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The CFROI Valuation Model

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CFROI (cash flow return on investment) is increasingly employed by corporate managements and security analysts as a key tool for gauging corporate performance and shareholder value (Mahoney [1996]; Peterson and Peterson [1996]). This article explains the ideas and evidence underpinning the forecasting mechanics of the CFROI valuation model, including its unique procedure for estimating firms' cost of capital.

While this procedure is grounded in the conventional relationship that a discount rate (cost of capital) converts a firm's forecasted net cash receipt (NCR) stream to a present value, it does not import a discount rate determined without regard to the NCR stream estimating procedures. Rather, it is based on the idea that an estimate of a firm's discount rate is necessarily contingent upon how the NCR stream is forecasted. Indeed, a central theme of this article is that the *assignment of a firm's discount rate is integral to the valuation model itself.*

First we show how the CFROI model avoids the use of accounting book capital in valuing the firm's existing assets and how it values future investments by use of a life-cycle approach. Next, we illustrate application of the model by calculating the warranted value for a sample firm at a particular time.

One of the important details of forecasting future financial performance is assigning a company-specific discount rate. A company's discount rate is the market rate plus a risk differential. Market discount rates are derived the same way a bond's yield to maturity is calculated, from a *known* price and a *forecast* of future cash receipts (interest and principal).

We use a sample company to describe the usefulness of a time series application of the valuation model using forecast data available annually and market discount rates estimated at those times. An important cause of systematic deviations over time between warranted and actual prices is firm characteristics that motivate investors to apply discount rates that are higher or lower than market rates.

This line of thinking is used to estimate apparent risk differentials assigned by investors. For a large sample of firms, at annual fixed times a discount rate is calculated that *equates* the firm's forecast NCR stream to its known market value. The difference between this calculated rate and the market rate is the firm's risk differential. These differentials are hypothesized to be related to financial leverage and size, and data supporting this hypothesis are presented.

Finally, we discuss how the model facilitates plausibility judgments regarding forecast data. Particular attention is given to comparing analysts' forecasts and market expectations for CFROI levels over a five-year forecast window.

CFROI VALUATION MODEL

Using discounted cash flow to calculate a "warranted" value for a firm involves two basic steps. First, a forecast is made of the firm's expected net cash receipt stream. Second, a discount rate converts this NCR stream to a present value. This process is perhaps more readily observed in the pricing of bonds, where the NCR stream is represented by interest and principal payments, and the calculated yield to maturity is the discount rate.

EXHIBIT 1
THE COMPONENTS OF FORECASTED NET CASH RECEIPTS (NCRs)

Existing Assets:
- Wind-Down of Cash Flows
- Non-Depreciating Asset Release
- Asset Life and Asset Age

Future Investments:
- ROIs on New Investments
- Sustainable Asset Growth (Size of New Investments)
- Competitive Fade Rate

$$\text{Total Firm Warranted Value} = \underbrace{\sum_{t=1}^{L} \frac{NCR_t}{(1+DR)^t}}_{\text{Existing Assets}} + \underbrace{\sum_{t=1}^{H} \frac{NCR_t}{(1+DR)^t}}_{\text{Future Investments}}$$

The CFROI was originally developed as an improvement to an accounting return that would help to implement a valuation model (Madden [1996]). The valuation model separates the NCR stream into a portion generated from existing assets and a portion generated from future investments as shown in Exhibit 1.

The NCRs from existing assets wind down over the economic life of these assets (L years). The NCRs from future investments cover the horizon representing the life of the firm (H years). To deal with the wealth created from future investments, the horizon can be shortened to a period of years beyond which ROIs are assumed to equal the discount rate.

Invariably, the more difficult valuation task is forecasting of ROIs on the firm's future investments. CFROIs address this problem in two ways:

1. As an inflation-adjusted, internal rate of return measure that minimizes accounting distortions, CFROIs displayed as a time series reflect levels and trends in "real," or "economic," performance.[1] The convention is to use ROIs for future capital projects (i.e., incremental or new investments) and CFROIs for cross-sectional or average returns derived from financial statements.
2. When near-term financial forecasts are translated into CFROIs, the future is then comparable to the past. This puts the forecast data into a useful context for judging likely ROIs on new investments.

Over the very long term, ROIs on future investments are forecast to regress eventually to the cost of capital, i.e., the investors' required rate of return. CFROIs reflecting this competitive process are depicted in Exhibit 2.

Accuracy in valuing existing assets is highly important, because it improves the calculation of the market's appraisal of a firm's future investments, i.e., the *difference* between total market value and the estimated value of existing assets. The percentage of a firm's value due to future investments is normally a useful gauge of where a firm is currently positioned in the competitive life cycle.

We illustrate how the elements of the CFROI valuation model produce a specific warranted value for Briggs & Stratton. Exhibit 3 displays the 1950-1995 track record for the world's largest producer of air-cooled gasoline engines for outdoor power equipment. CFROIs are shown in the first panel.

The effects of direct competition and the increased clout of the firm's major customers are reflected in the gradual decline from exceptionally high CFROIs toward the long-term 6% average level earned by corporate America. More recently, management has restructured the firm and improved CFROIs.

The second panel of Exhibit 3 shows actual and sustainable growth rates for total assets expressed in real terms. Acquisitions, divestitures, and capital structure changes create year-by-year volatility in actual growth rates. By holding dividend payout and capital structure constant, a "normalized" or sustainable growth is calculated. It reflects the likely growth in resources committed to new investments that is consistent with the level of CFROIs being achieved.[2]

Exhibit 4 displays the elements required to determine a warranted equity value at time t, August 1996 in this case. Security analysts' EPS forecasts are used to estimate a CFROI of 8.5% from the firm's existing assets for the year ahead (t + 1). This CFROI provides a calculated level of cash flow that is a key determinant of the value of the firm's existing assets.

EXHIBIT 2
COMPETITIVE LIFE CYCLE

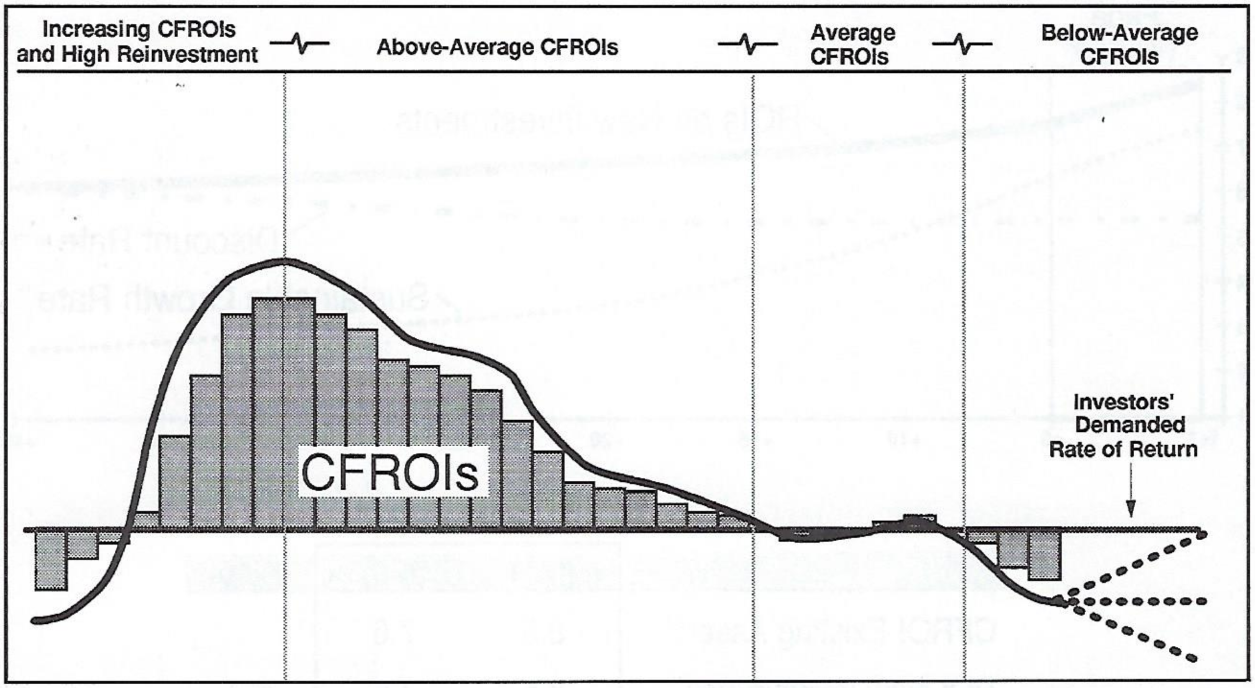


EXHIBIT 3
BRIGGS & STRATTON — HISTORICAL LIFE CYCLE 1950-1995

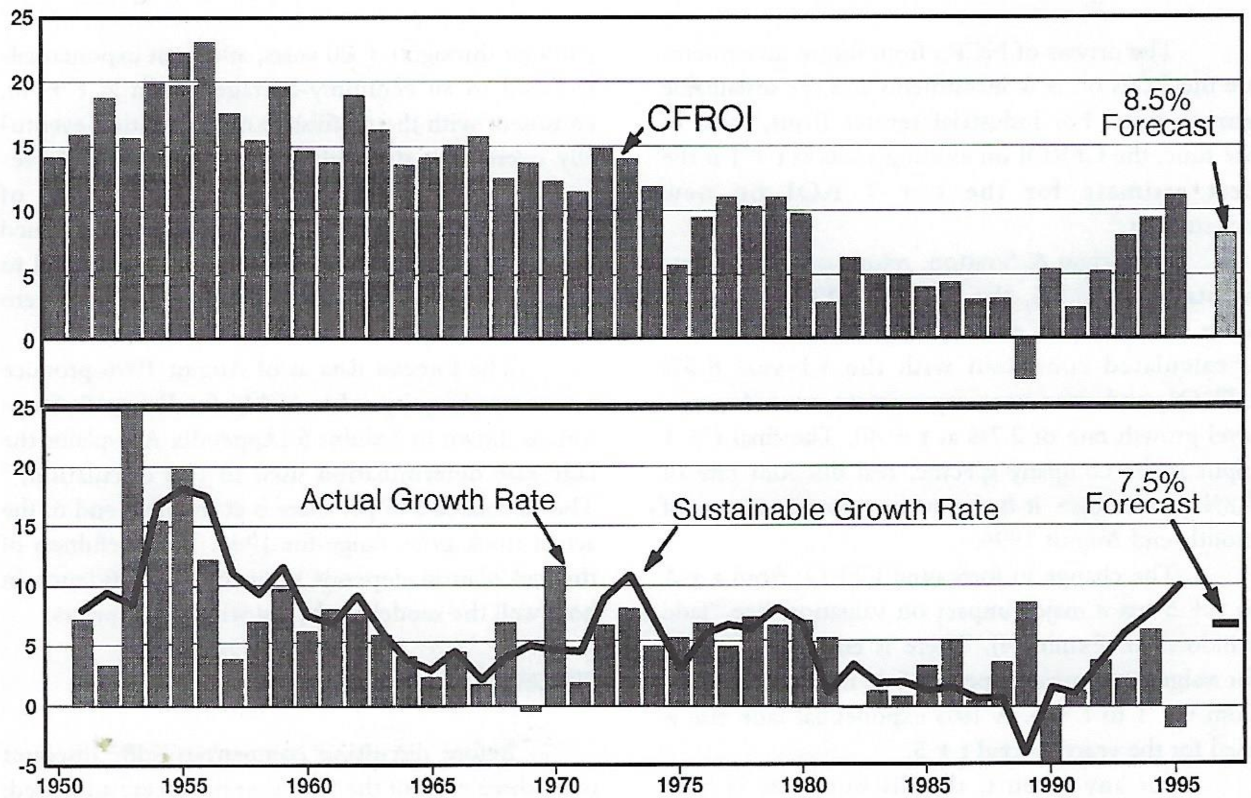
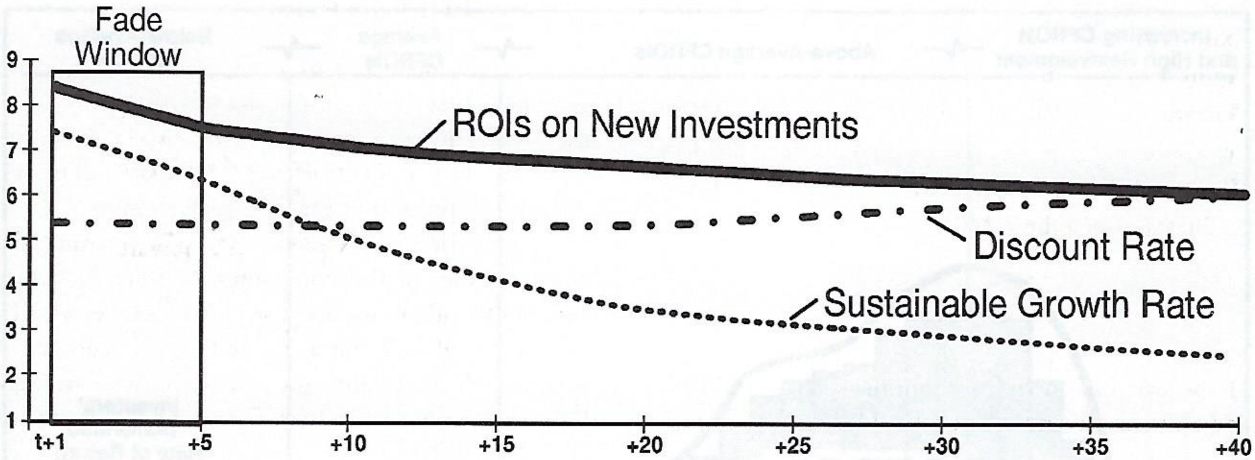


EXHIBIT 4
BRIGGS & STRATTON — FORECAST LIFE CYCLE AS OF AUGUST 1996



	Fade Window (t+1)	(t+5)	(t+40)
CFROI Existing Assets	8.5	7.6	
ROI New Investments	8.5	7.6	6.3
Sustainable Growth Rate	7.5	6.5	2.7
Real Discount Rate	5.8	5.8	6.3

The drivers of NCRs from future investments are the ROIs on new investments and the sustainable growth rates. For industrial/service firms, most of the time, the CFROI on existing assets at t + 1 is the best estimate for the t + 1 ROI on new investments.[3]

For Briggs & Stratton, return on new investments equals 8.5%, the same as CFROI existing assets. The +1-year sustainable growth rate of 7.5% is calculated consistent with the +1-year 8.5% CFROI, and over time regresses to an economy-level growth rate of 2.7% at t + 40. The final t + 1 input is the company-specific, real discount rate of 5.8%. In this case, it is the average market rate as of month-end August 1996.

The change in forecasted CFROI from t + 1 to t + 5 has a major impact on valuation (see "fade window" in Exhibit 4). There is empirical support for assigning company-specific fade rates for CFROIs from t + 1 to t + 5. A 10% exponential fade rate is used for the years beyond t + 5.

For any given t, the discount rate is held constant through t + 20 years, and then exponentially faded to an economy-average return at t + 40, consistent with the premise that competition eventually overcomes the ability of firms to earn above-average returns and forces reorganization of below-average businesses. All firms, whether assigned a high or a low cost of capital at t, are regressed to the same level of ROI at t + 40. Consequently, zero wealth is created from new investments at t + 40.

The forecast data as of August 1996 produce a warranted equity value of $46 for Briggs & Stratton, as shown in Exhibit 5 (Appendix A explains the fade rate determination used in this calculation).[4] The calculated $46 per share is at the high end of the actual stock price range for 1996. The usefulness of this calculation depends upon one's confidence in how well the model tracks historical stock prices.

TECHNICAL DETAILS

Before discussing company-specific discount rates, three parts of the valuation model are addressed:

EXHIBIT 5
WARRANTED VALUE OF BRIGGS & STRATTON AS OF AUGUST 1996

Existing Assets, $Mil	1,133
Future Investments	347
Warranted Firm Value	1,480
Less Debt	154
Warranted Equity Value, $Mil	1,326
Shares outstanding, Mil	28.9
Per share, $	46

1) the calculation of an economy-average CFROI and a sustainable growth at t + 40 horizon; 2) empirical support for t + 1 to t + 5 CFROI fade rates; and 3) the calculation of the market's discount rate.

Economy-Average CFROI and Sustainable Growth

Exhibit 6 displays yearly CFROIs and sustainable growth rates using aggregate financial data for the largest 500 U.S. industrial/service firms based on equity market values each year. Trailing seven-year medians for both variables are plotted. The assumption is that, at any time, the most recent trailing medians are plausible long-term (t + 40) levels to use in the valuation model.

CFROI Fade Rates

In Madden [1996] a large sample universe of industrial/service firms for the years 1966-1993 is used for constructing twenty "fade classes" based on three variables: CFROI level, CFROI variability, and growth (proportion of earnings reinvested).

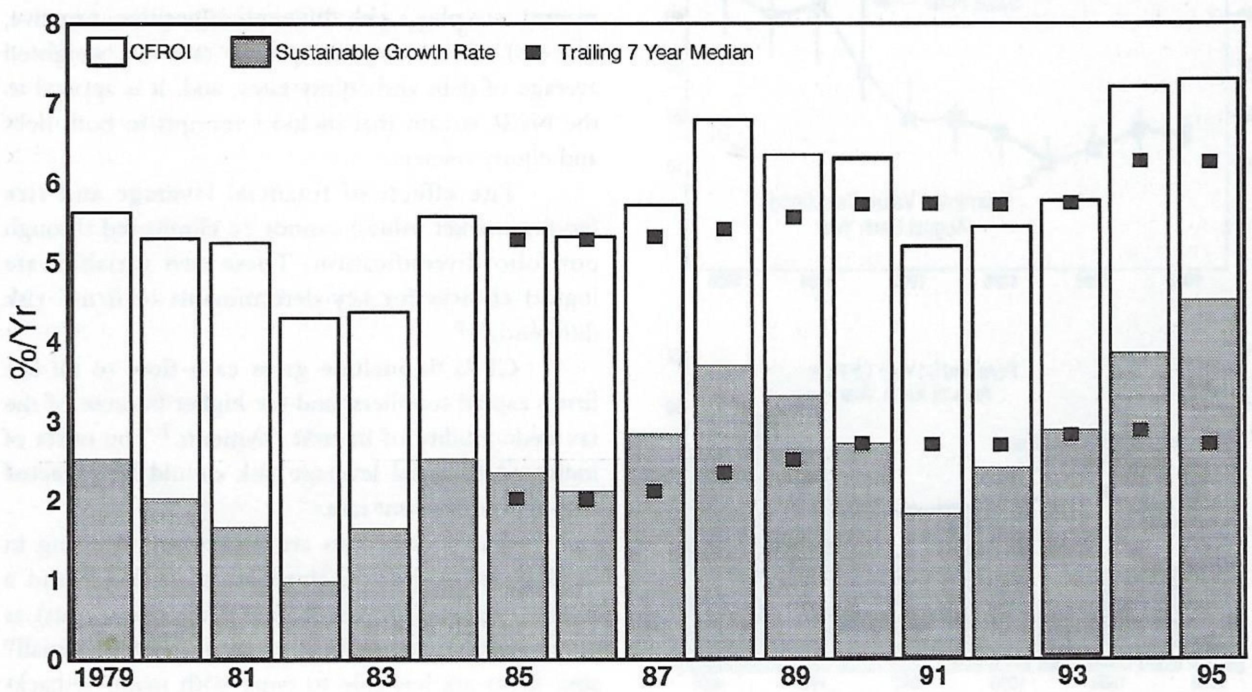
A variety of inferences are made regarding the characteristics of the companies in each class: Less variability with above-average CFROIs reflects higher managerial skill and a slower CFROI fade rate (t + 1 to t + 5). Higher growth with above-average CFROIs tends to produce faster fade rates. Firms earning average CFROIs tend to "stick" at that level, and below-average CFROI firms fade up at rates that are unrelated to CFROI variability or growth.

Appendix A explains how these empirical findings are used to provide fade rates needed to calculate warranted values.

Market Discount Rates

Given the market price of a firm and perfect knowledge of the market's forecast of the firm's

EXHIBIT 6
INDUSTRIAL/SERVICE FIRMS 1979-1995 — CFROIs AND SUSTAINABLE GROWTH RATES



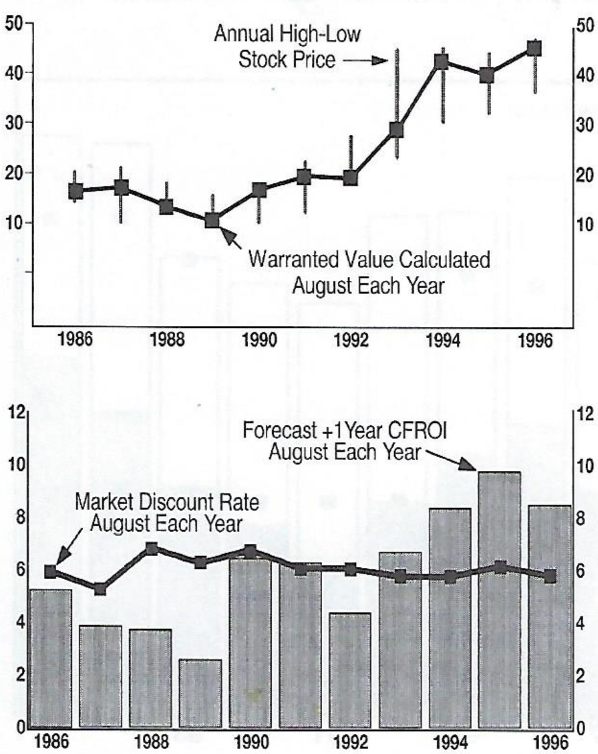
future NCR stream, one can derive the discount rate being used to price the firm, much like deriving the yield on a bond when the price and the expected NCRs from interest and principal payments are known.

The challenge is to apply this concept to a universe of industrial/service firms. The approach taken is to rank, at a particular time, all firms by their +1-year CFROIs and divide this universe into twenty fade classes, as previously noted.

The market value (debt and equity) of a class is the sum of the market values of its constituent firms. The forecasted NCR stream of a class is determined by the aggregate +1-year CFROI and sustainable growth rate calculated by pooling company data, plus the fade rate for that class.

An iterative process is used that selects a discount rate and then calculates a warranted value for each class's forecast NCR stream. When the sum of these warranted values, for all classes, equals the known market value of all firms in the universe, the corresponding discount rate is labeled the market's discount rate (Exhibit 7).

EXHIBIT 8
BRIGGS & STRATTON — STOCK PRICES AND FORECAST CFROIS



VALUATIONS THROUGH TIME

Estimating market discount rates across time is necessary in order to calculate warranted values for firms across time. Exhibit 8 displays warranted values for Briggs & Stratton, with matching forecasts of CFROI + 1 year at August month-ends for 1986 to 1996. The warranted value calculation uses the market discount rate for each year (Exhibit 7) without any positive or negative company-specific risk differentials.[5]

The first panel of Exhibit 8 shows a relatively good fit between actual price levels and warranted values using a market discount rate. In principle, systematic deviations over time for particular firms could be due to errors in forecasting the NCR stream and/or to applying a discount rate that differs from the rate actually used by investors.

Errors in NCR forecasting create noise, which increases the difficulty of empirically relating firm characteristics to company-specific discount rates. The approach we take is to calculate the discount rate that equates the firm's forecasted NCR stream to its known market value. The difference between that calculated rate and the market discount rate can be inferred to be the risk differential assigned to the firm by investors.

COMPANY-SPECIFIC RISK DIFFERENTIALS

The company-specific discount rate is the market rate plus a risk differential (positive, negative, or zero). This company-specific rate is a weighted average of debt and equity rates, and, it is applied to the NCR stream that includes receipts to both debt and equity owners.

The effects of financial leverage and size (equity market values) cannot be eliminated through portfolio diversification. These two variables are logical choices for key determinants of firms' risk differentials.[6]

CFROIs include gross cash flow to all the firm's capital suppliers, and are higher because of the tax deductibility of interest payments.[7] The offset of increased financial leverage risk should be reflected in a higher discount rate.

Transaction costs are higher for investing in smaller firms. Hence, investors should demand a higher expected return (before transaction costs) as compensation. In addition, at some level of "small" size, firms are less able to cope with major setbacks

EXHIBIT 9
MEDIAN RISK DIFFERENTIALS — 10,350 OBSERVATIONS 8/86 THROUGH 8/96

			Size (Equity Market) Deciles									
		All	Largest 1	2	3	4	5	6	7	8	Smallest 9	10
Highest	1	1.34	1.00	1.02	1.04	1.15	1.15	1.21	1.39	1.48	1.65	1.64
	2	0.92	0.64	0.53	0.95	0.82	0.76	0.70	1.01	1.15	1.19	1.60
	3	0.65	0.26	0.43	0.47	0.72	0.45	0.71	0.72	0.76	1.11	1.06
Financial	4	0.38	0.21	−0.19	0.18	0.28	0.35	0.37	0.50	0.90	0.82	1.18
Leverage	5	0.16	0.07	−0.46	−0.12	0.10	0.13	0.45	0.25	0.98	0.64	0.88
Deciles	6	−0.02	−0.60	−0.69	−0.20	−0.46	−0.11	0.14	0.14	0.49	0.76	0.38
	7	−0.29	−0.81	−0.68	−0.33	−0.49	−0.45	−0.11	−0.17	0.08	0.19	0.73
	8	−0.47	−1.25	−0.74	−0.70	−0.78	−0.57	−0.05	−0.24	−0.26	0.05	0.19
	9	−0.77	−1.47	−1.23	−1.09	−1.14	−0.95	−0.43	−0.77	−0.36	−0.57	0.05
Lowest	10	−0.99	−1.32	−2.09	−1.61	−0.99	−0.74	−1.52	−0.81	−0.44	−0.43	−0.56
	All	0.16	−0.19	−0.23	−0.06	−0.15	−0.02	0.18	0.22	0.51	0.64	0.90

from management mistakes or economic downturns.

The hypothesis is that the company-specific discount rate used in the CFROI model should be higher as financial leverage increases and as firm size decreases. To test this hypothesis, a universe of industrial/service firms is assembled from the firms reported on Compustat in August of each year 1986 through 1996 that have Zack's EPS forecast data.[8]

The cutoff in August 1996 for the smallest firm is set at $150 million in equity market value. So that "small" has the same meaning through time, cutoffs for earlier years are calculated by adjusting for changes in the S&P 500 index prior to August 1996; e.g., the cutoff is $58 million for August 1986. As Exhibit 7 displays, with increased Zack's coverage through time, the number of companies increases each year, from 732 in August 1986 to 1,284 in August 1996.

The test for leverage and size includes 10,350 observations using data available at August month-end for each year 1986 through 1996. An observation involves four measurements: 1) firm's leverage decile; 2) firm's size decile; 3) implied discount rate calculated from forecasted NCRs and the firm's market value at that time; and 4) the apparent risk differential calculated as the implied discount rate less the market rate at that time.

Exhibit 9 summarizes the resulting risk differentials by median values for the observations in each cell of a 10 × 10 matrix based on leverage and size. The calculated magnitude and direction of the effects of leverage and size are consistent with the hypothesized relationships.[9]

Note that these risk differentials are *real* rates, and they are applied to a real market discount rate. Consequently, they are smaller than the risk differentials calculated from conventional CAPM and beta procedures, which use nominal rates.

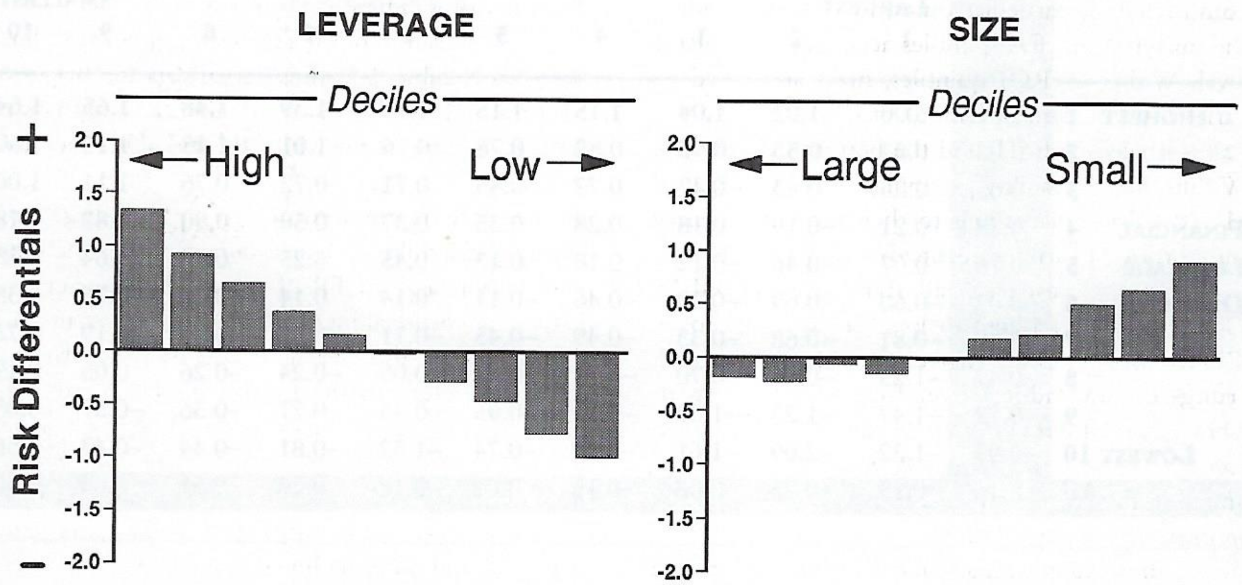
This process for deriving the market rate does not equally weight firms. It uses pooled data that are heavily influenced by large firms. When the universe is ranked high to low on size, there is a very sharp drop in size from the very largest firms to the median firm. Consequently, all else equal, a positive risk differential is expected for the median firm. Exhibit 9 shows a positive 0.16 risk differential for the median firm.

Exhibit 10 graphs summary data from Exhibit 9, illustrating the relationships between increasing leverage and higher risk differentials and decreasing size and higher risk differentials.

SUMMARY

In the valuation literature, there are a number of definitions for net cash receipts (often referred to as "free cash flow") and a variety of methods for calculating an accounting return on capital. Little, however, is said about the difference between accounting and economic ROIs or about the difference between cross-sectional returns on a firm's aggregate assets and ROIs on incremental future projects.

EXHIBIT 10
REAL DISCOUNT RATE DIFFERENTIALS FOR FIRM FINANCIAL LEVERAGE AND SIZE
U.S. INDUSTRIAL/SERVICE FIRMS, 1986-1996



A detailed numerical example in Appendix B demonstrates that the CFROI valuation model is soundly grounded in discounted cash flow principles. Also included is material that clarifies how CFROIs relate to project ROIs and NCRs.

A significant advantage of the CFROI model is its packaging of an NCR forecast not as a series of absolute values but rather as a future pattern (life cycle) of CFROIs and sustainable growth rates. This improves communication of what a forecast represents, and provides benchmarks to assess the plausibility of forecasted NCRs.

For established firms, track records of historical CFROIs and sustainable growth rates are useful visual displays for assessing managerial skill and for making industry peer comparisons. Study of past life cycles provides analysts a baseline for making future life cycle forecasts.

As a practical matter, for most firms most of the time, the key forecast is the CFROI trend over the next five years (t + 1 to t + 5). Empirical research on firm characteristics and actual CFROI fade rates enables +5-year CFROIs to be calculated on the basis of plausible expected fade rates (Madden [1996]). The five-year (+ 1 to + 5) fade window should be the centerpiece of valuation analysis.

Analysts can use the CFROI model to "set the line"; i.e., to quantify today's market expectations for +5-year CFROI. This can be compared with typical fade patterns for similar firms and, most important, with analysts' forecasts of likely future performance.

The CFROI model provides an alternative to the CAPM. The market discount rate is a product of the CFROI model itself. It is a forward-looking rate. This contrasts with CAPM's historical risk premium concept, which assumes the future to be an "average" of a selected piece of history.

In the CFROI model, a firm's discount rate is the market rate plus a risk differential for size and financial leverage, similar to variables used for firms' credit ratings. This approach obviates any notion of a "true" discount rate (cost of capital) that is derived independently of the valuation model. Rather, the discount rate needs to be an integral part of the valuation model.

A new empirical approach shows that leverage and size are significant determinants of risk differentials in the CFROI model. This approach resolves many of the counter-to-commonsense cost of capital estimates based on CAPM and beta (Madden and Eddins [1996]). For example, the CFROI model assigns higher-than-average costs of capital to troubled small firms that can have betas of less than 1.0 because of lagging or sharply falling stock prices in a rising market. The conventional CAPM approach gives these troubled firms lower-than-average costs of capital.

APPENDIX A
CFROI Fade Rate Research

In Madden [1996] twenty fade classes are constructed, at particular times, by initially dividing the universe into five quintiles according to CFROI level. Within CFROI quintiles, firms are sorted by variability (standard deviation) of CFROIs. The top half is labeled high (H) and the bottom half low (L). Within these variability groupings, firms are assigned H and L labels according to their growth potential (proportion of earnings retained).

In this research, all firms are ranked by CFROI levels on a high-to-low "ladder" (100 to 1). CFROI fade rates are measured as changes in rank (rungs on the ladder) over four-year time spans (shown in Exhibit A-1). In calculating a warranted value, as is done for Briggs & Stratton (Exhibits 5 and 8), CFROIs for years +2 through +5 are derived from these fade relationships.

In working with actual data, rather than ranked variables, some useful approximations are developed for estimating CFROI + 5 year based on CFROI + 1 year and the long-term "fade to" CFROI level. Fade factors (Exhibit A-2) express the proportion of the t + 1 spread that is diminished by t + 5.

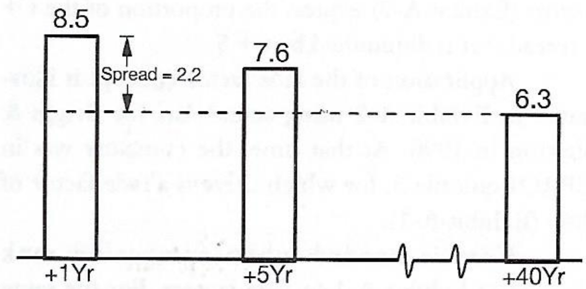
Application of the fade factor concept is illustrated in Exhibit A-2 using actual data for Briggs & Stratton in 1996. At that time, the company was in CFROI quintile 3, for which there is a fade factor of 0.40 (Exhibit A-1).

Care is needed when comparing rank changes of Exhibit A-1 to fade factors. For the same fade factor, a 2% CFROI firm will experience a higher proportional increase t + 1 to t + 5 than a 4% CFROI firm. Also, average CFROIs (fade classes 9 to 12) are close to the market discount rate, and consequently have a small spread. For these firms, the impact on warranted value is small due to varying fade factors. Note that the average rank changes are close to zero, but this results from some firms fading up and others fading down.

EXHIBIT A-1
CFROI Fade Rates

	CFROI Quintile	Variability	Growth	1966 to 1993 Rank Change Average	Approximate CFROI Fade Factor
	1	H	H	–27	0.60
Highest	1	H	L	–17	0.50
	1	L	H	–11	0.40
	1	L	L	–7	0.20
	2	H	H	–17	0.50
	2	H	L	–9	0.40
	2	L	H	–8	0.30
	2	L	L	–1	0.20
	3	H	H	–4	0.40
	3	H	L	–2	0.40
	3	L	H	2	0.40
	3	L	L	5	0.40
	4	H	H	9	0.40
	4	H	L	10	0.40
	4	L	H	10	0.40
	4	L	L	10	0.40
	5	H	H	16	0.40
	5	H	L	18	0.40
Lowest	5	L	H	12	0.40
	5	L	L	13	0.40

EXHIBIT A-2
BRIGGS & STRATTON — CFROI FADE



CFROI + 5 Yr = CFROI + 1 Yr –
[Fade Factor (Spread of CFROI + 1 Yr – CFROI + 40 Yr)]
7.6 = 8.5 – 0.4 (8.5 – 6.3)

APPENDIX B
DETAILED VALUATION AUDIT

The principal objectives of a valuation audit are to:

1. Specify a firm's investment activities in terms of project economics (ROI versus cost of capital), which produce an NCR stream that can be valued in three alternative ways.
2. Explain how a CFROI is related to a project ROI.
3. Prove that these three valuation approaches are equivalent.
4. Demonstrate that the CFROI model (the third approach) is soundly grounded in DCF principles.

A logical beginning point is a definition of net cash receipts. Exhibit B-1 displays a conventional sources and uses statement based on net working capital. A rearrangement of the components as in Exhibit B-2 illustrates that as NCR from the firm's perspective is gross cash inflows less outflows for new investments. In other words, a firm's NCR represents what the firm gets less what it gives up along the way. Exhibit B-2 shows that the same NCR can be calculated from the capital suppliers' perspective.

EXHIBIT B-1
SOURCES AND USES —
NET WORKING CAPITAL

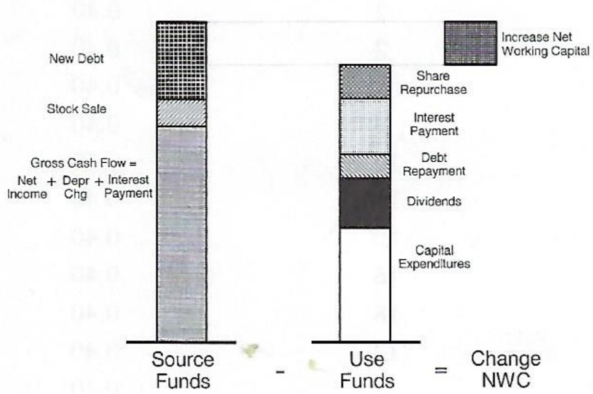
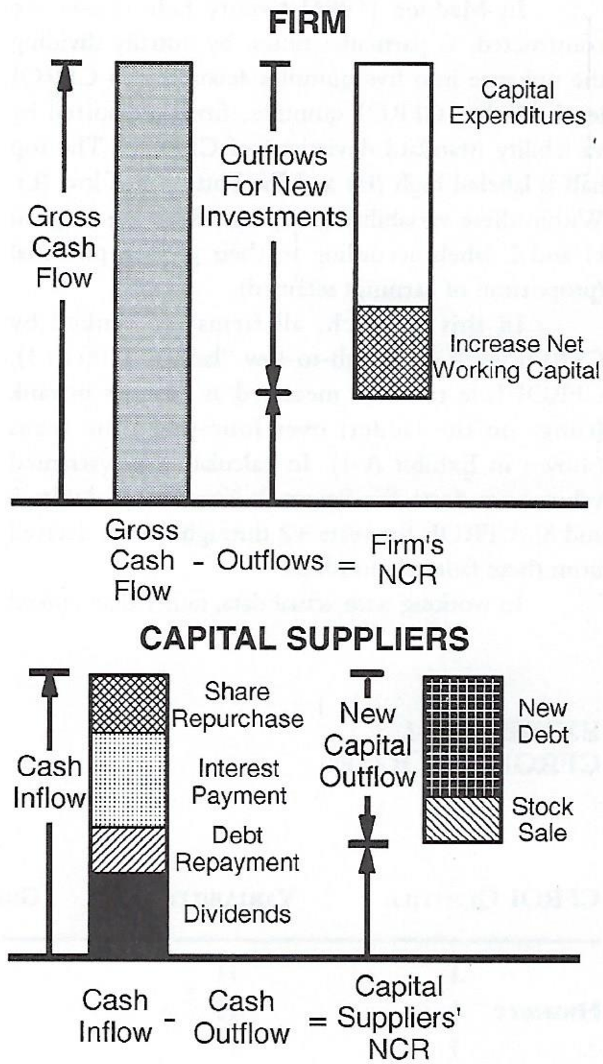
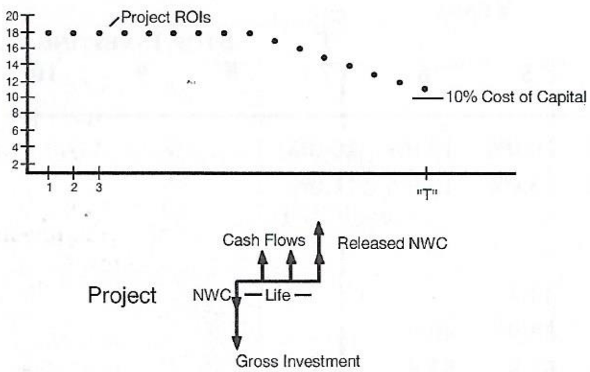


EXHIBIT B-2
FIRM'S NCR = CAPITAL SUPPLIERS' NCR



The valuation audit example focuses on a simplified firm that continually invests in a portfolio of projects (see Exhibit B-3). Each new investment or project has: an initial outlay that is 80% depreciating and 20% net working capital (NWC); a three-year life in order to simplify data checking; equal cash flows over the project life; and net working capital released at the end of the third year.

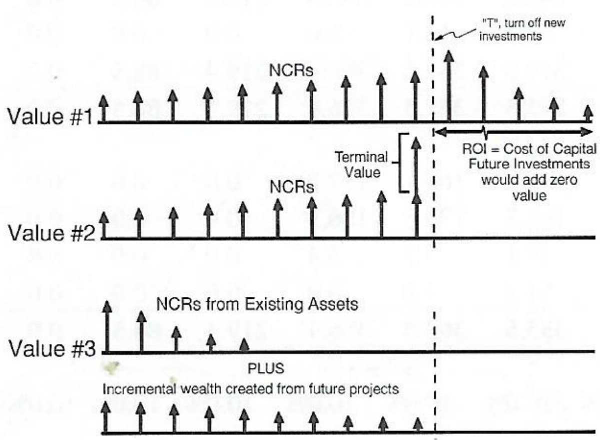
EXHIBIT B-3
SIMPLIFIED FIRM'S LIFE CYCLE



For simplicity, the firm's life cycle is represented by a constant 10% reinvestment rate and project ROIs that begin at 18% and regress toward the cost of capital. T designates the last year when project ROIs exceed the assigned 10% cost of capital. Thus, investments made beyond T would create zero wealth.

It is straightforward that, at any time, the valuation of the firm will be the same if calculated by discounting the complete NCR stream anticipated or by discounting a portion of the NCR stream and an appropriate terminal value. The CFROI valuation model uses a third approach: calculating the firm's value as the *economic or "cash" value of existing assets* plus the present value of incremental wealth created from *future projects.*[10] These three valuation models, which are mathematically equivalent, are diagrammed in Exhibit B-4.

EXHIBIT B-4
THREE METHODS, ONE VALUATION



To audit three separate valuation calculations, a spreadsheet (Exhibit B-5) shows the financial performance of our simplified firm. In year 1 of Exhibit B-5, capital expenditures (line G) of 80.0 and an NWC outlay (D) of 20.0 represent the initial 100.0 invested in the first project, which achieves an 18.0% ROI (B). Three years later, the 20.0 of NWC is released (E) and, based on an 18.0% internal rate of return, equal project cash flows of 40.4 are received in years 2, 3, and 4.

With a 10.0% growth in resources committed, year 2 capital expenditures total 88.0, with 22.0 invested in NWC. By year 4, the firm has a full portfolio of cash-producing projects. In year 4, the 133.7 of gross cash flow (line C) is the aggregate cash flow from three individual projects. Following the guidelines of Exhibit B-2, the firm's NCR (H) in year 4 is 20.6, from gross cash flow of 133.7 less NWC change (F) of 6.6 and less capital expenditures of 106.5.

The CFROI is a cross-sectional ROI measure calculated from aggregate financial statement data. In practice, a time series of past CFROIs coupled with near-term forecasted CFROIs has been found especially helpful for gauging incremental project ROIs. CFROIs (line L) equal project ROIs when project ROIs are holding steady (years 1 through 4). As *incremental* project ROIs (B) trend downward (beginning year 5), CFROIs (L) based on *aggregate* data, follow downward with a lag.

Year 4 shows an 18.0% CFROI (line L) calculated from the basic project ROI configuration. The gross investment (J) at the beginning of the year (i.e., at year 3) is 331.0, and balance sheet NWC (I) is 66.2. Gross cash flow in year 4 is 133.7. Hence, with a three-year project life, the internal rate of return using these aggregate data is 18.0%.

VALUE #1

At the end of year 3, Value #1 is calculated as 329.6 by discounting at 10.0% the total remaining NCR stream (line H) covering years 4 through 10. Note that, beyond year 7, as the firm winds down, no investments are made. This is why the NCRs in years 8 through 10 are so large.

EXISTING ASSETS

To audit the value of existing assets in a year such as year 3, let's begin with Exhibit B-6, which is a tabulation of project cash flows generated by year 3

EXHIBIT B-5
SIMPLIFIED CFROI VALUATION MODEL AUDIT

	YEARS									
		BUILD UP					T	STOP INVESTING		
10% COST OF CAPITAL	1	2	3	4	5	6	7	8	9	10
(A) Growth Rate		10.0%	10.0%	10.0%	10.0%	10.0%	10.0%			
(B) Project ROI	18.0%	18.0%	18.0%	18.0%	15.0%	13.0%	11.0%			
Project Cash Flows										
1		40.4	40.4	40.4						
2			44.4	44.4	44.4					
3				48.9	48.9	48.9				
4					53.8	53.8	53.8			
5						55.7	55.7	55.7		
6							58.8	58.8	58.8	
7								61.9	61.9	61.9
(C) Gross Cash Flow	0.0	40.4	84.8	133.7	147.1	158.3	168.2	176.3	120.6	61.9
(D) Investment NWC	20.0	22.0	24.2	26.6	29.3	32.2	35.4	0.0	0.0	0.0
(E) Released NWC	0.0	0.0	0.0	20.0	22.0	24.2	26.6	29.3	32.2	35.4
(F) Net Change NWC (D – E)	20.0	22.0	24.2	6.6	7.3	8.0	8.8	–29.3	–32.2	–35.4
(G) CAPEX	80.0	88.0	96.8	106.5	117.1	128.8	141.7	0.0	0.0	0.0
(H) NCR (C – F – G)	(100.0)	(69.6)	(36.2)	20.6	22.7	21.5	17.7	205.6	152.9	97.3
(I) Balance Sheet - NWC	20.0	42.0	66.2	72.8	80.1	88.1	96.9	67.6	35.4	0.0
(J) Balance Sheet - Gross Assets	100.0	210.0	331.0	364.1	400.5	440.6	484.6	338.2	177.2	0.0
(K) % Non-Depreciating	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	
(L) CFROI Gross CF(t) ÷ Gross Assets (t – 1)		18.0%	18.0%	18.00%	18.0%	16.9%	15.2%	12.9%	12.0%	11.0%
Value #1 = PV NCR(t + 1) to End [H]			329.6	341.9	353.5	367.3	386.4	219.4	88.5	0.0
Existing Assets:										
(M) PV This Year of Cash Flow/Wind Down			235.4	258.9	276.2	291.6	306.5	160.8	56.3	0.0
(N) PV Released NWC			54.5	60.0	66.0	72.6	79.9	58.6	32.2	0.0
(O) PV of Total Receipts From Existing Assets (M + N)			289.9	318.9	342.2	364.2	386.4	219.4	88.5	0.0
(P) PV NCR(t+1) to T [H]			65.7	51.6	34.1	16.1	0.0	0.0	0.0	0.0
(Q) PV This Year Existing Assets at T			263.9	290.3	319.3	351.3	386.4	219.4	88.5	0.0
Value #2 = (P + Q)			329.6	341.9	353.5	367.3	386.4	219.4	88.5	0.0
(R) Investment (D + G)			121.0	133.1	146.4	161.1	177.2	0.0	0.0	0.0
(S) PV of Investment			139.7	153.7	160.5	170.3	180.5	0.0	0.0	0.0
(T) Incremental Wealth Created (S – R)			18.7	20.6	14.1	9.3	3.4	0.0	0.0	0.0
(U) PV Incremental Wealth Stream			39.6	23.0	11.2	3.1	0.0	0.0	0.0	0.0
Value #3 = (O + U)			329.6	341.9	353.5	367.3	386.4	219.4	88.5	0.0
(V) Shareholder Return [(Value(t) + NCR(t)) / Value (t – 1)] – 1				10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%

EXHIBIT B-6
WIND DOWN OF CASH FLOWS

YEAR	4	5	6	TOTAL
(a) Future Cash Flows	40.4			
	44.4	44.4		
	48.9	48.9	48.9	
(b) Total Cash Flows	133.7	93.3	48.9	
(c) NWC Release	20.0	22.0	24.2	
(d) PV Factors @ 10%	1.10	1.21	1.33	
(e) PV Cash Flows	121.5	77.1	36.7	235.4
(f) PV NWC	18.2	18.2	18.2	54.5
(g) PV of Existing Assets				289.9

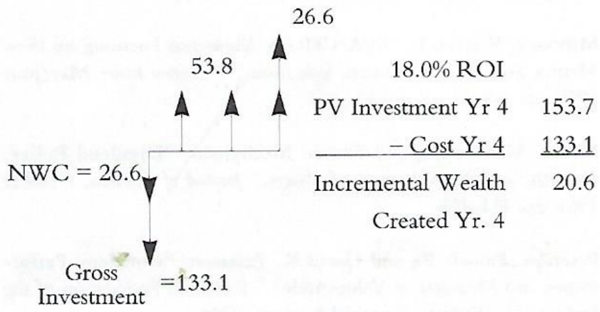
existing assets.

The total PV in year 3 of future cash flows (line M) from existing assets for years 4 through 6 is 235.4, the sum of 121.5 + 77.1 + 36.7. The total PV in year 3 of released NWC (N) is 54.5, the sum of 18.2 + 18.2 + 18.2. Finally, the value of existing assets (O) in year 3 is 289.9, the sum of the PV of existing project cash flows, 235.4, and the PV of released NWC, 54.5.

VALUE #2

Value #2 is the PV in year 3 of NCRs (line H) for years 4 through 7, which is 65.7, plus the present value in year 3 (Q) of existing assets in year 7 (i.e., terminal value), which is 263.9. Hence, Value #2 is 65.7 + 263.9 or 329.6, which agrees with Value #1.

EXHIBIT B-7
PROJECT ECONOMICS



VALUE #3

Value #3 represents the preferred approach that values NCRs from existing assets separately from the value of incremental wealth created from future projects. Consider a project having an investment (R) of 133.1 made in year 4 as shown in Exhibit B-7.

With a 10.0% discount rate, the present value in year 4 of this project is the sum of 53.8/1.10 + 53.8/1.21 + 53.8/1.33 + 26.6/1.33, or 153.7. Incremental wealth created in year 4 is the remainder of 153.7 – 133.1, or 20.6. Extending this analysis, the total value (U) of future investments beyond year 3 is 39.6, calculated as the present value in year 3 of incremental wealth created in years 4 through 7; i.e., 20.6/1.10 + 14.1/1.21 + 9.3/1.33 + 3.4/1.47.

Value #3 is the sum of the value of existing assets (line O) in year 3, i.e., 289.9, plus 39.6 for future investments. This sum is 329.6, which is equal to Value #1 and to Value #2.

Finally, an overall check on the entire process is to verify that the annual return to the firm's capital suppliers equals the 10.0% cost of capital. Consider a purchase of the firm in year 3 for 329.6. In year 4, the value has increased to 341.9; in addition, an NCR of 20.6 in year 4 is received. The achieved return is (341.9 + 20.6)/329.6 or a 10.0% return (line V). This checks with the 10.0% cost of capital.

ENDNOTES

Sam Eddins has made particularly significant contributions to the research reported in this article. Insightful comments were provided by Lee Glasner, Tom Hillman, John Montgomery, Raymond Stokes, and Ernest Welker. Also appreciated are programming and data tabulation by Steve Bock and George Ching, and graphs by Noel Rupprecht.

[1]A CFROI calculation uses four inputs: 1) gross cash flow to all the firm's capital (debt and equity) suppliers; 2) gross assets, expressed in current dollars; 3) an explicit life for the total of depreciating assets; and 4) non-depreciating assets expressed in current dollars (from the proportion of gross assets that are non-depreciating). See the calculation for CFROI in line (L) of Exhibit B-5.

[2]The sustainable real growth rate approximates the firm's basic growth in assets, assuming that both the proportion of debt in the capital structure and dividends relative to earnings remain constant:

P = Plowback = Net income + Depreciation + Minority interest – Dividends
R = Normalized current dollar retirements based on past asset growth
D = Normalized change in debt = Debt/Equity (P – R)

To avoid problems due to mixing fiscal year data, the beginning-of-year current dollar assets are calculated as end-of-year current dollar assets (A) less new investment, or A – (P – R + D).

Sustainable growth is then (P – R + D)/[A – (P – R + D)]. If a firm regularly repurchases shares primarily because of a lack of attractive investment opportunities, then plowback should be reduced by the amount of the share repurchase, thus lowering sustainable growth.

[3]The CFROI model enables the ROI + 1 year for *future* investments to differ from the forecast CFROI on existing assets at t + 1 year. The model's completeness forces important valuation issues to be addressed. Consider a firm with large intangibles due to acquiring high-return businesses at purchase prices well in excess of book assets. The cross-sectional CFROIs for historical years include intangibles in order to properly account for the full resources (purchase price) financed by the firm's capital suppliers.

Nevertheless, ROIs for future expenditures could exceed near-term CFROI levels (with intangibles) partly due to the profitability of acquired businesses, absent any further large acquisition outlays. The procedure used in the valuation calculation here is to average the CFROIs + 1 year calculated with and without intangibles and use that figure for + 1 year ROI for future investments.

[4]In valuing existing assets at a particular time, the CFROI model calculates a declining cash flow stream over the firm's project life (calculated as gross plant divided by depreciation charges for straight-line depreciation firms). The wind-down pattern for this cash flow stream is a function of asset age, project life, and the forecasted fade pattern for future CFROIs. Higher past growth rates imply newer plant and thus maintenance of a larger portion of today's cash flow longer.

To illustrate the effect of asset age, consider a $10 cash flow from existing assets with a ten-year life and a historical 0% real asset growth rate. This historical growth rate implies equal constant-dollar capital expenditures over the past ten years. For the next ten years, cash flows would be forecasted to wind down by 10% increments each year as 10% of today's plant is retired each year.

Also, today's non-depreciating assets will be released in future years when today's plant is retired. The value of existing assets is the PV of this cash flow stream plus the PV of released non-depreciating assets. This is similar to the valuation audit details presented in the Appendix B, Exhibit A-1, line (O).

The value of future investments is keyed to the +1-year CFROI that is forecasted at 8.5%. The project life is fourteen years with 27.3% of assets being non-depreciating. The NPV of the forecasted life cycle for future investments follows the computation for line (U) in Exhibit A-1. In valuing future investments, the end-of-year CFROI is translated to a beginning-of-year project ROI by assuming that assets grow at the sustainable growth rate for the year.

[5]The warranted value calculations for Briggs & Stratton made at month-end August each year use asset and debt information from lagged Compustat annual and quarterly data. Zack's forecast EPS for the next two fiscal years, which is available at the end of August for each year, is the key driver of the forecast CFROI + 1 year. See the Appendix of Madden [1996] for assorted technical details including logical relationships between CFROI and debt calculations.

Fade factors are calculated each year according to Exhibit 11 and classifying Briggs & Stratton into one of twenty fade classes. These fade classes follow Madden [1996], with the exception that forecast CFROI + 1 year is used instead of four-year medians for determining CFROI quintiles. Also, variability uses the past four fiscal year CFROIs and the forecast CFROI + 1 year in calculating a standard deviation.

[6]Financial leverage is Debt/(Debt + Equity). Debt follows Madden [1996] with quarterly short- and long-term debt, when available, replacing year-end values. Equity is month-end August equity market value.

[7]The CFROI model puts the tax deductibility benefit of interest directly into the NCR stream via higher CFROIs due to lower taxes paid. From the owners' perspective, the cost of debt (or equity) capital is properly viewed as the return that bondholders (or common stock owners) expect to achieve in the future. Bondholders obviously receive full interest and principal payments, and their anticipated return is understated when the cost of debt capital is reduced by impounding the benefit of the tax deductibility of interest payments.

[8]Industrial/service firms exclude financial firms (SIC 6000-6999), utilities (4900-4911, 4931, and 4932), and specialized asset firms (1-1499, 2835-2836, 4000-4099, 4400-4499, 4600-4699, 4800-4812, 4814-4899, 4912-4930, 4933-4999).

Annual data are lagged by four months, and quarterly data by two months. August is selected as the measurement time since data on essentially all the December fiscal year-end firms would have been assimilated by analysts at that time, while no more than two quarters of the current fiscal year (December firms) would have been reported. Analysts' EPS forecasts for the coming two fiscal years are weighted to produce a CFROI forecast + 1 year from August month-end. Compustat data for four fiscal years are required in order to calculate fade classes as described in Madden [1996].

[9]Comparing the actual number of positive risk differentials per cell of Exhibit 9 to the expected number provides a χ^2 of 3,816.45 with 81 degrees of freedom. This should be interpreted with caution since leverage, size, and calculated risk differentials (which are a function of fade factors) are interrelated. For example, leverage can be related to fade factors, as "better" managed firms may have less debt in their capital structure.

The key point is that the risk differential methodology here promotes an awareness of interrelationships and treats the discount rate as an integral part of the valuation model. The procedures for forecasting NCRs (and for that matter, the pattern used for the discount rate through time) are intimately related to the calculation of risk differentials.

[10]The valuation perspective of Exhibit B-4 is quite similar to Miller and Modigliani's [1961] original valuation equivalence proofs. Nevertheless, it is important to note that the third valuation approach, which underpins the CFROI valuation model, eliminates the need for a perpetuity assumption.

Both M & M's original algebraic manipulations and the formulas used in residual income models (Bernard [1995]) use perpetuity assumptions to simplify their mathematical expressions. The CFROI model, on the other hand, requires more complex estimating procedures to gauge the economic value of existing assets and to grapple with myriad biases in accounting ROIs. This added complexity has the benefit of fostering additional insights and generating increased accuracy for analysts.

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