Financial Decisions, Winter 2007, Article 3

The Sustainable Growth Rate And The Short-Run

Fernando Arellano and David Higgins
University of Dallas

Abstract

The sustainable growth equation developed by Robert Higgins is an accepted tool for determining how fast sales can grow given a profit margin, a target capital structure, and a dividend payout ratio. The equation inherently presumes long-run behavior of costs and the simultaneous reinvestment of depreciation charges into new fixed assets. Since short-run applications are likely to be the most useful for practitioners, we extend Higgins' equation to allow for cost structure behavior and the impact of depreciation in the short-run, yielding an equation useful for short-run planning.

1. Introduction

Robert Higgins developed the sustainable growth formula in 1977 (Higgins, 1977). The formula is used by lenders to assess borrowers' feasible growth prospects and ability to service debt as well by security analysts to estimate how fast a firm can grow without causing financial relationships to become askew. Evidence of the formula's practical relevance is seen in its common use by analysts and practitioners, but it is often inappropriately used for short-run planning. It has become standard content in many finance textbooks as well, (e.g., Higgins, 2004, pp. 116-132; Lewellen, et al., pp. 663-671; Maness and Zietlow, pp. 42-43; Ross et al., p 52), but some textbook writers state that the equation is applicable in the long-run while demonstrating its use using short-run examples (Lewellen, et. al., pp. 669-670; Maness and Zietlow, p. 43).

The basic equation (Higgins, 1977, p. 8), it should be noted, contains two simplifications that limit its use to long-run situations (Taggart, p. 102, Firer, pp 41-42). First, the formula contains a constant profit margin, implying that all costs are variable. In the short run, however, fixed costs result in larger profit margins when sales increase as long as variable costs are in constant proportion to sales. In the appendix to his article Higgins acknowledges the possibility that the profit margin on incremental sales may be different from the profit margin applicable to the base level of sales at the start of a period, but he does not attribute a reason for the difference or explain how it should be computed.

Second, Higgins' equation does not consider depreciation. In the long-run, depreciation is not a source of operating cash because the accounting charges represent the amount of cash reinvested in fixed assets to maintain the firm's overall level of asset investment. Depreciation in the short-run is a source of operating cash that is available to be invested in current assets and/or used for operating expenses in support of higher sales so long as reinvestment in fixed assets is less than the depreciation charge. Most operating plans are short-run, and inaccuracies will result when depreciation is not considered.

Since Higgins' equation omits depreciation, the implicit assumption is that the depreciation charge for a period is equal to the amount needed in order to keep the level of assets unchanged from one period to the next. Consequently, depreciation cannot be a source of operating cash. Higgins reformulates the equation to incorporate depreciation in the article's appendix, but he does so from a concern that "depreciation need not be sufficient to maintain the value of assets" (Higgins, 1977, p. 15). In other words, he views depreciation in relation to asset values rather than as a source of operating cash.

The purpose of this work, then, is to give economic expression to the effects of fixed costs and depreciation as factors which influence short-run sales growth within the constraints of capital structure and dividend payout policies. This is done by incorporating fixed costs and depreciation into an extended sustainable growth equation suitable for determining the limit to short-run sales growth. The extended equation enhances both user perspective and usefulness when applying it in practical situations as well as making possible the determination of how much short-run growth may occur when profit margin is zero or negative.

2. The Long-Run Sustainable Growth Rate

The relationships incorporated into Higgins' basic equation are the profit margin, the dividend payout ratio, the ratio of assets to sales, and the debt-equity ratio. Once the profit margin is calculated based on the firm's cost structure and the values for the other variables have been established by executive decision, these variables determine how fast sales can increase without disturbing the desired relationships. In equation form, the amount that sales can increase given a particular ratio of total assets-to-sales is expressed as:

$$g^* = \frac{p(1-d)\left(1+\frac{D}{E}\right)}{\frac{A}{S} - p(1-d)\left(1+\frac{D}{E}\right)} \qquad (1)$$

where, g^* = sustainable sales growth rate
A/S = the ratio of total assets to sales at the beginning of the period
p = after-tax profit margin on current sales
d = the target dividend payout ratio
D/E = the target total debt-to-equity ratio

A higher profit margin, a lower dividend payout ratio, a higher debt-to-equity ratio, or a lower assets-to-sales ratio will increase the sustainable sales growth rate. The original Higgins equation is rooted in the balance sheet identity that equates sources and uses of funds. Like Higgins' formula, the extended equation derived below is also based on the balance sheet, but it presumes that a firm has sufficient capacity in the short run to expand output as needed so that depreciation is not a cash outflow for reinvestment in fixed assets. From an income statement perspective, fixed costs cause profit margin to change over time as sales change. Our analysis considers the cash flow implications of these changes.

3. Derivation of the Short-Run Growth Rate Equation

The model defines the short-run as the period of time during which fixed costs are constant and assumes that fixed costs are operating expenses that are unaffected by a change in the level of business activity. The analysis covers two periods, but it is valid for multiple periods so long as fixed costs are constant and there is no additional investment in fixed assets.

Let:
- g = Sales growth rate
- g* = Long-run sustainable sales growth rate
- g** = Maximum short-run sales growth rate
- A = Total assets
- FA = Fixed Assets
- NFA = Net Fixed Assets
- CA = Current Assets
- D = Debt
- E = Equity
- R = Depreciation
- S = Sales
- P = Profit
- DIV = Dividends
- p = Profit margin as a percent of sales
- d = Dividend payout ratio
- r = Depreciation rate for the period applicable to fixed assets
- vc = Variable cost as a percent of sales
- fc = Fixed cost as a percent of sales

Note: All values correspond to the beginning of a period

The fundamental accounting identity asserts that assets are equal to the sum of liabilities and equity. We prefer the term debt to liabilities, so viewing change from one period to the next, the balance sheet identity based on accounting convention is:

$$\Delta D = \Delta A - \Delta E \qquad (2)$$

Assets can be expressed as the sum of current assets plus net fixed assets. The depreciation charge will cause the change in net fixed assets to be negative since it is assumed here that no new investment in fixed assets is made in the short run. The change in net fixed assets is offset by an increase in current assets; that is, cash increases because the depreciation charge is not a cash outflow:

$$\Delta D = \Delta CA - \Delta NFA - \Delta E \qquad (3)$$

If sales growth occurs without additional investment in fixed assets, ΔNFA must equal the change in accounting depreciation, or ΔR, so ΔR may be substituted for ΔNFA:

$$\Delta D = \Delta CA - \Delta R - \Delta E \tag{4}$$

With no additional investment in fixed assets, asset expansion is confined to the increase in current assets needed to support higher sales:

$$\Delta \mathrm{CA} = \left(\frac{\mathrm{CA}}{\mathrm{S}}\right)\Delta \mathrm{S} \tag{5}$$

The sales growth rate and the level of sales at the beginning of a period determine the change in sales, and thus, the added investment in current assets:

$$\Delta \mathrm{CA} = \left(\frac{\mathrm{CA}}{\mathrm{S}}\right) \mathrm{g\ S} \tag{6}$$

Define current assets to be total assets minus fixed assets (A – FA). Equation (6) becomes:

$$\Delta \mathrm{CA} = \left(\frac{\mathrm{A - FA}}{\mathrm{S}}\right) \mathrm{g\ S} \tag{7}$$

Now, we turn our attention to ΔR, which represents the cash generated by the depreciation charge for the period. The amount of cash generated by depreciation is a product of a depreciation rate and the amount of fixed assets, or:

$$\Delta \mathrm{R} = \mathrm{r\ FA} \tag{8}$$

To construct the equation in a form that will be needed later, and to preserve the assumption that in the short-run only current assets change when sales change, incorporate the relationship between sales and current assets in the following manner:

$$\Delta \mathrm{R} = \mathrm{r} \left(\frac{\mathrm{FA}}{\mathrm{S}}\right) S \tag{9}$$

Now, we shift our focus to equity. Accounting profit less dividends determines the change in equity:

$$\Delta E = P - DIV \tag{10}$$

and profit margin and the new level of sales determine profit for an accounting period:

$$\mathrm{P = p\ S\ (1 + g)} \tag{11}$$

Profit and the payout ratio determine dividends:

$$DIV = Pd, \text{ or } pS(1+g)\,d \tag{12}$$

The change in equity may now be expressed as:

$$\Delta E = p(S)(1 + g)(1 - d). \tag{13}$$

Note that profit margin will remain constant from one period to another only if all costs are variable. The presence of fixed costs will cause profit margin to increase as sales increase because total costs will increase at a rate lower than the rate of sales growth. The increasing margin will produce higher profit that, in turn, permits higher asset and sales growth through larger reinvestment.

Since the profit margin changes from period to period because fixed costs are constant, and the focus here is on the short run, we must express profit margin showing the impact of fixed cost. The following equation, derived by Arellano (2007), is based on a starting profit margin, sales growth, and fixed cost as a percent of sales. It captures the relationship of profit margin in two successive periods where p_1 is profit in period 1 and p_2, profit in period 2.

$$p_2 = \frac{p_1 + g\,(p_1 + fc)}{1 + g} \tag{14}$$

Since vc + fc + p = 1, in the long run there are no fixed costs and p_1 will equal p_2, thereby implying a constant profit margin.

In equation (13), profit margin corresponds to profit margin at the new level of sales, which is p_2 in equation (14). Substituting equation (14), the expression for profit margin, into equation (13) produces:

$$\Delta E = (p + g(p + fc))(1 - d)\,S \tag{15}$$

By substituting equations (7), (9), and (15) into equation (4) we obtain:

$$\Delta D = \frac{A - FA}{S}\,g\,S - (p + g(p + fc))(1 - d)\,S - r\left(\frac{FA}{S}\right)S \tag{16}$$

Per equation (16), the change in debt is a function of the ratio of current assets to sales, the ratio of current assets to total assets, profit margin, the ratio of variable cost to sales, the sales growth rate, the beginning level of sales, the dividend payout ratio, and the depreciation rate applied to fixed assets.

If the change in debt and the change in equity during the period are in the same proportion to one another as at the beginning debt-to-equity ratio, the debt-to-equity ratio will not change during the period. Represent this idea as:

$$\frac{\Delta D}{\Delta E} = \frac{D}{E}, \tag{17}$$

and it follows that:

$$\Delta D - \Delta E \frac{D}{E} = 0 \tag{18}$$

Now, subtract $\Delta E\left(\frac{D}{E}\right)$ from both sides of equation (16),

$$\Delta D - \Delta E \frac{D}{E} = \frac{A - FA}{S} g\, S - (p + g(p + fc))(1 - d)\, S - r\left(\frac{FA}{S}\right) S - \Delta E \frac{D}{E} \tag{19}$$

and the equality is preserved. Next, substitute equation (16) into ΔE in the right-hand side of equation (19):

$$\Delta D - \Delta E \frac{D}{E} = \frac{A - FA}{S} g\, S - (p + g(p + fc))(1 - d)\, S - r\left(\frac{FA}{S}\right) S - (p + g(p + fc))(1 - d)\, S \frac{D}{E} \tag{20}$$

Each side of equation (20) must equal zero to be consistent with equation (18) and to comply with the premise that the debt ratio remains constant. This is accomplished by taking the first partial derivative of the right-hand side of equation (20) with respect to sales, which yields:

$$0 = \frac{A - FA}{S} g - (p + g(p = fc))\,(1 - d) - r\left(\frac{FA}{S}\right) - (p + g(p + fc))\,(1 - d) \frac{D}{E} \tag{21}$$

Factoring produces:

$$0 = \frac{A - FA}{S} g - (p + g(p + fc))\,(1 - d)\left(1 + \frac{D}{E}\right) - r\left(\frac{FA}{S}\right) \tag{22}$$

Solving for g, the sales growth rate, results in:

$$g^{**} = \frac{p\,(1 - d)\left(1 + \frac{D}{E}\right) + r\left(\frac{FA}{S}\right)}{\frac{A - FA}{S} - (p + fc)\,(1 - d)\left(1 + \frac{D}{E}\right)} . \tag{23}$$

Equation (23) extends Higgins' analysis by adding variables that increase the sustainable growth rate in the short run when fixed costs remain constant and there is no reinvestment in fixed assets. It incorporates the impacts of depreciation, fixed costs, and the ratio of fixed assets to sales.

Sales growth can also occur if profit is zero. When accounting profit is zero there is no addition to equity, but the period's depreciation charge can be used to increase current assets in support of higher sales. If the numerator in equation (23) remains positive, growth can occur even if profit is negative ($p < 0$). This finding is in contrast to Higgins long-run formulation in which growth resolves to zero when the profit margin is zero.

It is also true that the formulation g* = ROE(1 − d) that is shown in some textbooks (Higgins, 2004, p. 118; Lewellen, 2000, p. 664) is not valid in the short-run. This expression can be derived from the basic Higgins equation and has intuitive appeal, but it implies that profit is the only source of internally generated cash. We have shown that sales growth can be greater than that suggested by this expression when the impacts of fixed cost and depreciation are included.

Equation (23) does have a limitation. In practical situations it is difficult to foresee when fixed costs will increase, but projecting a growing profit margin over successive periods is valid only as long as fixed costs do not change. Fixed costs become variable costs over the long term, but this is not relevant for most short-term applications.

To more clearly show the relationship between equation (23) and Higgins' original equation, equation (23) can be rewritten as:

$$g^{**} = \frac{\mathrm{p}\,(1-\mathrm{d})\left(1+\dfrac{\mathrm{D}}{\mathrm{E}}\right)+\mathrm{r}\left(\dfrac{\mathrm{FA}}{\mathrm{A}}\right)\left(\dfrac{A}{S}\right)}{\left(\dfrac{A}{S}\right)-\left(\dfrac{FA}{A}\right)\left(\dfrac{A}{S}\right)-(\mathrm{p}+\mathrm{fc})\,(1-\mathrm{d})\left(1+\dfrac{\mathrm{D}}{\mathrm{E}}\right)} \qquad (24)$$

If the amount of the depreciation charge is invested in fixed assets in every period to keep the value of fixed assets unchanged, the second term in the numerator and the denominator disappears. In addition, if there are no fixed costs, Higgins' original sustainable growth rate equation results:

$$g^{*} = \frac{p\,(1-d)\left(1+\dfrac{D}{E}\right)}{\dfrac{A}{S}-p\,(1-d)\left(1+\dfrac{D}{E}\right)} \qquad (1)$$

4. Practical Implications

When compared to the long run sustainable growth equation, the extended equation provides insight into situations that have relevance for short-term planning when its imbedded assumptions are met. As examples: a firm with limited or no access to external funding may be able to grow faster than its management expects. A highly levered firm that is unable to sell additional equity may think its ability to grow is more limited than it actually is. When profit has declined, it may be possible to sustain a dividend policy until profits recover. A company may be able to increase its dividend payout ratio temporarily in an effort to make its stock more attractive to investors.

In summary, operations may be able to provide more liquidity than management expects even when revenue and profit have declined. The short run growth rate can be higher than that suggested by the long-run sustainable growth rate equation when profits, the depreciation charge, and the mix of fixed and variable operating costs make that possible.

Finally, since firms with large investments in fixed assets tend to have high depreciation charges, such firms have the potential to grow more rapidly than firms with smaller fixed asset investments. The potential to grow faster also applies to firms that do not have large investments in fixed assets, but nonetheless have high fixed costs. The higher growth potential of these two types of firms can be viewed as compensation for bearing a higher degree of operating risk.

5. Conclusion

The extended formula is operationally useful, easily understood, and may be applied simply and directly by business financial planners since it relies on measures customarily generated by finance and cost accounting departments. The formula encourages more precise thinking about the effects of depreciation and cost behavior in the short-run, and how much sustainable sales growth is actually possible in the short-run without disrupting capital structure or dividend policy.

When the short run and long run sustainable growth rate equations are compared, fixed costs and depreciation make it possible for sustainable short-run sales growth to exceed sustainable long run sales growth. Accordingly, external financing needed to support growth in the short run can be less than the amount indicated by the long-run model.

The extended equation is easily modeled using a spreadsheet. The larger number of variables in the short run equation increases the number of outcomes that result from their interplay. A spreadsheet application enables business practitioners to understand the important relationships and how they impact the growth rate. This enhances the value of equation (22) as a planning device and as a tool for understanding financial relationships. A financial spreadsheet model using the extended equation is available by e-mail request at farellan@gsm.udallas.edu.

References

Arellano, F. (2004), "Forecasting Profits in the Short Run: Using a More Reliable Profit Margin Ratio" (April 12, 2007). Working paper available at SSRN: http://ssrn.com/abstract=980181

Firer, C. (1999), 'Driving Financial Performance Through the Du Pont Identity: A Strategic Use of Financial Analysis and Planning', *Financial Practice and Education,* 9, (Spring/Summer), pp. 34-45.

Higgins, R. C. (2004), *Analysis for Financial Management,* 7th ed. (New York: McGraw-Hill).

Higgins, R. C. (1977), 'How Much Growth Can a Firm Afford?', *Financial Management,* 6, (Fall), pp. 7-16.

Lewellen, W. G., J. A. Halloran, and H. P. Lanser (2000), *Financial Management: An Introduction to Principles and Practice* (Cincinnati: South-Western).

Maness, T. S. and J. T. Zietlow (2005), *Short-Term Financial Management (*3rd ed., Cincinnati: South-Western).

Ross, S. A., R. W. Westerfield, and J. F. Jaffe (2005), *Corporate Finance,* 7th ed. (New York: McGraw Hill).

Taggart, R. A. (1999), 'Spreadsheet Exercises for Linking Financial Statements, Valuation, and Capital Budgeting', *Financial Practice and Education,* 9, (Spring/Summer), pp. 102-10.