# Sustainable Growth Rate and Optimal Capital Structure

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## ABSTRACT

Sustainable growth rate (SGR) is the maximum sales growth rate, measured from a base sales level, which a company can support without any additional external equity financing while maintaining a target Debt-Equity (D/E) ratio, given the retention ratio, ***b.*** SGR formulations available in literature do not consider variable liability as an internal source of financing, and thus, these formulations underestimate SGR. The present study proposes a new formula to correctly calculate SGR which includes variable liability as an internal source of financing, to examine the impact of D/E ratio on SGR, to construct SGR–D/E Ratio Continuum, and, thereby, to determine optimal D/E ratio of a company based on its forecasted level of sales growth rate. That is, the study proposes that SGR formulation is an alternative tool to determine the optimum D/E ratio for a given level of forecasted sales growth rate of a company. The study finds that as D/E ratio increases, SGR also increases and at one level of D/E ratio, SGR reaches its maximum. After that level of D/E ratio, SGR becomes negative. This relationship between SGR and D/E ratio is true if a company is not already in financial distress. The present study finds that based on the forecasted level of sales growth rate of a company the optimum level of D/E ratio or optimum capital structure can be determined from the proposed SGR–D/E Ratio Continuum. This is a new approach to determine optimum D/E ratio in financial management. Empirical test supports the findings of this study.

## 1. Introduction

The management of growth requires careful balancing of the sales objectives of the firm with its operating efficiency and financial resources. The trick is to determine what sales growth rate is consistent with the financial realities of the company. In this regard, sustainable growth modeling is a powerful planning tool and has found enthusiastic use in many world-famous firms. Sustainable growth rate **(SGR)** is the maximum sales growth rate, measured from a base sales level, which a company can support without any additional external equity financing while maintaining a target Debt-Equity (D/E) ratio, given the retention ratio, ***b***. In a simple language, SGR is the maximum percentage increase in sales (measured from a base sales level) that can be achieved based on a target Debt/Equity ratio and dividend-payout ratio. If actual growth exceeds the SGR, something must be given up and frequently it is the Debt/Equity ratio. "By modeling the process of growth, we are able to make intelligent trade-offs" (Van Horne, 1995, p. 818). The present study finds that as the target Debt-Equity (D/E) ratio increases, SGR initially increases and then suddenly falls below zero, which may lead to financial distress and bankruptcy. Therefore, if a company measures various levels of SGRs corresponding to various D/E ratios, it will find that a given level of D/E ratio maximizes the SGR and after that a slight increase in D/E ratio makes SGR negative. This suggests that the maximum financial leverage a firm can utilize depends on its forecasted sales growth rate and the maximum ceiling is up to a level at which its SGR is at its maximum. Thus, this helps the company to decide what should be the optimum financial leverage (or D/E ratio) it can utilize based on its forecasted sales growth rate without the risk of bankruptcy and financial distress. Financial Management theories state that low leverage is not good and at the same time high

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leverage is also risky. A company can, therefore, determine what should be its optimum financial leverage (or D/E ratio) from the analysis of SGR.

## 2. Literature Review

In literature of Financial Management, SGR is used to determine at what sales growth rate, measured from a base sales level, a company will not need external equity financing to support its production and sales activities while maintaining a predetermined constant D/E ratio and retention ratio. That is, what the maximum annual sales growth rate a company can achieve without any external equity financing while maintaining a constant and predetermined target D/E ratio (Ross *et. al.* 2003, p.112), or "target operating, debt, and dividend-payout ratios" is (Van Horne, p. 818) (whether that target D/E ratio is optimum or not, given the retention ratio). In literature, there is no mention about the effect of D/E ratio on SGR and it says nothing about the optimality of the target D/E ratio of a company for next period for a given level of forecasted sales growth rate. In reality, however, it is possible to determine the optimal D/E ratio for a company, given the retention ratio, based on the relationship between SGR and D/E ratio. There are two basic formulas to calculate SGR. One was proposed by Ross *et al.* (2003, p.112), and the other one was by Higgins (1984, Chap. 5, pp. 19-25; 1997, pp. 7-16). The formulation of Higgins was elaborated later by Van Horne (1995, pp. 818-24). These formulations, as mentioned above, do not say anything about the effect of D/E ratio on SGR or about the optimality of the target D/E ratio. In addition, these formulations exclude variable or spontaneous liability as a source of internal financing. Furthermore, these formulations assume that (i) the firm is operating at full capacity and (ii) various balance sheet items and net profit margin change proportionally with the change in sales; that is, ratios of sales to different variables are constant over time. But these are not plausible assumptions.

Ross *et al.* (2003, p.112) propose the following formula to calculate SGR assuming that (i) the firm is operating at full capacity, (ii) balance sheet items and net profit margin change over time proportionally with the change in sales, and (iii) variable liability is not a source of internal financing and, at the same time, it is not a part of debt *(then, what is it?)*:

$$SGR = \frac{ROE \times b}{1 - ROE \times b} \times 100$$

Where, SGR = Sustainable Growth Rate
ROE = Return On Equity and
b = Retention Ratio.

This formula adopted the Percentage of Sales Approach (POSA). Another problem of this version of SGR formulation is that if we want to examine the effect of Debt/Equity ratio on SGR, we need to calculate ROE with new set of data. Calculation of SGR using the above formula with a hypothetical numerical example will be useful. Following information of a hypothetical company can be considered in this respect:

Let:

Eo = Base year's equity = \$100
Do = Base year's debt = \$80
Base year's Debt/Equity (D/E) ratio = 0.80

So = Base year's sales level = $300
NIo = Base year's net income = $12
TAo = Base year's total asset = $180
VLo = Base year's variable liabilities = $10
b = Retention ratio (determined by management) = 0.70
d = Dividend- payout ratio = (1− b) = (1− 0.70) = 0.30
ROE = Base year's return on equity = $12/$100 = 0.12
NPo/So = Base year's profit margin, π = $12/$300 = 0.04
Do/Eo = Initial target Debt/Equity ratio = 0.80
TAo/So = Base year's total asset-to-sales ratio = $180/$300 = 0.60

Thus, putting the necessary values in above formula, we get:

$$SGR = \frac{0.12 \times 0.70}{1 - 0.12 \times 0.70} \times 100$$

$$SGR = \frac{0.084}{0.916} \times 100$$

$$= 0.0917 \times 100$$

$$= 9.17\%$$

The second model, proposed by Robert C. Higgins (1984, Chap. 5, pp. 19-25; 1997, pp. 7-16) is the so-called steady state model of SGR. This model is identical to the model formulated by Ross *et. al.* mentioned above. However, this model of Higgins allows us to change D/E ratio and its effect on SGR can be observed. But this model also does not consider variable liability as an internal source of financing and, in addition, maintains the two assumptions of the first model of Ross *et. al.* It also does not say anything about the effect of D/E ratio on SGR since it assumes that the target D/E ratio is given. Like the first model, this one also does not say anything about the optimality of the target D/E ratio.

The formula of Higgins is given below:

$$\Delta S\,(TA/S) = [b\,(NP/S)\,(So + \Delta S) + [b\,(NP/S)\,(So + \Delta S)] \times D/E] \times 100 \quad \ldots\ldots\ldots\ldots \quad (1)$$

Increase in Asset — Increase in Retained Earnings — Increase in Debt

By rearranging, this equation can be expressed as:

$$SGR = \Delta S/S \times 100 = \frac{b\,(NP/S)\,(1+D/E)}{(TA/S) - [b\,(NP/S)\,(1+D/E)]} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

In this formulation, TA/S (total asset intensity ratio), NP/S (net profit margin), b (retention ratio), and D/E ratio are used as target variables. The total asset-to-sales ratio (total asset intensity ratio), TA/S, is a measure of operating efficiency (it is the reciprocal of the traditional Asset Turnover Ratio). Lower TA/S indicates higher level of efficiency in utilization of assets, and vice versa. "In turn, this ratio is a composite of (1) receivable

management, as depicted by the average collection period; (2) inventory management, as indicated by the inventory turnover ratio; (3) fixed asset management (management of capital intensity), as reflected by the throughput of product through the plant (i.e., capital inventory); and (4) liquidity management, as suggested by the proportion of the return on liquid assets. In this model, it is assumed that liquid assets are kept at moderate levels (i.e., there is no excess current assets) and the company is operating at full capacity and capital intensity ratio always remains fixed" (Van Horne, 1995, p. 818). This formulation is also based on Percentage of Sales Approach POSA). As mentioned earlier, this formulation does not consider variable liability as a source of internal financing.

The net profit margin is a relative measure of operating efficiency, while both the TA/S and net profit margin, NI/S, are affected by the external product markets, they largely capture internal management efficiency. The retention ratio (b) and D/E ratio should be determined in keeping with dividend and capital structure theory and practice.

SGR can be calculated by using the formula of Higgins for the above mentioned hypothetical company as shown below:

$$SGR = \Delta S/S \times 100 = \left[ \frac{0.70 \times 0.04 \times 1.80}{0.60 - [0.70 \times 0.04 \times 1.80} \right] \times 100 = 9.17\%.$$

Thus, we get the same value of SGR as we get from the formula proposed by Ross *et. al.*

As mentioned earlier, the formulations of Higgins was revised by Van Horne (1995, pp. 818-24). Van Horne proposes that, if a company wants to change the target D/E ratio and thus needs to issue new stock during any period, the formulation of Higgins will be as follows:

$$SGR = \left[ \left\{ \frac{(Eo + \text{New Equity} - \text{Dividend})\,(1 + Do/Eo)\,(So/TAo)}{1 - \{(NPo/So)\,(1 + Do/Eo)\,(So/TAo)} \right\} (1/So) - 1 \right] \times 100$$

Let us calculate SGR with our above mentioned hypothetical data as follows:

$$SGR = \left[ \frac{(100 - 3.93^{*})\,(1.80)\,(1.6667)}{1 - \{(0.04)\,(1.80)\,(1.6667)\}} \right] [1/300] - 1 = 9.17\%$$

* Dividend = (1 – retention ratio) × $NI_1$ = (1 - b) × $NI_1$ = d$\Pi S_1$

$$= \frac{0.30}{d} \times \frac{0.04}{\Pi} \times \frac{So\,(1 + 0.0917)}{S_1}$$

$$= 3.93$$

where, $\Pi$ = Current profit margin.

Similarly, we can solve for SGR by changing our target values next year.

Now it is clear that in the above formulation we can change our target Debt/Equity ratio, target profit margin, target capital intensity ratio, and target dividend-payout ratio. But if we

keep all these four target ratios unchanged over time, we will get the same SGR as before (9.17%) after one year. (Now sales will be 9.17% more).

In existing formulations of SGR, the variable liability (VL) is not included as an internal source of financing. In reality, VL is generated internally and thus this must not be included in debt, but (it) must be considered as an internal source of financing. In addition, the assumptions that the firm is operating at full capacity and various balance sheet items and net profit margin change proportionally with the change in sales over time are not required to be made. If VL is included as an internal source of financing, SGR can be recalculated as follows:

The left side of balance sheet = The right side of the balance sheet

$TA_1 = Eo + VL_1 + (R/E)_1 + Do + \Delta D$, (1 = Next Year)

Where, $TA_1$ = Total Asset to be needed next year, Eo = Current Equity, $VL_1$ = Variable Liability in next year, $(R/E)_1$ = Retained Earnings in next year, Do = Current Long-term Debt, and $\Delta D$ = Change in Debt needed to maintain target D/E ratio.

Now we need to increase debt to keep the D/E ratio constant:

$FA_1 + CA_1 = Eo + VL_1 + (R/E)_1 + Do + \{(R/E)_1 \times (Do/Eo)\}$

Where, Do/Eo = Target D/E ratio at present.

Let $\Delta S/So = (S_1 - So)/So = Z$, $CA_1$ = Current Asset to be needed next year, CA = Current Asset at present, $FA_1$ = Fixed Asset to be needed next year, FA = Fixed Asset at present, NIo = Current year's Net Income, and b = Retention ratio.

Therefore, we can write:

$CA_1 = (Z + 1)\, CAo$, $FA_1 = (Z + 1)\, FAo$, $VL_1 = (Z + 1)\, VLo$, $(R/E)_1 = (Z + 1)\, NIo \times b$ and $\Delta D = (Z + 1)\, NIo \times b \times Do/Eo$.

Thus,

$$Z = \left( \frac{Eo + Do}{TAo - VLo - NIo \times b\,(1 + Do/Eo)} - 1 \right) \times 100 = SGR$$

By using the data of the hypothetical company mentioned above, we get:

$$Z = \left( \frac{100 + 80}{180 - 10 - (12 \times 0.7 \times 1.80)} - 1 \right) \times 100$$

$$= [\{180/(170 - 15.12)\} - 1\,] \times 100 = 16.219\%$$

This 16.219% is the correct value of SGR if our target Debt/Equity ratio = 0.80, and target **b** = 0.70.

## 3. Objectives of the Present Study

There are three objectives of this present study. They are mentioned below:

(i) Development of a revised formula which considers variable or spontaneous liability (VL) as an important source of internal financing and which does not need the assumptions that the firm is operating at full capacity and various balance sheet items and net profit margin change proportionally with the change in sales growth rate over time.

(ii) Analysis of the effect of changing D/E ratios on SGRs.

(iii) Determination of the **SGR–D/E Ratio Continuum** (the relationship between SGRs and D/E ratios) and thereby determination of optimal D/E ratio of a company based on its forecasted level of sales growth rate from the SGR–D/E Ratio Continuum.

## 4. A Proposed Dynamic Formula for SGR

Now, we need to develop a formula for SGR without the assumptions that (i) the firm is operating at full capacity and (ii) various balance sheet items and net profit margin change proportionally with the change in sales. We can determine the required fixed asset (FA) and current asset (CA) from time series analyses of the past and present ratios of CA to Sales (CA/S) and of FA to S (FA/S). The same procedure can be used to determine other variables. In this proposed formulation, variable liability has been used as an internal source of financing and the two assumptions made by the first two formulations that (i) the firm is operating at full capacity and (ii) various balance sheet items and net profit margin change proportionally with the change in sales over time are not required to be made. In addition, in this proposed formulation, the effect of changing D/E ratio on SGR can be calculated based on which the optimal D/E ratio of the firm for its forecasted level of sales growth rate can be determined.

Let, VL = Spontaneous liabilities or Variable Liabilities
CA/S = Current Asset/Sales Ratio
FA/S = Fixed Asset/Sales Ratio or capital intensity ratio
VL/S = Variable Liability/Sales Ratio
NI/S = Net Income/Sales Ratio or net profit margin.
The values of all the above ratios are time series forecast values.

We know that the left hand side of a Balance Sheet = Right hand side of a Balance Sheet.

Therefore, we can write:

$$TA_1 = Eo + VL_1 + R_1/E_1 + Do + \Delta D \quad \text{[It is an Accounting Identity]}$$
$$\Rightarrow CA_1 + FA_1 = Eo + VL_1 + R_1/E_1 + Do + (R_1/E_1) \times (Do/Eo) \ldots\ldots\ldots\ldots (1)$$

Let, $Z = \Delta S/So$, $\boldsymbol{R_i}$ is the time series forecast values of CA/S, FA/S (capital intensity ratio), VL/S, and NI/S (net profit margin), and $\mathbf{b} = (\mathbf{1 - d})$ = Retention ratio.

Thus,

$CA_1 = (Z \times CA/S + 1)\, CAo = (ZR_{CA} + 1)\, CAo$
$FA_1 = (Z \times FA/S + 1)\, FAo = (ZR_{FA} + 1)\, FAo$
$VL_1 = (Z \times VL/S + 1)\, VLo = (ZR_{VL} + 1)\, VLo$
$(R/E)_1 = \{Z \times (R/E)/NI + 1\}\, NIo \times b = (ZR_{NI} + 1)\, NIo \times b$
$(R/E)_1 \times (Do/Eo) = (ZR_{NI} + 1)\, NIo \times b \times Do/Eo$

Putting the values in equation (1), we get:

$(ZR_{CA} + 1)\, CAo + (ZR_{FA} + 1)\, FAo = Eo + (ZR_{VL} + 1)\, VLo + (ZR_{NI} + 1)\, NIo \times b + Do + (ZR_{NI} + 1)\, NIo \times b \times Do/Eo$

Or, $(ZR_{CA}\, CAo + CAo) + (ZR_{FA}\, FAo + FAo) = Eo + (ZR_{VL}\, VLo + VLo) + (ZR_{NI}\, NIo \times b + NIo \times b) + Do + (ZR_{NI}\, NIo \times b \times Do/Eo + NIo \times b \times Do/Eo)$

Or, $ZR_{CA}\, CAo + ZR_{FA}\, FAo - ZR_{VL}\, VLo - ZR_{NI}\, NIo \times b - ZR_{NI}\, NIo \times b \times Do/Eo = Eo + VLo + NIo \times b + Do + NIo \times b \times Do/Eo - CAo - FAo$

Or, $ZR_{CA}\, CAo + ZR_{FA}\, FAo - ZR_{VL}\, VLo - ZR_{NI}\, NIo \times b\,(1 + Do/Eo) = Eo + VLo + Do + NIo \times b\,(1 + Do/Eo) - CAo - FAo$

Or, $Z\,[R_{CA}\, CAo + R_{FA}\, FAo - R_{VL}\, VLo - R_{NI}\, NIo \times b\,(1 + Do/Eo)] = Eo + VLo + Do + NIo \times b\,(1 + Do/Eo) - CAo - FAo$

$$\text{Or, } Z = \frac{Eo + VLo + Do + NIo \times b\,(1 + Do/Eo) - CAo - FAo}{R_{CA}\, CAo + R_{FA}\, FAo - R_{VL}\, VLo - R_{NI}\, NIo \times b\,(1 + Do/Eo)}$$

$$\text{Or, } Z = \frac{Eo + VLo + TLo - VLo + NIo \times b\,(1 + Do/Eo) - CAo - FAo}{R_{CA}\, CAo + R_{FA}\, FAo - R_{VL}\, VLo - R_{NI}\, NIo \times b\,(1 + Do/Eo)}$$

Where, TL = Total Liabilities.

$$\text{Or, } Z = \frac{Eo + TLo + NIo \times b\,(1 + Do/Eo) - CAo - FAo}{R_{CA}\, CAo + R_{FA}\, FAo - R_{VL}\, VLo - R_{NI}\, NIo \times b\,(1 + Do/Eo)}$$

$$\text{Or, } Z = \frac{NIo \times b\,(1 + Do/Eo)}{R_{CA}\, CAo + R_{FA}\, FAo - R_{VL}\, VLo - R_{NI}\, NIo \times b\,(1 + Do/Eo)}$$

Or, $SGR = Z \times 100$

Note that Eo + TLo = R.H.S. of the original Balance Sheet, and CAo + FAo = TAo = L.H.S. of the original Balance Sheet.

So, R.H.S. – L.H.S. = − EFNo (External Finance Needed).

It is important to note that if we use forecasted values of ***Ri***, we do not need to make the above mentioned two assumptions that (i) the firm is operating at full capacity and (ii) various balance sheet items and net profit margin change proportionally with the change in sales.

This proposed dynamic formula of SGR shows the impact of changes in D/E ratio on SGR. From the above formula, we can also construct a **SGR–D/E Ratio Continuum**. From this continuum, a company can easily determine its optimal D/E ratio for a given level of forecasted sales growth rate (in a period). The formula shows that, at lower level of D/E ratio, as D/E ratio increases, SGR also increases up to a certain level and then it drops down from maximum level to the minimum level (becomes negative) and will never reach to the positive level.

The D/E ratio at which SGR suddenly becomes negative from its maximum level can be called "financial distress level of D/E ratio or capital structure." In addition, this formulation includes the effect of variable or spontaneous liability which is a very important source of internal financing. The general relationship between SGR and D/E ratio is as follows:

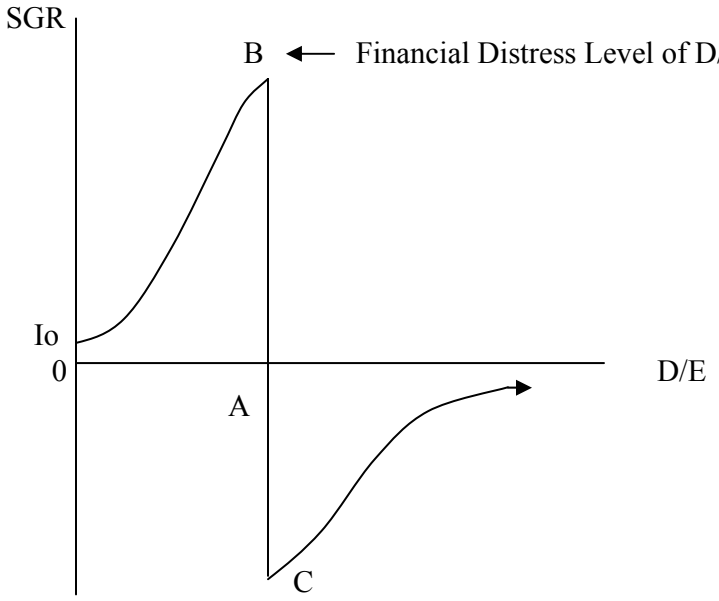


Figure 1: Relationship between SGR and D/E Ratio

We find that the **SGR–D/E Ratio Continuum** is ***IoB***. A firm can easily determine its optimal D/E ratio from this continuum for any level of its forecasted sales growth rate (in a period). However, the firm cannot use D/E ratio more than ***A*** even if its forecasted sales growth rate is higher than ***B*** After ***A,*** if a firm further increases its debt even by $1, it will become bankrupt. So, the firm will choose that level of D/E ratio based on its level of forecasted sales growth rate in a period from the range ***IoB*** shown in above diagram.

On the other hand, it is found that if the SGR of a company is negative at all D/E ratios, then the negative value decreases as D/E ratio increases. In that case, the company immediately needs extra equity capital to survive financially. In this case, the graph will be as shown below:

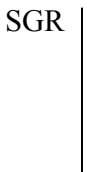


Figure 2: SGR is always negative.

## 5. Empirical Validity Test: A Case Study

For testing empirical validity, we have used data from the Balance Sheets and Income Statements of H.R. Textile Mills Limited. We have used original data of the Company from the year 2000 to year 2004 and used time series (forecasted) values of different required variables for the year 2005 as follows:

| Variables | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 (Forecasted) |
|---|---|---|---|---|---|---|
| **Sales (S)** | 422505829 | 466235482 | 392730882 | 430065154 | 547221130 | |
| **Current Assets(CA)** | 150039231 | 152254052 | 197335868 | 224979591 | 221085687 | |
| **Fixed Assets(FA)** | 242579944 | 294302398 | 289628910 | 284396858 | 322623614 | |
| **Variable Liabilities(VL)** | 124798813 | 156470527 | 217063664 | 229336224 | 228934396 | |
| **Net Income(NI)** | 23199416 | 5989494 | 18883645 | 20196169 | 17380778 | |
| **CA/S ($R_{CA}$)** | 0.3551175 | 0.3265604 | 0.502471 | 0.5231291 | 0.4040153 | 0.41661 |
| **VL/S($R_{VL}$)** | 0.2953777 | 0.3356041 | 0.5527033 | 0.5332593 | 0.4183581 | 0.42952 |
| **FA/S($R_{FA}$)** | 0.5741458 | 0.6312312 | 0.7374742 | 0.6612878 | 0.5895672 | 0.64658 |
| **NI/S($R_{NI}$)** | 0.0549091 | 0.0128465 | 0.0480829 | 0.0469607 | 0.0317619 | 0.03094 |

Table -1: List of Required Data

However, in determining retention ratio, we have used average dividend-payout ratio as shown below:

Dividend Pay-out Ratio

| 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|
| 0.862 | 0.8347 | 0.7945 | 0.5952 | 0.7307 | 0.76342 |

Table-2: Five Years' Dividend Pay-out Ratios

Here, average dividend pay-out ratio, d = 0.76

So, retention ratio of H. R. Textile Mills Limited is, b = 1 – d = 1- 0.76 = 0.24

**The Proposed Dynamic Formula to Find Out the Effect of D/E Ratio on SGR**

$$SGR = \frac{NIo \times b\,(1 + Do/Eo)}{} \times 100$$

$$R_{CA}\,CAo + R_{FA}\,FAo - R_{VL}\,VLo - R_{NI}\,NIo \times b\,(1 + Do/Eo)$$

Here,

Base Year = 2004
Assuming that the Co. is in 21% Tax Bracket
$R_{CA}$ = CAo/So = Forecasted Current Assets to Sales Ratio = 0.41661
$R_{FA}$ = FAo/So = Capital intensity ratio or Forecasted Fixed Assets to Sales Ratio = 0.64658
$R_{VL}$ = VLo/So = Forecasted Variable Liabilities to Sales Ratio = 0.42952
$R_{NI}$ = NIo/So = Profit margin or Forecasted Net Income to Sales Ratio = 0.03094
b = The Retention Ratio = 0.24
NIo = Base Year Net Income after Tax = 13683805
CAo = Base Year Current Assets = 221085687
FAo = Base Year Fixed Assets = 322623614
VLo = Base Year Variable Liabilities = 228934396

Now by putting the values into our Dynamic Formula, we get:

$$SGR = \frac{NIo \times b\,(1 + Do/Eo)}{R_{CA}\,CAo + R_{FA}\,FAo - R_{VL}\,VLo - R_{NI}\,NIo \times b\,(1 + Do/Eo)} \times 100$$

$$\text{Or, } SGR = \frac{13683805 \times 0.24\,(1 + 0)}{(0.41661 \times 221085687) + (0.64658 \times 322623614) - (0.42952 \times 228934396) - \{0.03094 \times 13683805 \times 0.24\,(1 + 0)\}} \times 100$$

$$\text{Or, } SGR = \frac{3284113.2}{202376612.7 - 101610.5} \times 100$$

Now the change in D/E ratio only affects the equation as follows:

$$SGR = \frac{3284113.2\,(1 + D/E)}{202376612.7 - 101610.5\,(1 + D/E)} \text{ x } 100$$

Putting the different values for D/E, we get the following table:

| D/E Ratio | SGR (%) |
|---|---|
| 0 | 1.624 |
| 1 | 3.249 |
| 2 | 4.875 |
| 3 | 6.504 |
| 4 | 8.134 |
| 5 | 9.766 |
| 100 | 172.655 |
| 1000 | 3265.696 |
| 1500 | 9886.738 |
| 1900 | 67748.929 |
| 1950 | 154970.678 |

| | |
|---|---|
| 1975 | 407047.065 |
| 1990 | 9326673.125 |
| 1990.5 | 33884200.5 |
| 1990.68 | 6462959229 |
| 1990.7 | -641177107.3 |
| 1991 | -20765930.85 |
| 2000 | -694664.46 |

Table-3: List of SGRs at Various D/E ratios

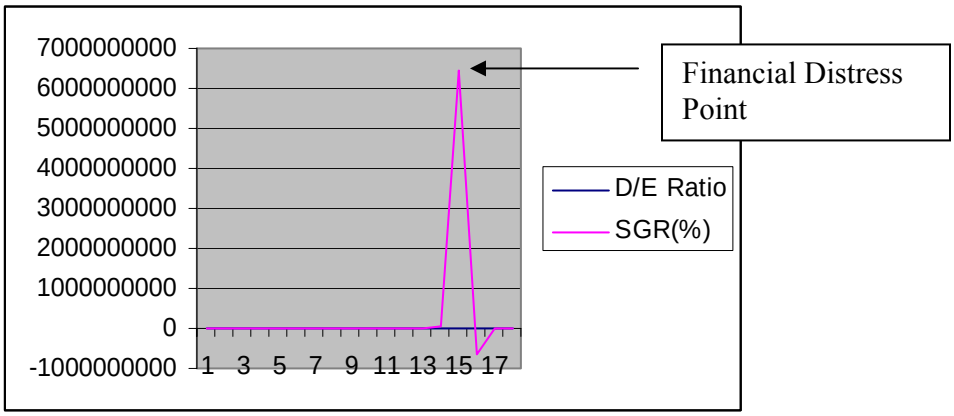


Figure 3: SGRs at different D/E ratios

From the case study, we find that the company can determine its optimum D/E ratio from the above table for any given level of forecasted sales growth rate in a period. If we plot the above table, we find the **SGR–D/E Ratio Continuum** of the company. The table itself can be called the **SGR–D/E Ratio Schedule.**

However, if the company increases its D/E ratio above1990.68 in a period despite high forecasted sales growth rate of even 6462959229% (if this rate is possible in real life), this will cause a serious financial distress and bankruptcy problem for the company and SGR will suddenly fall below zero (at D/E ratio 1990.70, SGR is – 641177107.3%). This negative growth may steadily be recovered but will never become positive (SGR will remain negative).

## 6. Conclusion

Sustainable growth rate **(SGR)** is the maximum sales growth rate, measured from a base sales level, which a company can support without any additional external equity financing while maintaining a target D/E ratio, given the retention ratio, ***b***. In a simple language, SGR is the maximum percentage increase in sales (measured from a base sales level) that can be achieved based on target D/E ratio and dividend-payout ratio. If actual growth exceeds the SGR, something must be given up and frequently it is the D/E ratio. In literature of financial management, SGR is used to determine at what sales growth rate, measured from a base sales level, a company will not need external equity financing to support its production and sales activities while maintaining a predetermined constant D/E ratio and retention ratio. That is, what the maximum annual sales growth rate a company can achieve without any external equity financing while maintaining a constant and predetermined target D/E ratio target operating, debt, and dividend-payout ratios is (whether that target D/E ratio is optimum or

not, given the retention ratio). In Financial Management literature, there is no mention about the effect of D/E ratio on SGR and financial management literature says nothing about the optimality of the target D/E ratio. In reality, however, it is possible to determine the optimal D/E ratio for a company, given the retention ratio, based on the relationship between SGR and D/E ratio. There are two basic formulas to calculate SGR in literature. These formulations exclude variable or spontaneous liability as a source of internal financing. Furthermore, these formulations assume that (i) the firm is operating at full capacity and (ii) various balance sheet items and net profit margin change proportionally with the change in sales; that is, ratios of sales to different variables are constant over time. But in reality, these are not plausible assumptions. The present study proposes a new formula to correctly calculate SGR that includes variable liability as an internal source of financing and that does not require the assumptions that (i) the firm is operating at full capacity and (ii) various balance sheet items and net profit margin change proportionally with the change in sales. The proposed formulation can be used to examine the impact of D/E ratio on SGR. The present study finds that as D/E ratio increases, SGR also increases and at one level of D/E ratio, SGR reaches its maximum. After that level of D/E ratio, SGR becomes negative. From the relationship between various D/E ratios and SGRs the **SGR–D/E Ratio Continuum** of a company can be constructed. From this continuum the optimal D/E ratio for a given level of forecasted sales growth rate in a period can be determined. The above mentioned relationship between SGR and D/E ratio is true if a company is not already in financial distress. Thus, the present study finds that SGR formulation can be used as an alternative tool to determine the optimum D/E ratio or capital structure of a company in a period. The authors of this study argue that variable liability must be included in formulating SGR since variable liability is a very important source of internal financing. Empirical test also supports the findings of this study.

## References


1. Higgins, Robert C. (1997). How Much Growth Can a Firm Afford? *Financial Management,* Vol. 6, Fall, pp. 7-16.

2. Higgins, Robert C. (1984). *Analysis for Financial Management.* Richard D. Irwin, IL. USA. Chapter 5. For detailed analysis of SGR formulation, see James C. Van Horne. (1988). Sustainable Growth Modeling, *Journal of Corporate Finance.* Vol. 1, Winter, pp. 19-25.

3. Ross, Stephen A, Westerfield, Randolph W, and Jordan, Bradford D. (2003). *Fundamentals of Corporate Finance.* 6th Standard Edition. The McGraw-Hill, N.Y. pp. 112-13.

4. Van Horne, James C. (1995). *Financial Management and Policy.* 10th Edition. Prentice-Hall, N.J. pp. 818-24.