitalize (issue another class of shares) two achieve dual voting classes. As in the family-related case above, dual class recapitalizations permit firms to separate control from claims to dividend income. Such separation may shield managers from shareholder discipline, enabling managers to extract increased private benefits.

The wealth impact of dual class recapitalizations is not clear. For example, Partch [1987] finds no evidence of shareholder wealth reductions resulting from dual class recapitalizations. However, after expanding the data set of Partch from 44 firms to 94 and including recapitalizations from 1984 to 1987, Jarrell and Poulsen [1988] found that shareholders experience significant negative abnormal returns from dual class recapitalization announcements. Cornett and Vetsuypens [1989] find evidence of abnormal price increases around announcements of dual class recapitalizations. In a study of British dual class firms, Ang and Megginson [1989] found that shareholders realized positive wealth effects after announcements by firms of dual class recapitalizations. Moyer, Chatfield and Sisneros [1989] and Moyer, Rao and Sisneros [1992] find that substitutability exists among monitoring alternatives, suggesting that ownership of voting power by management need not exacerbate agency problems.

While the impact of dual class issuance on shareholder wealth is not clear, the one share-one vote system of corporate governance is intended to provide a fair distribution of power among shareholders with diverse interests and expectations. This rule intends to align shareholder power with the intensity of the shareholder's investment. The one

share-one vote system has been encouraged by the New York Stock Exchange and other corporate governance codes while the American Exchange and non-U.S. exchanges have been somewhat more accommodating to other voting schemes as well. Stock exchanges in Europe, especially in Scandinavia and Germany have been particularly accommodating to multiple classes of shares. Bennedsen and Neilson [2002] calculated that approximately 20% of all exchange-listed firms in Europe use multiple share classes to concentrate control, with the practice most widespread in Scandinavia. The one-share-one-vote system provides a distribution of power that is significantly out of proportion to the distribution of votes among shareholders. This is particularly true for many smaller companies where each of the individual shareholders or partners may hold significant numbers of shares relative to the total number outstanding. Yet, there remains significant debate as to whether this rule maximizes shareholder wealth. Grossman and Hart [1988] and Harris and Raviv [1988] provide a theoretical rationale that supports the maintenance of the one share-one vote rule, arguing that the rule does increase shareholder wealth. Other empirical evidence was discussed earlier in this section.

### Using Shares to Synthesize Votes

Multiple share classes provide for an interesting technique for valuing and synthesizing corporate votes. Consider an example where superior class shares of the Harper Company carries two votes per share and sell for \$11. Inferior class shares of the same firm carrying one vote sell for \$10 per share. One can infer from these values that each vote is worth approximately \$1 given the price disparity between the superior and inferior class shares. The only difference between the two share classes is one vote, leading the superior class shares to sell for \$1 more than the inferior class shares. More generally, votes can be valued from price differences between A and B shares as follows:

$$V_{\text{vote}} = (P_A - P_B) / (\# \text{votes per A share} - \# \text{votes per B share})$$

An investor seeking control can, in effect, synthesize a vote by short selling a single inferior class share and simultaneously purchasing a single superior class share. Hence, the investor has purchased the vote associated with a single share without actually owning an economic interest in the stock's cash flows. Tactics such as this can be invaluable when trying to control a firm with limited funds.

Suppose an investor wished to control 10,000 votes in the Harper Company while minimizing holding risk and investment into the firm. The investor could purchase 10,000 shares of Class A stock with a total of 20,000 votes while short selling 10,000 shares of class B stock with 10,000 votes. The investor would have a net claim on dividends equal to zero and a net total of 10,000 votes, purchased at a price of \$11,000 - \$10,000 = \$1,000.

Consider a second technique for synthesizing votes, which is, in effect, purchasing shares and hedging cash flow claims by simultaneously entering into a forward contract to sell them. Andrew Sorkin [2004] reported that Mylan Laboratories was engaged in a struggle to take over King Pharmaceuticals, with Carl Icahn trying to

block the takeover.<sup>5</sup> Mylan had offered \$16.49 per share of King while its market price was \$12.42. Mylan Laboratory shareholders would have to approve the takeover in order for King shareholders to receive this above-market price for their shares. Sensing an excellent selling opportunity, the Perry Corporation, a hedge fund owning 7 million shares of King, purchased 26.6 million shares of Mylan stock in the market, simultaneously agreeing to sell them to Goldman Sachs and Bear Stearns with a forward contract for the same sum. Thus, the Perry Corporation hedged its purchase of Mylan shares with its forward contract to sell them. But, the Perry Company would control the votes on these 26.6 million shares during the period that they were held. At the same time, Perry engaged Goldman Sachs and Bear Stearns to short-sell the same number of Mylan shares. This meant that Goldman Sachs and Bear Stearns would cover their short position in the shares with their long position in the forward contract. Thus, each institution's long or short position in Mylan was covered by an offsetting position.

The series of transactions enabled Perry to be the single largest vote holder of Mylan, while not actually maintaining a position of risk in the firm. The shares of King that Perry owned could then be offered for sale to Mylan at the higher price of \$16.49, with Perry voting its Mylan shares in favor of the takeover. In effect, Perry's offsetting long and short positions in Mylan enable it to synthesize and hold votes for the length of the forward contract to ensure a takeover of King Pharmaceuticals at terms favorable to Perry. Carl Icahn, the other major shareholder of Mylan complained that "this maneuver is rigging an election, plain and simple, and robbing shareholders of the right to have a meaningful vote, one of the few rights they have left." Nevertheless, Perry was the single largest shareholder during the period of the forward contract and its most influential voter.

#### Sotheby's and Single Class Unification

Sotheby's, one of the world's premier auction houses was founded in 1744 by Samuel Baker in London. The firm first sold its equity shares to the general public in 1977, but a majority interest in the firm was acquired in 1983 by A. Alfred Taubman. In December 2001, Taubman was convicted of fixing commissions behind the scenes with rival auctioneer Christie's and served a ten-month prison sentence. On September 7, 2005, Sotheby's Holdings, Inc. agreed to purchase from A. Alfred Taubman and his family 14,034,158 shares of the Company's "Class B Stock" representing approximately 73.6% of the aggregate voting power of the firm's stock for \$168,409,896 in cash plus 7.1 million shares of the firm's Class A limited voting shares. Sotheby's Chairman Michael Sovern said Sotheby's directors believed eliminating the Class B shares would improve corporate governance and will have an overall positive impact on earnings.

Prior to the share class unification, Sotheby had 50,200,000 limited voting shares outstanding with one vote each and 14,034,158 superior class shares with 10 votes each held by the Taubman family. Thus, the Taubman family controlled 140,341,580 of the firm's 190,541,580 votes ( $10 \times 14,341,580 + 50,200,000$ ), a very clear majority.

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<sup>5</sup> New York Times, December 2, 2004, p. C1.

On the September 7 transaction date, the NYSE open price for the limited voting shares was \$17.40 per share. Based on this price, the 14,034,158 shares would have had a total value of \$244,194,349 if these had not been superior class shares concentrated in the hands of the Taubman family. However, let us continue to assume that \$17.40 was the per share value of limited voting stock and note that the Taubman family received a total of \$290,209,896 in stock and cash ( $7,100,000 \times \$17.40 + \$168,409,896$ ) for their superior class shares. This implies that the Taubman family received  $\$290,209,896 / 14,341,580 = \$20.23$  per superior class share, implying that their control was worth \$2.83 per superior class share. Since each superior class share had nine more votes than each inferior class share, the value of each vote should be worth  $\$2.83 / 9 = \$0.31$ .

Apparently, the stock market did not disagree with Sotheby Chair Mr. Sovern, with share prices jumping 5% on the announcement. The limited voting shares rose to close at \$18.30 on September 8, the date that the transaction details appeared in the *Wall Street Journal*. The market seemed to believe that removing votes from the control of the Taubman family was worth in excess of \$0.31 for each vote.

#### Managerial Shareholdings And Entrenchment

Management teams not acting on behalf of their shareholders' interests would normally be regarded as being ineffective. Shareholders have a variety of mechanisms at their disposal to replace an ineffective management team. However, each of these mechanisms has difficulties:

1. Shareholders can exercise their rights to vote, selecting board members who will, in turn, replace the ineffective management team. However:
  - a. Managers usually maintain control of large numbers of shares and votes. Even where their shareholdings are small, they can control large numbers of votes through contacts with large individual or institutional shareholders or with dual classifications of shares where shares that managers control have more votes than other shares.
  - b. Corporate shareholders tend to be rather apathetic regarding firm management issues. They frequently do not vote and rarely obtain proper information before casting votes.
  - c. Corporate shareholders are usually widely dispersed. They usually do not share information, form coalitions or organize against ineffective management teams.
  - d. Unhappy shareholders normally simply sell their shares rather than attempt to replace ineffective managers.
2. A shareholder or group of shareholders can conduct a proxy raid for the purpose of accumulating a sufficient number of shares to oust the ineffective management team.
  - a. Proxy raids tend to be very expensive and time-consuming. They tend to be associated with legal actions, often bordering on the frivolous. Even seemingly simple matters like obtaining contact addresses of other shareholders is often complicated due to firms' unwillingness to cooperate.
  - b. Proxy raids are rarely successful in terms of displacing ineffective management teams.



3. A shareholder or group of shareholders can file a derivative suit against the management team for not acting in the interests of shareholders.
  - a. Derivative suits involve significant legal fees.
  - b. Losing plaintiffs in a derivative suit must usually pay the legal expenses of the defendant. This threat discourages many derivative suits.
  - c. Managers have access to the firm's (i.e., shareholders') resources in defending themselves against a derivative suit.
  - d. It is very difficult to prove that management's actions were not taken in the shareholders' interests. Proving managerial motivations is, at best, difficult, even when it is clear that shareholders suffered significant losses.
  - e. The majority of derivative suits are won by defendants.
4. Shareholders can attempt to locate a purchaser for their firm, or wait until a one surfaces.
  - a. Waiting for a suitor is obviously a passive strategy.
  - b. Managers have a variety of takeover defenses at their disposal, including poison pills, shark repellents, etc.
  - c. Corporate laws (and many corporate charters) in many states discourage unfriendly takeovers.
  - d. Unfriendly takeovers tend to be expensive in terms of legal expenses and other costs.

There exists substantial evidence that increased shareholdings by management provides incentives for superior managerial performance. However, particularly high levels of insider shareholdings may enable management to become entrenched (Morck, Shleifer and Vishny [1988], Gorton and Rosen [1995] and Bagnani, Milonas, Saunders and Travlos [1994]) or discourage profitable takeover activity for that firm (Weston [1973]). One might expect that as insider shareholdings increase, insiders have a greater incentive to act on behalf of shareholder interests; yet particularly high levels of insider shareholdings may lead to managerial entrenchment. Thus, entrenched insiders may be able to secure non-stock benefits at the expense of shareholders.

Morck, Shleifer and Vishny [1988] performed piecewise OLS regressions to study the relationship between insider shareholdings and Q-Ratios ( $\text{Asset Market Value} \div \text{Asset Replacement Value}$ . This ratio is often used to indicate managerial quality). They suggest that managers of firms in this control class (less than 5% of firm shares are held by insiders) are not likely to be entrenched. Thus, they do have incentives to act on behalf of shareholder interests. At the same time, they should be expected to maintain low risk levels given their incentive to maintain their own job security (Knopf and Teall [1996]). The incentives to act on behalf of shareholders and to maximize the security of their employment are consistent if risk-taking behavior in this industry tends to result in financial policies that are negative NPV from the perspective of shareholders. However, at the highest levels of insider shareholders (more than 25% of shares are held by insiders), Morck, Shleifer and Vishny found that managers behaved as though they were entrenched. Their performance levels dropped as their shareholdings and control levels increased, suggesting that they were more difficult to fire, even with inferior performance levels. Gorton and Rosen in their study of commercial bank performance argue that

higher levels of insider shareholdings lead to managerial entrenchment by increasing the costs of firing managers, enabling insiders to continue securing private benefits for themselves.

### Death of the CEO

In a study on the impact of CEO death on firm performance, Johnson, Magee, Nagarajan and Newman [1985] find that the sudden death of a founder-CEO results in increased share prices. For example, the death of Campbell Soup Company chairman John Dorrance, Jr. preceded a two day 20% increase in share price.<sup>6</sup> Even the anticipation of a founding-CEO's death can increase share prices. During the 1980s, shareholders were so concerned about the health of octogenarian Occidental Petroleum chairman Armand Hammer that the stock price increased when he fell in the shower. It is useful to note that Occidental's 1989 proxy statement revealed that the firm would spend \$86 million on a museum to house Dr. Hammer's art collection (this figure turned out to be an underestimate). When he died on December 10, 1990, Occidental Petroleum's total share value increased by approximately \$500,000,000.

On the other hand, the study reported that the death of a non-founding CEO results in a share price decline. One possible rationale for this difference is that founding-CEOs are more likely to be entrenched and generating private benefits for themselves. Founding CEOs typically wield far more influence on people affiliated with their firms than non-founding CEOs. For example, it is not unusual for founding-CEOs to appoint their own family members to important managerial positions within their firms (e.g.: Ford Motor Company and Weis Markets). This can create problems within the firm while it further heightens CEO influence. Furthermore, founding CEOs tend to maintain higher levels of shares and control, particularly those shares carrying superior voting privileges (e.g.: Ford Motor Company, Media General). Holding higher levels of shares enables such managers to enjoy a higher degree of entrenchment. Such managers can block actions that might increase shareholder wealth. On the other hand, professional managers rising through the ranks or hired from other firms are not as likely to maintain nearly such levels of control. Stock markets behave as though professional CEOs obtained their positions through merit and cannot wield enough influence in their employers to entrench themselves. Sudden deaths by such managers seem likely to decrease share prices. The 1997 death of Coca Cola CEO Robert Goizueta, under whose 16-year leadership the firm's share price rose 7200%, coincided with an approximate 2% decrease in share price. The unexpected 2004 death of McDonald's CEO Jim Cantalupo was also followed by a 2% decline in his employer's share price.

More generally, the Johnson et al. study found that sudden CEO deaths do not impact share values, with founding CEO-death effects apparently offsetting professional CEO death effects. This overall effect may suggest that the market does not regard CEOs to be overpaid.

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<sup>6</sup>The *Wall Street Journal*, August 6, 1996, pp. C1-C2.

The market clearly pays attention to CEO deaths. In 1996, *The Wall Street Journal* reported on shareholders maintaining and revising their shareholdings positions based on their perceptions of CEO departures. Mario Gabelli, head of Gabelli Funds referred to such strategies as “octogenarian plays.” The same issue of *The Wall Street Journal* reported that Archer Daniels-Midland, Sequa, Skyline, Dillard Department Stores all seemed to have shareholders who at least questioned whether would be better off without their entrenched CEOs.

In a different type of study focusing on longer-term corporate performance and on a larger sample of firms with a total of 11,002 deaths of CEOs, board members and family members of CEOs, Benneson, Perez-Gonzalez and Wolfenzon [2006] find that accounting statement performance deteriorates when CEOs die. Operating Return on Asset levels drop significantly over two-year periods following deaths of CEOs and their close family members. Board member deaths do not affect firm performance.

### Failure of Corporate Governance

Since 2000, dozens of public American companies, including Enron, Tyco, Hollinger, Adelphia, etc. have failed or suffered exorbitant losses due to failures in corporate governance systems. While shareholders suffer substantial losses from these failures, in most instances, they simply failed to heed warnings, some obvious and some rather subtle. Consider the following case involving Parmalat.

#### *Example: The Parmalat Meltdown*

Parmalat, Italy's giant dairy foods producer, was founded in 1961 by Calisto Tanzi, a 22 year-old college dropout and Italian food industry heir. The company was named for Parma (“the food valley” in Italian) and lat (an abbreviation of latte, Italian for milk). Parmalat's major innovation allowed it to produce the first shelf-stable milk through an Ultra Heat Treatment (UHT) process developed in Sweden, enabling processors to produce milk that could be stored for long periods without refrigeration. The product was a hit, benefiting from its associations with and advertising through sports, including Formula One Racing and Alpine Ski Championships. Parmalat was a European pioneer in brand advertising. Sales rapidly expanded throughout Europe, Latin America and, in total, in over 30 countries. The firm rapidly grew into a family empire, the largest food company in Italy, the fourth largest food company in Europe, with over 36,000 employees in 139 plants and branching into a variety of industries including beverages, television, tourism, cookies and football. In 1997, Parmalat initiated an aggressive campaign to acquire other firms, particularly in the Americas. One of its large purchases in 1997 was Beatrice Foods, a large U.S. producer. Many of these acquisitions were huge money losers. Most of the acquisitions were financed with debt and the firm's debt ratings gradually deteriorated. Nonetheless, Parmalat appeared to be a good citizen to many Italians, donating to Catholic causes and rebuilding a cathedral in Parma. By 2002, the firm had grown to realize €13 billion in sales.

On the surface, all seemed at least reasonably well with Parmalat through 2002. In addition to many individual shareholders, Parmalat had a number of well-regarded institutional investors and creditors, a solid credit rating and even listed securities in the

United States. However, as we will discuss shortly, there were important warning signals of troubles ahead. Company financial weaknesses started to surface in early 2003 when the firm experienced difficulties trying to sell €500 million in bonds. But the real implosion was towards the end of the year when, on December 8, 2003, the firm defaulted on a €150 million bond obligation, a seemingly small sum given Parmalat's size and prominence. Tanzi initially attributed the default to a temporary liquidity problem, blaming it on a customer, a speculative fund named Epicurum. Parmalat claimed that Epicurum did not pay its bills. It was later revealed that Epicurum was one of Parmalat's own offshore subsidiaries. The rating agencies quickly downgraded Parmalat's bonds to junk status. On December 19, the biggest corporate scam in European history was unveiled when Bank of America announced and Parmalat confirmed that a €3.95 billion account that Parmalat claimed to have at the Bank simply did not exist. About a week later, Tanzi, who admitted to taking over €500 million for himself and his other businesses, was jailed in Milan's overcrowded San Vittore prison, albeit, reportedly, in his own cell with his own shower and a little camping stove to cook food. Two Italian-based executives of Parmalat's former auditing firm, Grant Thornton S.p.A., were also held and questioned in Italian jails.

On December 24, 2003, Parmalat S.p.A. filed for bankruptcy protection with a court in Parma, Italy, the largest bankruptcy in European history. Since December 2003, Parmalat has been enmeshed in, and apparently emerging from the aftermath of the largest financial fraud in European history, with approximately €14 billion having apparently simply vanished. Much of this loss seems to be related to Parmalat's debt level being over €14 billion, almost eight times what had been reported before the firm's unraveling.

For years, Parmalat hid its losses, overstated its assets, recorded non-existent assets, understated its debt and diverted cash to Tanzi family members. The firm created over 260 foreign entities such as Bonlat, its Cayman Islands subsidiary to dump its non-performing and fictitious assets and to hide its debts. Interestingly, much of the fraud went undetected for as long as 13 years. Parmalat's business interests were far-flung, extending into travel and sports businesses and well beyond the areas of competence of its founder and his family.

Parmalat was a publicly held Milan Stock Exchange listed firm with ADRs traded in the U.S. How could such a large international firm, with such a large following of investors and analysts be so deceptive in such a large way? When the scandal broke, Parmalat had a governance structure that was practically a recipe for a corporate meltdown. First, consider that Parmalat was Tanzi family-dominated, with Calisto Tanzi serving for many years as C.E.O. until he resigned when the scandal broke. Tanzi, his family and affiliate firms controlled the major blocks of votes in Parmalat. Tanzi founded the firm and used it and its outside suppliers of capital to build himself an empire for himself and his family. At the time of the firm's collapse, Tanzi served on Parmalat's Board of Directors, as did his son Stefano who also served as the president of the Parmalat-owned Parma Calcio football team. The Board also included Tanzi's brother Giovanni and his niece Paola Visconti. Other board members included the company's

CFO Fausto Tonna, who was deeply involved in the fraud and three other firm managers, Luciano Del Soldato, Alberto Ferraris and Francesco Giuffredi, all hired by Tanzi. The outside directors were Tanzi's attorney and two of Tanzi's close friends. Tanzi's daughter Francesca apparently ran Parmatours, one of the family tourism businesses, another of Parmalat's major money-losers that owned Club Vacanze with its nine beach and four Alps resorts. She denied running the firm after her arrest.

Tanzi clearly was the driving force exercising almost complete control over the company, inserting his own people in every position of power and in positions to oversee those who held power. For example, CFO Tonna, who confessed that he had forged Band of America documents for the €3.95 billion account using a scanner, scissors and glue, was also a member of the Parmalat board three-member audit committee. That is, Tonna was appointed to a position with responsibility to oversee his own operations and to ensure that he did not steal from or mislead the company's investors. He was, in effect, his own monitor.

Were there warnings to shareholders of what was to come? Consider the following:

1. Prior to the firm's implosion, Parmalat had a poor rating on the Institutional Shareholder Service's Global Corporate Governance Quotient. This quotient measures corporations' governance practices against a set of 61 criteria, many of which have been discussed in this book. Parmalat was tied for last among the 69 Italian companies that were rated. Parmalat was in the bottom 3 percent of companies in the MSCI EAFE governance index, which comprises companies on major indexes in Europe, Asia, and the Far East.
2. Why were its governance scores so low and how was the Tanzi family able to exert such control over this public firm? First, Parmalat's governance structure violated practically every major standard set forth for sound corporate governance. Parmalat's stakeholders suffered a lack of transparency on many important issues, including executive and director compensation and directors and officers stock ownership. The board failed to set and disclose adequate board guidelines for evaluations, term limits, and retirement ages, all contributing to the poor performance in the company's governance scores. The firm did have a code of conduct for internal dealings, but this did not seem to inhibit officers' theft and deception.
3. Perhaps, more importantly, Parmalat was at the top of a complicated pyramid ownership structure controlled by Coloniale S.p.A., the Tanzi holding firm that owned 51 percent of Parmalat equity.
4. The board chair and CEO positions were held by the same individual, Calisto Tanzi. Members of Parmalat's management team and the firm's board members had many associations, outside directorships, management responsibilities and conflicts of interest involving a host of other firms.
5. The board obviously lacked a reasonable number of independent directors; in fact, it is not clear that the firm had any really independent directors. Insiders sat on the executive, remuneration and audit committees of the board.

6. The Tanzi family tightly controlled virtually all aspects of governance. Officers and directors clearly failed to act in shareholders' best interests or act in a professional and ethical manner.
7. While Parmalat's auditor Grant Thornton was replaced by Deloitte after nine years as required by Italian law, Grant Thornton continued to audit Parmalat's offshore companies, the primary dumping grounds for Parmalat's losses, debts and non-performing assets. Furthermore, it is not yet clear the extent to which the firm's auditors aided in the cover-up of Parmalat's activities.

As in Germany, banks typically play an important role in monitoring Italian firms. Parmalat's banks failed miserably in this capacity. In fact, numerous banks were targeted for investigation in possible roles aiding the frauds, including Bank of America, Citicorp, and J.P. Morgan, each of which placed Parmalat bonds, and Deutsche Bank, Banco Santander, ABN, Capitalia, S. Paolo-IMI, Intesa-BCI, Unicredito and Monte dei Paschi. While most of these banks claim that they also were victimized by Parmalat, some observers argued that Parmalat's banks sought profitable deals with Parmalat that conflicted with their monitoring responsibilities. In sum, Parmalat was plagued with an excess concentration of power disproportional to residual claims, dishonest officers and directors, a willful lack of transparency, monitors and auditors who failed or simply stole and empire building. The governance structure was simply rotten to its core.

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## Exercises

1. Briefly discuss the strengths and weaknesses of each of the following techniques as a means to estimate the anticipated covariance between returns of two securities:
  - a. Forecasted Covariance as a function of potential return outcomes and their associated probabilities
  - b. Historical Covariances
  - c. Single Index Betas
  - d. Multi-index Betas
  - e. Fundamental Betas
  
2. Under what circumstances does *increasing* the number of indices that I use in my index model improve my covariance estimates? Under what circumstances does *decreasing* the number of indices that I use in my index model improve my covariance estimates?
  
3. Flanagan Pharmaceuticals has just committed \$20,000,000 to develop a new anti-depressant. The probability that the development efforts will be successful is 50%. The firm will decide in three years whether to pursue human testing on the drug at an annual cost of \$5,000,000, per year, at the beginning of each of four years, beginning three years from now. It will pursue human testing only if initial development efforts are successful. At present, given a successful development effort, the human testing efforts are projected to be successful with a 75% probability. If testing efforts are successful, the anti-depressant is projected to generate \$10,000,000 in annual profits beginning seven years from now for twenty years. While the investment is currently carried on Flanagan's books at its original investment of \$20,000,000, what is the option value of the project? Was the initial investment into product development sound? Cash flows are all discounted at 8%.
  
4. The table below represents income statements from tax year 2007 for South Acme Products and Southwest Products. South Acme plans to acquire Southwest and needs to determine an offer price for a stock transaction for Southwest shares. Synergies generated by the merger are anticipated to be substantial. In particular, revenues for both companies are anticipated to increase by 2 percent as a direct result of the merger, while cost of goods sold and for both companies are expected to decline by .5 percent. Fixed costs for both companies are expected to decline by 1 percent. In addition, sales, all costs (including those for both target and acquiring firms, but excluding depreciation and interest) are expected to grow at an annual rate of 2 percent starting with year 2008 for 8 years and then remain unchanged indefinitely thereafter. Depreciation and interest payments are not expected to change. The corporate tax rate equals 35 percent and South Acme discounts cash flows at 8 percent. Based on this information and a discounted cash flow evaluation model, what is the value of the acquisition of Southwest to South Acme?

**South Acme Income Statement: 2007**

	Rate	<u>SP: 2007</u>
Sales		\$ 20,000,000
COGS		<u>\$ 12,000,000</u>
Gross Margin	0.60	\$ 8,000,000
Fixed Cost		\$ 4,000,000
Depreciation		<u>\$ 3,000,000</u>
EBIT		\$ 1,000,000
Interest		<u>\$ 500,000</u>
EBT		\$ 500,000
Income Taxes		<u>\$ 175,000</u>
NIAT	0.35	\$ 325,000
# of shares		1,000,000
EPS		\$0.33

**Southwest Income Statement 2007**

	Rate	<u>SWP: 2007</u>
Sales		\$ 10,000,000
COGS	0.50	<u>\$ 5,000,000</u>
Gross Margin		\$ 5,000,000
Fixed Cost		\$ 2,000,000
Depreciation		<u>\$ 2,000,000</u>
EBIT		\$ 1,000,000
Interest		<u>\$ 600,000</u>
EBT		\$ 400,000
Income Taxes	0.35	<u>\$ 140,000</u>
NIAT		\$ 260,000
# of shares		20,000
EPS		\$13.00

5. Consider the Dennis Company, which has \$50,000,000 in assets that intends to take over Sam's Products, which has \$30,000,000 in assets. Dennis has \$40,000,000 in zero coupon debt maturing in five years and Sam's has \$20,000,000 in zero coupon debt maturing in five years. Assume that all Black-Scholes assumptions apply to each of the two firms and their securities. The standard deviations of asset returns for Dennis and Sam's are, respectively, .6 and .8. The riskless return rate is currently .04. The correlation coefficient between asset returns for the two firms is .2. What will be the post merger debt and equity values of the two firms? By how much will the merger reduce overall equity value?

6. Consider a firm with superior class shares that carry five votes per share and sell for \$20 and inferior class shares carrying one vote each sell for \$15 per share. From this value disparity, what appears to be the value of a single vote?

### Solutions To Exercises

1. a. Technically, the correct method, but where do we get the probabilities?  
 b. OK if betas are stable, but requires a lot of inputs  
 c. OK if only one index explains returns, fewer computations may be required for a large sample of securities  
 d. OK if more than 1 index explains returns, but is more likely to generate errors in measurement or be less significant  
 e. Updates for new information better than b through e, but is time consuming and assumes that all securities react identically to changes in fundamental factors
  
2. increasing the number improves when: more sources of covariance are picked up in the model; there is relatively little covariance between old and new indices; decreasing the number improves when there is less measurement error
  
3. If the development phase is successful, the present value (three years from now) of the 4-year annuity associated with testing is \$16,560,063:

$$NPV_3 = \frac{\$5,000,000}{.08} \times \left[ 1 - \frac{1}{(1 + .08)^4} \right] = \$16,560,630$$

If the human testing phase is successful, the present value of the 20-year profit annuity seven years from now is \$98,181,470:

$$NPV_7 = \frac{\$10,000,000}{.08} \times \left[ 1 - \frac{1}{(1 + .08)^{20}} \right] = \$98,181,470$$

There is a 50% probability that the testing phase annuity will be incurred and a .375 probability that the drug product will be launched:

$$NPV = -\frac{.5 \times \$16,560,630}{(1.08)^3} + \frac{.375 \times \$98,181,470}{(1.08)^7} = \$14,909,800$$

Because this NPV is positive, the human testing will occur if the project development phase is successful. The option value is \$14,909,800. However, this value did not justify the initial \$20,000,000 in product development. The \$20,000,000 book value of this project overstates its worth.

4. Including synergies, the combined firm income statement for 2007 would have been as follows:

<u>Combined</u>	<u>Company</u>	<u>Income</u>
<u>Statement: 2007</u>		<u>TAR: 2007</u>
Sales		\$ 30,600,000
COGS		\$ 17,253,300

Gross Margin	\$ 13,346,700
Fixed Cost	\$ 5,940,000
Depreciation	\$ 5,000,000
EBIT	\$ 2,406,700
Interest	\$ 1,100,000
EBT	\$ 1,306,700
Income Taxes	\$ 457,345
NIAT	\$ 849,355

Note that the sales level in this revised combined income statement is simply the sales level without the synergies times 1.02. The revised COGS is determined as follows:  $(17,000,000/30,000,000) \times 30,600,000 \times .995 = 17,253,300$ . This income statement represents changes to the Acme 2007 income statement as follows:

**Differences in Acquiring Income Statement: 2007**

With Synergies	(\$000's)
	<u>AC: 2007</u>
Sales	\$ 10,600,000
COGS	\$ 5,253,300
Gross Margin	\$ 5,346,700
Fixed Cost	\$ 1,940,000
Depreciation	\$ 2,000,000
EBIT	\$ 1,406,700
Interest	\$ 600,000
EBT	\$ 806,700
Income Taxes	\$ 282,345
NIAT	\$ 524,355

The value of the cash flow affected by the growth rate for 2008 ( $E[CF1]$  for the growing perpetuity) is  $(\$5,346,700 - 1,940,000)(1-.35)(1+.02) = \$2,258,642$ . Using a two stage growth model where  $n=8$ ,  $g_1=.02$ ,  $g_2=0$  and  $k$  is .08, we obtain present values as follows:

First stage PV=	13,814,942.74
Second Stage PV=	17,521,391.37
PV Both Stages=	31,336,334.11
Takeover NPV	
After-tax sales, CGS and FC:	\$ 31,336,334
Depr. Shield- $Int(1-t)$ :	<u>\$ 3,875,000</u>
Total Takeover NPV =	\$ 35,211,334

Hence, the value of the target is \$35,211,334 to the acquirer.

5. Inputs are as follows:

Dennis:	
$t = 5$	$r_f = .04$
$X = 40,000,000$	$S_0 = 50,000,000$
$F = .6$	$F^2 = .36$

