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Tom W. Miller
Kennesaw State University

Richard E. Mathisen
Kennesaw State University, rmathise@kennesaw.edu

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DRIVERS OF THE VALUE OF THE FIRM: PROFITABILITY, GROWTH, AND CAPITAL INTENSITY

Tom W. Miller, Kennesaw State University
Richard E. Mathisen, Kennesaw State University

ABSTRACT

Value-based management systems focus on wealth and the wealth creation process and promote the generation of value for the shareholders. A valuation model for the firm is extended analytically to focus explicitly on profitability, growth, and capital intensity as drivers of the value of the firm. The extended model provides information about the sensitivities of the value of the firm to changes in the firm's profitability, growth, and capital intensity. These sensitivities are presented in terms of changes per dollar of sales and actual dollar changes. The changes per dollar of sales show the relative sensitivities of the changes in the value of the firm resulting from changes in the measures for profitability, growth, and capital intensity. Each dollar amount shows the total dollar changes in the value of the firm resulting from changes in the profitability, growth, and capital intensity measures. These sensitivities show the impact of changes in the profitability, growth, and capital intensity measures on the value of the firm. This information is valuable in helping managers determine a desired course of action to improve the wealth generating ability of the firm by managing these value drivers more effectively.

INTRODUCTION

Value-based management systems focus on wealth and the wealth creation process and promote the generation of value for the shareholders (Fisher 1995; Lieber 1996; Walbert 1994). A valuation model for the

firm is extended analytically to focus explicitly on profitability, growth, and capital intensity as drivers of the value of the firm. The extended model provides information about the sensitivities of the value of the firm to permanent changes in the firm's profitability, growth, and capital intensity. These sensitivities are presented in terms of partial derivatives and dollar changes. They show the impact of changes in the profitability, growth, and capital intensity measures on the value of the firm. This information is valuable in helping managers determine a desired course of action to improve the wealth generating ability of the firm by managing these value drivers more effectively (Lehn and Makhija 1996). Value-based management is a system that integrates valuation and action. A detailed analytical development of the extended valuation models used to produce the measures of sensitivities for profitability, growth, and capital intensity is presented. Profitability, growth, and capital intensity are shown to be important drivers of free cash flow, the value of the firm, and the value of the firm per dollar of sales. The relationships of permanent changes in profitability, growth, and capital intensity to free cash flow, the value of the firm, and the value of the firm per dollar of sales are presented. Expressions are developed for the sensitivities of free cash flow, the value of the firm, and the value of the firm per dollar of sales with respect to changes in profitability, growth, and capital intensity in the fifth section. Expressions for dollar changes in the value of the firm per dollar of sales and in the value of the firm for permanent changes in profitability, growth,

and capital intensity are provided. An illustrative example employing the sensitivity models is presented. This example provides numerical values of the partial derivatives and dollar changes for the value of the firm and the value of the firm per dollar of sales for permanent changes in profitability, growth, and capital intensity.

DRIVING SHAREHOLDER VALUE

Management systems that focus on driving shareholder value incorporate valuation principles and are designed and implemented in a way that promotes and rewards decisions that add market value to investor-supplied funds (Copeland, Koller, and Murrin 1995; Stern, Stewart, and Chew 1995; Ehrbar 1998; Rappaport 1998; Stewart 1991). Such management systems emphasizing value creation need valuation models that are expanded to include concepts from both the income statement and balance sheet. The value of the firm should be related to income statement and balance sheet items and financial metrics. The extended valuation models developed in this paper incorporate items from the income statement and balance sheet as value drivers. The value drivers are designed so that components of the employees' work can be identified and linked to the value drivers in the extended valuation model. Performance targets for the value drivers can be established and actual performance can be measured, evaluated, and rewarded in terms of the targets for value drivers. When the value drivers are identified properly, the measurement system is designed properly, and actual performance is reinforced appropriately, value-based management systems will produce business decisions that increase the value of the firm (Stern Stewart 1992).

EXTENDING VALUATION MODELS

The cost of capital and measures of future cash flows and are used by generally

accepted valuation frameworks to provide measures of the value of the firm. The timing, magnitude, and riskiness of future cash flows, and the cost of capital determine the value of the business. The two-phase valuation model for free cash flow shown in Table 1 as equation (1) is employed in this study. When constant growth with $g < r$ occurs after time T the two-phase valuation takes the form shown by equations (2) and (3) in Table 1. The first T periods in this model, phase one, represent an explicit forecast (transition) period during which varying behavior is possible and the remaining periods (phase two) are a continuing value (steady-state) period during which growth is constant and parameters have steady-state values (Copeland, Koller, and Murrin 1995; Stewart 1991; Stewart 1994). Free cash flow, FCF_t , is defined as equal to the net operating profit after taxes, $NOPAT_t$, less the required net investment, $NINV_t$. Equation (4) in Table 1 is the model for free cash flow is that is used in this study. Net operating profit after taxes is equal to earnings before interest and taxes, $EBIT_t$, after taxes. In this model, shown as Equation (5) in Table 1, τ is the cash income tax rate. The required net investment is the required change in invested capital, $IC_t - IC_{t-1}$. The model for net investment is given by Equation (6) in Table 1. The return on invested capital, $ROIC_t$, which relates net operating profit after taxes and invested capital, IC_t , is the measure of profitability used in this study. The definition employed for the return on invested capital is shown as Equation (7) in Table 1. Capital intensity, ci_t , relates invested capital and sales revenue. The model used for capital intensity is shown as Equation (8) in Table 1. These relationships provide a model for net operating profit after taxes in terms of the return on invested capital, capital intensity, and sales revenue. This model is presented in Table 1 as Equation (9). The model for invested capital in terms of capital intensity and sales revenue shown as Equation (10) in Table 1 is provided by the

TABLE 1
Equations Employed in the Study

$$V_0 = \sum_{t=1}^T \frac{FCF_t}{(1+r)^t} + \frac{V_T}{(1+r)^T} \quad (1)$$

$$V_T = \sum_{t=T+1}^H \frac{FCF_T \cdot (1+g)^{t-T}}{(1+r)^{t-T}} = FCF_T \cdot \sum_{t=T+1}^H \left(\frac{1+g}{1+r} \right)^{t-T} \quad \text{as } H \rightarrow \infty \quad (2)$$

$$V_T = \frac{FCF_T \cdot (1+g)}{r-g} = \frac{FCF_{T+1}}{r-g} \quad (3)$$

$$FCF_t = NOPAT_t - NINV_t \quad (4)$$

$$NOPAT_t = (1-\tau) \cdot EBIT_t \quad (5)$$

$$NINV_t = IC_t - IC_{t-1} \quad (6)$$

$$ROIC_t = \left(\frac{NOPAT_t}{IC_t} \right) \quad (7)$$

$$ci_t = \left(\frac{IC_t}{S_t} \right) \quad (8)$$

$$NOPAT_t = ROIC_t \cdot ci_t \cdot S_t \quad (9)$$

$$IC_t = ci_t \cdot S_t \quad (10)$$

$$NINV_t = ci_t \cdot S_t - ci_{t-1} \cdot S_{t-1} \quad (11)$$

$$S_t = (1+g_t) \cdot S_{t-1} \quad (12)$$

$$NINV_t = ci_t \cdot (1+g_t) \cdot S_{t-1} - ci_{t-1} \cdot S_{t-1} = [ci_t \cdot (1+g_t) - ci_{t-1}] \cdot S_{t-1} \quad (13)$$

$$FCF_t = ROIC_t \cdot ci_t \cdot S_t - [ci_t \cdot (1+g_t) - ci_{t-1}] \cdot S_{t-1} \quad (14)$$

$$FCF_T = \{ROIC_T \cdot ci_T \cdot (1+g_T) - [ci_T \cdot (1+g_T) - ci_{T-1}]\} \cdot S_{T-1} \quad (15)$$

TABLE 2
Equations Employed in the Study

$$V_0 = \sum_{t=1}^T \frac{\{\text{ROIC}_t \cdot ci_t \cdot (1+g_t) - [ci_t \cdot (1+g_t) - ci_{t-1}]\} \cdot S_{t-1}}{(1+r)^t} + \frac{V_T}{(1+r)^T} \quad (16)$$

$$V_T = \frac{[\text{ROIC} \cdot ci \cdot (1+g) - ci_T \cdot g] \cdot S_T}{r-g} \quad (17)$$

$$S_{t-1} = \prod_{n=1}^{t-1} (1+g_n) \cdot S_0 \quad (18)$$

$$S_T = \prod_{n=1}^T (1+g_n) \cdot S_0 \quad (19)$$

$$\prod_{n=1}^0 (1+g_n) = 1 \quad (20)$$

$$\left(\frac{V_0}{S_0}\right) = \sum_{t=1}^T \frac{\{\text{ROIC}_t \cdot ci_t \cdot (1+g_t) - [ci_t \cdot (1+g_t) - ci_{t-1}]\} \cdot \prod_{n=1}^{t-1} (1+g_n)}{(1+r)^t} + \frac{\left(\frac{V_T}{S_0}\right)}{(1+r)^T} \quad (21)$$

$$\left(\frac{V_T}{S_0}\right) = \frac{[\text{ROIC} \cdot ci \cdot (1+g) - ci_T \cdot g] \cdot \prod_{n=1}^T (1+g_n)}{r-g} \quad (22)$$

$$\text{ROIC}_t + \rho \quad (23)$$

$$g_t + \gamma \quad (24)$$

$$ci_t + \delta \quad (25)$$

$$\text{ROIC} + \rho \quad (26)$$

$$g + \gamma \quad (27)$$

$$ci + \delta \quad (28)$$

$$\text{FCF}_t = \{(\text{ROIC}_t + \rho) \cdot (ci_t + \delta) \cdot (1+g_t + \gamma) - [(ci_t + \delta) \cdot (1+g_t + \gamma) - (ci_{t-1} + \delta)]\} \cdot \prod_{n=1}^{t-1} (1+g_n + \gamma) \cdot S_0 \quad (29)$$

$$\text{FCF}_{T+1} = \{(\text{ROIC} + \rho) \cdot (ci + \delta) \cdot (1+g + \gamma) - [(ci + \delta) \cdot (1+g + \gamma) - (ci_T + \delta)]\} \cdot \prod_{n=1}^T (1+g_n + \gamma) \cdot S_0 \quad (30)$$

definition of capital intensity. Using the model for invested capital gives the model for required net investment in terms of capital intensity and sales revenue given in Equation (11). The model for the period-to-period growth rate for sales revenue, g_t , given in Equation (12) of Table 1 shows how sales revenue evolves over time. Net investment also depends on the period-to-period growth rate for sales revenue as shown in Equation (13) of Table 1. Using the models for net operating profit after taxes, required net investment, and sales revenue growth, produces the models for free cash flow shown in equations (14) and (15) of Table 1. Substituting the expression for free cash flow into the two-phase valuation model shown in equations (1), (2), and (3) gives the valuation model shown in Table 2 as equations (16) and (17). The model for sales revenue can be expanded as shown in equations (18), (19), and (20) so that each year's sales revenue depends on S_0 and the period-to-period growth rates from time 0 up to time $t-1$ and T . Substituting the expanded model for sales into the model for the value of the firm gives the extended valuation model for the value of the firm per dollar of sales shown in Table 2 as equations (21) and (22). The time subscripts are removed from the symbols for return on invested capital, capital intensity, and sales revenue growth after time T to emphasize that steady-state values occur. This model shows how the return on invested capital, capital intensity, sales revenue growth, and cost of capital are drivers of the value of the firm per dollar of sales.

THE IMPORTANCE OF PROFITABILITY, GROWTH, AND CAPITAL INTENSITY

Profitability, growth, and capital intensity are important drivers of free cash flow and the value of the firm in the models presented so far. The importance of profitability, growth, and capital intensity in the value generation process can be

examined more closely by looking at their effects on free cash flow and the value of the firm.

Perturbation Terms for the Value Drivers

The following notation that is used to examine sensitivities for the measures of profitability, growth, and capital intensity is presented in Table 2 in equations (23), (24), and (25) for the explicit forecast (transition) period and in equations (26), (27), and (28) for the for the continuing value (steady-state) period. In these models, ρ , γ , and δ are perturbation terms which normally equal zero, but are set to positive and negative values to measure sensitivities of the value of the firm with respect to permanent changes in these measures of profitability, growth, and capital intensity.

FCF in Terms of Profitability, Growth, and Capital Intensity Including Perturbation Terms

When the perturbations terms are introduced into the expressions, the relationship between free cash flow and the measures of profitability, growth, and capital intensity are given in Table 2 by Equation (29) for the explicit forecast (transition) period and by Equation (30) for the continuing value (steady-state) period.

Sensitivities of FCF with Respect to Profitability, Growth, and Capital Intensity

The partial derivatives of free cash flow show their sensitivities with respect to profitability, growth, and capital intensity. The partial derivatives for free cash flow with respect to permanent changes in profitability, growth, and capital intensity are obtained from the models for free cash flow. For profitability, the partial derivatives of the free cash flow with respect to a permanent change in the rate of return on invested capital are given in Table 3 by

TABLE 3
Equations Employed in the Study

$$\left(\frac{\partial \text{FCF}_t}{\partial \rho}\right) = (ci_t + \delta) \cdot (1 + g_t + \gamma) \cdot \prod_{n=1}^{t-1} (1 + g_n + \gamma) \cdot S_0 \quad (31)$$

$$\left(\frac{\partial \text{FCF}_{T+1}}{\partial \rho}\right) = (ci + \delta) \cdot (1 + g + \gamma) \cdot \prod_{n=1}^T (1 + g_n + \gamma) \cdot S_0 \quad (32)$$

$$\left(\frac{\partial \text{FCF}_t}{\partial \gamma}\right) = [(\text{ROIC}_t + \rho) \cdot (ci_t + \delta) - (ci_t + \delta)] \cdot \prod_{n=1}^{t-1} (1 + g_n + \gamma) \cdot S_0 +$$

$$\{(\text{ROIC}_t + \rho) \cdot (ci_t + \delta) \cdot (1 + g_t + \gamma) - [(ci_t + \delta) \cdot (1 + g_t + \gamma) - (ci_{t-1} + \delta)]\} \cdot \sum_{h=1}^{t-1} \prod_{n=1}^{t-1} (1 + g_n + \gamma) \cdot S_0 \quad (33)$$

$n \neq h$

$$\left(\frac{\partial \text{FCF}_{T+1}}{\partial \gamma}\right) = [(\text{ROIC} + \rho) \cdot (ci + \delta) - (ci + \delta)] \cdot \prod_{n=1}^T (1 + g_n + \gamma) \cdot S_0 +$$

$$\{(\text{ROIC} + \rho) \cdot (ci + \delta) \cdot (1 + g + \gamma) - [(ci + \delta) \cdot (1 + g + \gamma) - (ci_T + \delta)]\} \cdot \sum_{h=1}^T \prod_{n=1}^T (1 + g_n + \gamma) \cdot S_0 \quad (34)$$

$n \neq h$

$$\left(\frac{\partial \text{FCF}_t}{\partial \delta}\right) = [(\text{ROIC}_t + \rho) \cdot (1 + g_t + \gamma) - (g_t + \gamma)] \cdot \prod_{n=1}^{t-1} (1 + g_n + \gamma) \cdot S_0 \quad (35)$$

$$\left(\frac{\partial \text{FCF}_{T+1}}{\partial \delta}\right) = [(\text{ROIC} + \rho) \cdot (1 + g + \gamma) - (g + \gamma)] \cdot \prod_{n=1}^T (1 + g_n + \gamma) \cdot S_0 \quad (36)$$

$$\left(\frac{V_0}{S_0}\right) = \sum_{t=1}^T \frac{\text{FCF}_t}{S_0 \cdot (1+r)^t} + \frac{\text{FCF}_{T+1}}{S_0 \cdot [r - (g + \gamma)] \cdot (1+r)^T} \quad (37)$$

$$\frac{\partial \left(\frac{V_0}{S_0}\right)}{\partial \rho} = \sum_{t=1}^T \frac{\left(\frac{\partial \text{FCF}_t}{\partial \rho}\right)}{S_0 \cdot (1+r)^t} + \frac{\left(\frac{\partial \text{FCF}_{T+1}}{\partial \rho}\right)}{S_0 \cdot [r - (g + \gamma)] \cdot (1+r)^T} \quad (38)$$

$$\frac{\partial \left(\frac{V_0}{S_0}\right)}{\partial \gamma} = \sum_{t=1}^T \frac{\left(\frac{\partial \text{FCF}_t}{\partial \gamma}\right)}{S_0 \cdot (1+r)^t} + \frac{\left(\frac{\partial \text{FCF}_{T+1}}{\partial \gamma}\right) \cdot [r - (g + \gamma)] + \text{FCF}_{T+1}}{S_0 \cdot [r - (g + \gamma)]^2 \cdot (1+r)^T} \quad (39)$$

$$\frac{\partial \left(\frac{V_0}{S_0}\right)}{\partial \delta} = \sum_{t=1}^T \frac{\left(\frac{\partial \text{FCF}_t}{\partial \delta}\right)}{S_0 \cdot (1+r)^t} + \frac{\left(\frac{\partial \text{FCF}_{T+1}}{\partial \delta}\right)}{S_0 \cdot [r - (g + \gamma)] \cdot (1+r)^T} \quad (40)$$

Equation (31) for the explicit forecast (transition) period and by Equation (32) for the continuing value (steady-state) period.

The partial derivatives for free cash flow with respect to a permanent change in growth are given in Table 3 by Equation

(33) for the explicit forecast (transition) period and by Equation (34) for the continuing value (steady-state) period. Equations (35) and (36) in Table 3 are the partial derivatives for free cash flow with respect to a permanent change in capital intensity for the explicit forecast (transition) period and for the continuing value (steady-state) period, respectively.

SENSITIVITIES OF VALUE PER DOLLAR OF SALES WITH RESPECT TO PROFITABILITY, GROWTH, AND CAPITAL INTENSITY

The value of the firm per dollar of sales equals the present value of the future free cash flows divided by S_0 and is given by Equation (37) in Table 3. The partial derivative of the value of the firm per dollar of sales with respect to permanent changes in profitability is equal to the expression in Equation (38) in Table 3. The partial derivative of the value of the firm per dollar of sales with respect to a permanent change in growth is equal to the expression in Equation (39) in Table 3. The partial derivative of the value of the firm per dollar of sales with respect to a permanent change in capital intensity is equal to the expression in Equation (40) in Table 3.

DOLLAR CHANGES FOR PROFITABILITY, GROWTH, AND CAPITAL INTENSITY

Another way to measure the sensitivities of value and value added to changes in profitability, growth, and capital intensity is the dollar change resulting from a permanent change in profitability, growth, and capital intensity. The dollar change for a permanent change in the measures of profitability, growth, and capital intensity is equal to the partial derivative of the value of the firm with respect to the respective value driver times the change in the value driver. The changes in the value of the firm are given by equations (41), (42), and (43) in Table 4 for a permanent change in each of the value drivers, profitability, growth, and capital intensity.

ILLUSTRATIVE EXAMPLE

The models developed in this paper can be used to generate information about the value of the firm per dollar of sales, the value of the firm per dollar of sales, and the sensitivities of the value of the firm per dollar of sales to profitability, growth, and

TABLE 4
Equations Employed in the Study

$$\Delta \left(\frac{V_0}{S_0} \right)_\rho = \rho \cdot \frac{\partial \left(\frac{V_0}{S_0} \right)}{\partial \rho} = \rho \cdot \left\{ \sum_{t=1}^T \frac{\left(\frac{\partial FCF_t}{\partial \rho} \right)}{S_0 \cdot (1+r)^t} + \frac{\left(\frac{\partial FCF_{T+1}}{\partial \rho} \right)}{S_0 \cdot [r - (g + \gamma)] \cdot (1+r)^T} \right\} \quad (41)$$

$$\Delta \left(\frac{V_0}{S_0} \right)_\gamma = \gamma \cdot \frac{\partial \left(\frac{V_0}{S_0} \right)}{\partial \gamma} = \gamma \cdot \left\{ \sum_{t=1}^T \frac{\left(\frac{\partial FCF_t}{\partial \gamma} \right)}{S_0 \cdot (1+r)^t} + \frac{\left(\frac{\partial FCF_{T+1}}{\partial \gamma} \right) \cdot [r - (g + \gamma)] + FCF_{T+1}}{S_0 \cdot [r - (g + \gamma)]^2 \cdot (1+r)^T} \right\} \quad (42)$$

$$\Delta \left(\frac{V_0}{S_0} \right)_\delta = \delta \cdot \frac{\partial \left(\frac{V_0}{S_0} \right)}{\partial \delta} = \delta \cdot \left\{ \sum_{t=1}^T \frac{\left(\frac{\partial FCF_t}{\partial \delta} \right)}{S_0 \cdot (1+r)^t} + \frac{\left(\frac{\partial FCF_{T+1}}{\partial \delta} \right)}{S_0 \cdot [r - (g + \gamma)] \cdot (1+r)^T} \right\} \quad (43)$$

capital intensity. The models are used to generate the information presented in tables 5 through 8. In the tables, the explicit forecast (transition) period is five years and a continuing value (steady-state) period occurs after that. The different values of $ROIC_t$, g_t , and ci_t shown in the four tables are used to produce the different values of the partial derivatives of the value of the firm per dollar of sales with respect to the measures of profitability, growth, and capital intensity. Table 5 uses an initial ROIC of 25%, an initial growth rate of 20%, an initial capital intensity of 0.50, and a cost of capital of 15%. Table 6 uses an initial ROIC of 25%, an initial growth rate of 20%, a higher initial capital intensity of 1.00, and a cost of capital of 15%. Table 7 uses an initial ROIC of 25%, an initial growth rate of 20%, an even higher initial capital intensity of 1.50, and a cost of capital of 15%. Table 8 uses a lower initial ROIC of 20%, an initial growth rate of 20%, an initial capital intensity of 1.00, and a cost of capital of 15%. For the continuing value (steady-state) period, all four tables use an ROIC of 15%, a growth rate of 5%, and a cost of capital of 15%. The capital intensity for the

continuing value (steady-state) period is 0.50, 1.00, 1.50, and 1.00 for the four tables. For the parameters shown in the tables, a permanent change in ROIC has the largest impact on the value of the firm per dollar of sales and a permanent change in capital intensity has the smallest impact on the value of the firm per dollar of sales. A permanent change in growth has an intermediate impact on the value of the firm per dollar of sales for the parameters shown. The sensitivities of the value of the firm per dollar of sales to profitability, growth, and capital intensity for other values of the parameters for the explicit forecast (transition) and continuing value (steady-state) periods can be generated using the models developed in this paper. The value of the partial derivative multiplied by the anticipated permanent changes in ROIC, g , or ci shows the magnitude of the anticipated change in the value of the firm per dollar of sales resulting from the change in the value driver. Suppose there is a permanent change in ROIC equal to 1% when the relevant values for the parameters are shown in Table 6. The value of the firm per dollar of sales will increase by approximately 16.90277

TABLE 5

t	Explicit Forecast (Transition) Period						Steady State	Partial Derivative
	0	1	2	3	4	5		
$ROIC_t$	0.25	0.25	0.25	0.25	0.25	0.15	0.15	8.45139
g_t	0.20	0.20	0.20	0.20	0.20	0.05	0.05	2.30627
ci_t	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.64568
r	0.15	0.15	0.15	0.15	0.15	0.15	0.15	

times 0.01 equals 0.1690277. In addition, assume that the firm's sales are \$1 billion. The value of the firm will increase by approximately 16.90277 times 0.01 times \$1 billion equals \$0.1690277 billion. The effects of permanent changes in the growth rate and capital intensity can also be analyzed using this approach. This example

shows how the models provide quantitative measures of the effects of permanent changes in profitability, growth, and capital intensity on the value of the firm per dollar of sales and on the value of the firm. Other combinations of profitability, growth, capital intensity, and cost of capital for explicit forecast (transition) period and a continuing

TABLE 6

t	Explicit Forecast (Transition) Period						Steady State	Partial Derivative
	0	1	2	3	4	5		
ROIC _t	0.25	0.25	0.25	0.25	0.25	0.15	0.15	16.90277
g _t	0.20	0.20	0.20	0.20	0.20	0.05	0.05	4.61253
ci _t	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.64568
r	0.15	0.15	0.15	0.15	0.15	0.15	0.15	

TABLE 7

t	Explicit Forecast (Transition) Period						Steady State	Partial Derivative
	0	1	2	3	4	5		
ROIC _t	0.25	0.25	0.25	0.25	0.25	0.15	0.15	25.35415
g _t	0.20	0.20	0.20	0.20	0.20	0.05	0.05	6.91880
ci _t	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.64568
r	0.15	0.15	0.15	0.15	0.15	0.15	0.15	

TABLE 8

t	Explicit Forecast (Transition) Period						Steady State	Partial Derivative
	0	1	2	3	4	5		
ROIC _t	0.20	0.20	0.20	0.20	0.20	0.15	0.15	16.90277
g _t	0.20	0.20	0.20	0.20	0.20	0.05	0.05	4.13869
ci _t	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.42298
r	0.15	0.15	0.15	0.15	0.15	0.15	0.15	

value (steady-state) period can be examined in similar fashion. Such results are interpreted as discussed in this example and can be used to develop a more complete understanding to the response surface for the value of the firm.

SUMMARY AND CONCLUSIONS

This research extends two-stage valuation models so that they include explicit treatment of profitability, growth, and capital intensity. Extended valuation models are presented which show the relationships between these three value drivers and the value of the firm and the value of the firm per dollar of sales. Partial derivatives for the extended valuation

models are used to provide expressions for the sensitivities of the value of the firm per dollar of sales and the value of the firm with respect to profitability, growth, and capital intensity. The partial derivatives are used to produce expressions for dollar changes in the value of the firm associated with permanent changes in profitability, growth, and capital intensity. The partial derivatives and dollar changes are measures of the sensitivities of the value of the firm with respect to changes in these value drivers. An illustration example demonstrates the usefulness of the valuation models and sensitivities models developed. The sensitivity measures show the relative importance of permanent changes in profitability, growth, and capital intensity.

This information can be used by value-based management systems in designing programs to enhance the value of the firm.

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