Introduction to Finance

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Chapter 3 *Corporate Risk*

"If you don't take risks, you'll have a wasted soul." – Drew Barrymore (actress)

"In school we learn that mistakes are bad, and we are punished for making them. Yet, if you look at the way humans are designed to learn, we learn by making mistakes. We learn to walk by falling down. If we never fell down, we would never walk." — Robert T. Kiyosaki, (Author, Rich Dad, Poor Dad).

"Education is learning from the accumulated mistakes of the entire history of human-kind, which is more prudent, less traumatic, and more productive than learning solely from one's own mistakes." ─ Professor Blazenko.

In Chapter Three We Learn:

1. **What are corporate risk measures?**
2. **What types of risk can we measure with firms' financial statements that impact investors in trading financial assets in financial markets?**
3. **What is "leverage?" Are there different types of leverage? Yes, there are!**
4. **How does financial leverage impact shareholders?**
5. **Does the risk impact of financial leverage on shareholders mean that corporations should not finance business investments with debt? No, it does not! Why!**
6. **Does financial leverage impact business risk? No, it does not!**
7. **Can we measure operating leverage? Yes, we can!**
8. **Can we estimate contribution margin per dollar sales and demand price-elasticity for the composite of a firm's products/services? Yes, we can!**
9. **Can we use the EBITDA margin as an inverse operating-risk measure? Yes, we can!**

Chapter Three Contents

(3.1) INTRODUCTION

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In chapter one, we identify four questions a financial analyst investigates for any investment: expenditure, return, risk, and "is this a good investment." In chapter two, we study how to measure business returns and the *cost of capital* as an opportunity cost rate of return. In this chapter, we study two types of business risks: *operating* and *financial leverage*. Investors assess and price risk in financial markets. The analysis of the current chapter identifies the characteristics of companies that make investors assess them with greater or lesser risk. Other things equal, firms with greater operating leverage have higher costs of capital. And, firms with high operating leverage and/or high financial leverage have high opportunity cost rates of return for shareholders specifically: the so-called *market capitalization rate* (see chapter 8).

(3.2) EBITDA and Operating Leverage

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Corporate Financial Measures of Risk: 14 Minutes

In chapter two, we defined EBITDA as Sales less Cost of Sales less General, and Administrative Expenses (before depreciation and amortization The financial statement decomposition of expenses into Cost of Sales and General and Administrative Expenses is a convenient way to measure operating efficiency. In addition, there are other useful ways to decompose expenses.

A second decomposition is to separate fixed expenses from variable expenses. Variable expenses *vary* with the level of a firm's sales and fixed expenses do not. The usual financial statement

decomposition of expenses into Cost of Sales versus General and Administrative Expenses is not the same as the decomposition of expenses into variable expenses versus fixed expenses because some commercial (general) expenses vary with the level of sales. One example is advertising: higher sales should be associated with higher advertising expenditure.

Using the variable and fixed decomposition of expenses, we can represent EBITDA as[1]:

$$EBITDA = SALES - VC - FC$$

where VC is total variable cost and FC is fixed cost per period. The measurement interval for EBITDA and SALES can be daily, weekly, monthly, yearly or any other period. In practice, for convenience, we generally measure EBITDA over the fiscal reporting period of a firm like, for example, a quarter or a year.

Total contribution is SALES less total variable cost, VC. If we divide total contribution by SALES, we get contribution margin per dollar of sales,

$$\mathrm{CM}/\$ = \frac{(SALES - VC)}{SALES}$$

Contribution margin per dollar sales, $[CM/\$]$, is the increment to EBITDA that arises from an additional dollar of sales (before fixed costs). We presume $[CM/\$]$ is a constant in the short-term. In particular, $[CM/\$]$ does not vary with a firm's sales activity. Initially this presumption might be hard to accept because both the numerator and the denominator in the above formula depend upon SALES. However, we justify this presumption in a numerical example shortly.

We can write EBITDA with $[CM/\$]$,

[1] For a multi-product firm, contribution margin times sales must be summed over all of the products and services sold by the firm.

$$EBITDA = [CM/\$] * SALES - FC$$

A similar expression for EBITDA but with CM/unit and unit sales is

$$EBITDA = [CM/unit] * UnitSales - FC$$

CM/unit is the contribution to EBITDA of an extra unit sale.

In Chapter 2, we defined EBITDA margin as EBITDA[2] divided by dollar sales. Using the fixed/variable decomposition of expenses, we can represent the EBITDA margin as:

$$EBITDA\ Margin = \frac{[CM/\$] * SALES - FC}{SALES}$$

EBITDA margin is the increment to EBITDA of an extra $SALES *after* fixed costs.

Consder the following example:

Assumed Facts for ABC Company

Unit price	$2.50
Unit variable cost	$2.00
Fixed Costs	$40,000 per month
Units sold	250,000 units per month

For ABC Company,

SALES=$2.5*250,000=$625,000/month

VC=$2.0*250,000=$500,000/month

[2]As a general rule, in applying this representation for actual firms, you should use EBITDA before other income like, for example, investment income.

$$CM/_{unit} = \$2.50 - \$2.00 = \$0.50$$

$$\text{CM}/_{\$} = \frac{(625,000 - 500,000)}{625,000}$$

$$= \frac{(2.5 - 2.0)}{2.5} = 0.2$$

The incremental impact of one unit sale on the firm's EBITDA is \$0.50. The incremental impact of one dollar of sales on EBITDA is \$0.20.

The above calculation illustrates why we can presume CM/\$ is a constant in the short-term. We can calculate CM/\$ as total contribution (SALES-VC) divided by SALES. We can also calculate CM/\$ as unit contribution (unit product price less unit variable cost) divided by unit product price (that is, $\frac{2.5-2.0}{2.5}$). Unit product price is the price we require of our customers. Unit variable cost is the price that our suppliers require of us. So, we can calculate CM/\$ with prices only. In business, prices are "sticky." That is, they generally do not change dramatically in the short-term. If prices are sticky, then CM/\$ is also sticky so that we can presume it constant in the short-term.

We now calculate EBITDA in a number of ways,

$$\text{EBITDA} = (\$2.50 - 2.00) \times 250{,}000 - \$40{,}000$$

$$=(625{,}000\text{-}500{,}000)\text{-}40{,}000$$

$$=0.2*625{,}000\text{-}40{,}000$$

$$=\$85{,}000$$

We also calculate the EBITDA margin,

$$\text{EBITDA Margin} = \frac{85,000}{625,000} = 0.136$$

Notice that the contribution margin (20%) is greater than the EBITDA margin (13.6%), because CM/$ is before fixed costs whereas EBITDA margin is after fixed costs.

3.2.1 The Degree of Operating Leverage

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DOL: 12 Minutes

Operating risk of a firm is the sensitivity of EBITDA to changes in sales. More explicitly, the *degree of operating leverage* (DOL) is the percentage change in EBITDA with respect to a percentage change in sales. This definition focuses on sales variability as the primary and exclusive source of EBITDA variability.

$$DOL = \frac{\%\ change\ in\ EBITDA}{\%\ change\ in\ Sales}$$

Suppose the sales of a firm fall by 1%. If EBITDA falls by 2%, the firm has a degree of operating leverage of 2. Alternatively, a DOL equal to 3 indicates greater operating risk because EBITDA is more sensitive to a percentage change in sales. Downside risk is greater for an equal percentage fall in SALES.

With the VC and FC decomposition of expenses for EBITDA, we can express DOL as:

$$DOL = \frac{(CM/\$)\times(Sales)}{(CM/\$)\times(Sales) - FC}$$

Or, equivalently, dividing top and bottom of this expression by dollar Sales,

$$DOL = \frac{CM/\$}{EBITDA\ MARGIN}$$

This expression indicates that DOL is the ratio of two margins: contribution margin per dollar of sales, and the EBITDA margin. Because CM/$ is before fixed costs and EBITDA Margin is after fixed costs, CM/$ exceeds or equals the EBITDA margin, and therefore, if EBITDA is positive (and it generally is), DOL exceeds one,

$$DOL = \frac{CM/\$}{EBITDA\ MARGIN} \geq 1$$

Also, equivalently, in terms of unit sales rather than dollar sales,

$$DOL = \frac{(CM/unit)\times(units\ sold)}{(CM/unit)\times(units\ sold)\ -\ FC}$$

All of the above expressions for DOL presume perfect competition in the firm's product (or service) market[3].

For ABC company, DOL = 0.2×625,000 / (0.20×625,000 - 40,000) = 1.47. The interpretation of this number is that a one-percent fall in sales (dollar sales or unit sales) leads to a 1.47- percent fall in EBITDA.

If EBITDA is zero, DOL is infinitely large. If EBITDA is negative, DOL is meaningless and should not be used for financial analysis. However, most businesses have positive EBITDA.

[3] If the product market is not perfectly competitive, the percentage change in EBITDA with respect to a percentage change in revenue (DOL) depends on the price elasticity of demand for the firm's product. In this environment, DOL = $(1+\frac{c}{p}\cdot\frac{e}{(1-e)})\Big/(EBITDA\ MARGIN)$, where c is variable cost, p is price and e is the elasticity of demand. Elasticity of demand is defined as e = -(dQ/dp)·p/Q. In the case of perfect competition, elasticity approaches infinity, and this expression for DOL approaches those that are given in the body of the text.

Negative net income is much more common (approximately 20% of publicly traded companies) compared to negative EBITDA (less than 2% of companies).[4]

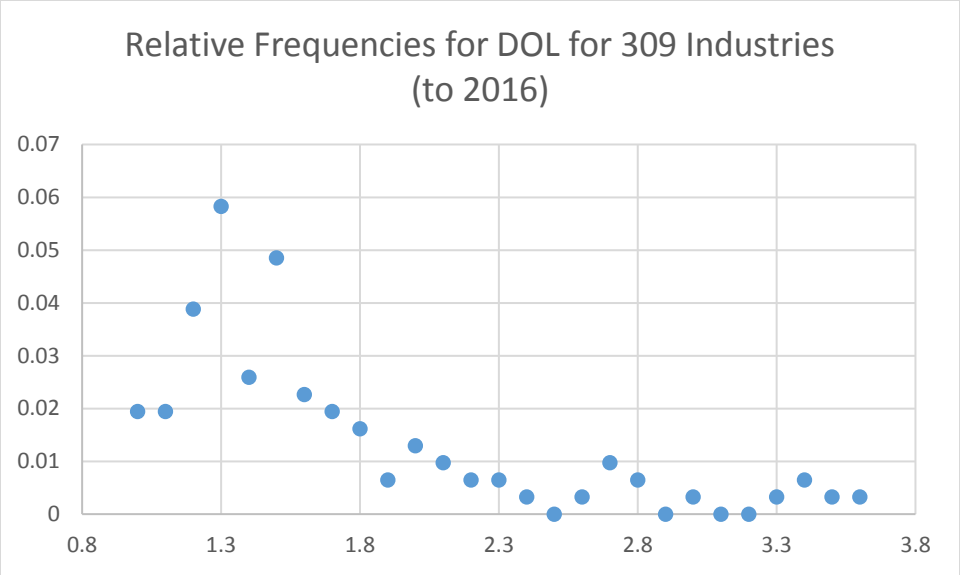
DOL Example: 12 Minutes

The spreadsheet below reports estimated DOL for 309 industries (with positive average EBITDA margin) in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016).

DOL for 309 US and Canadian Industries (ending 2016)

The below chart plots relative frequencies for DOL for 309 industries in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016). DOL centers at about 1.3 but the average 2.16 is higher because there are some industries with exceptionally high DOL.

[4] See Fu and Blazenko (2015) for some statistics on the relative portion of publicly traded firms that are in financial distress, which they define as firms with negative trailing twelve month (TTM) earnings.



3.2.2 Operating Efficiency and Risk

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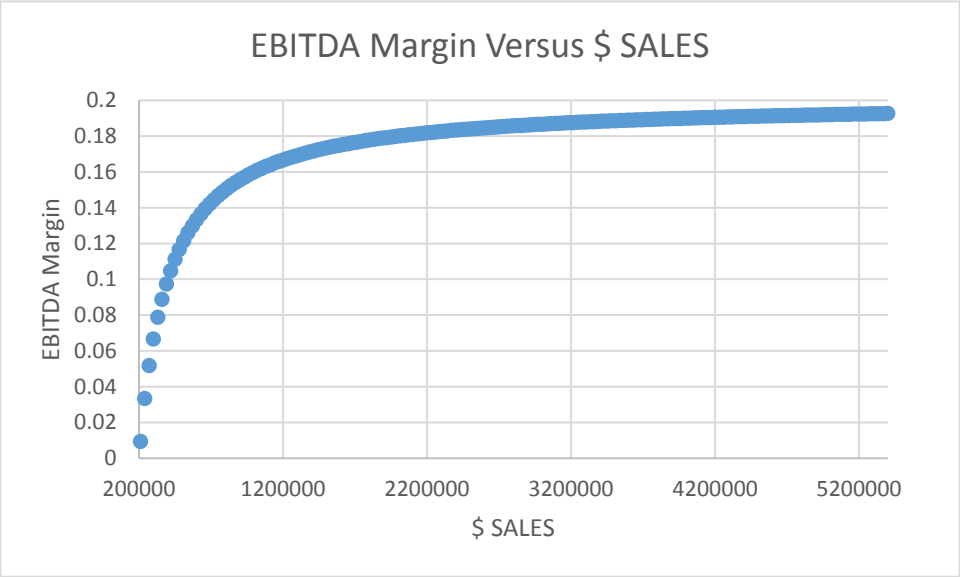
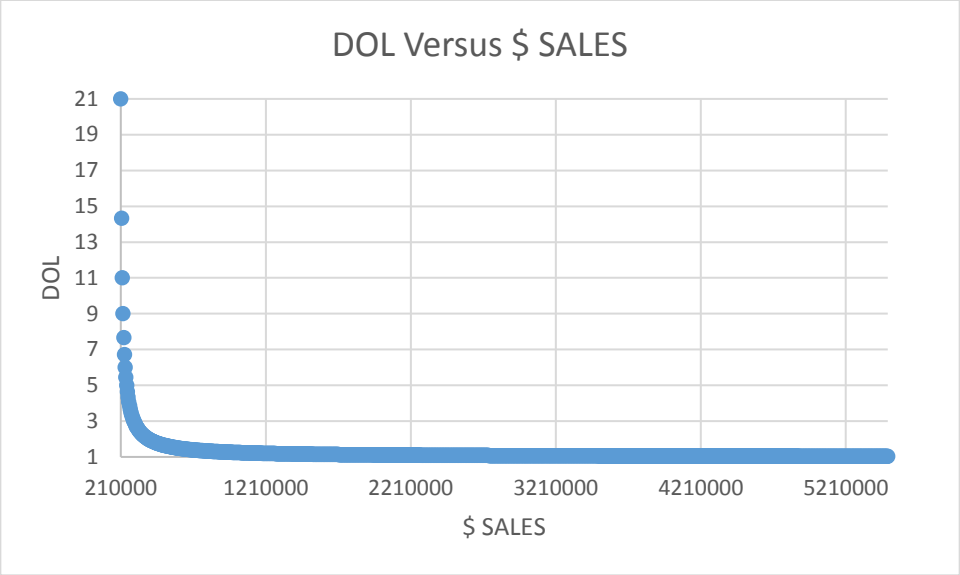
If you are a Math student, you can proof that operating efficiency measured by the EBITDA margin increases with $SALES. Business students are not terribly interested in proofs. So, we can verify that the EBITDA margin increases with $SALES with a numerical example. End-of-Chapter problem #20 illustrates two important characteristics of the EBITDA margin. First, unlike CM/$ the EBITDA margin is not constant in either the long-term or the short-term because it depends upon $SALES. Second, the relation between the EBITDA margin and $SALES is positive. When $SALES increases the EBITDA margin increases.

The below Figure plots the EBITDA margin for ABC Company versus $SALES (other things equal). When $SALES approach break-even so that EBITDA equals zero, the EBITDA margin also approaches zero. When $SALES become very large, the EBITDA Margin approaches CM/$

which is 20%. Notice that this diagram also illustrates that the EBITDA margin increases with $SALES.



$SALES determines both the EBITDA margin and DOL. The below Figure plots DOL for ABC Company versus $SALES. When $SALES approach EBITDA break-even, DOL goes to infinity. When $SALES become very large, DOL approaches unity because when sales are large the EBITDA Margin approaches CM/$ and DOL is CM/$ divided by the EBITDA margin.



Notice in the above two diagrams and risk as measured by DOL and profitability as measured by the EBITDA margin are inversely related. From Chapter 2, we know that operating efficiency is measured by EBITDA margin. EBITDA margin is, therefore, both a direct measure of operating efficiency and an inverse measure of operating risk.

DOL Versus Sales: 7 Minutes

As a comparison example, suppose that product price for the firm described above is $3.00 rather than $2.50 but that unit sales remain 250,000. The cost structure of the firm remains unchanged. At this price, is EBITDA more sensitive or less sensitive to revenue changes? Let us refer to this new firm as DEF Company. The level of dollar sales for DEF company is $3.00 × 250,000 = $750,000. Because dollar sales have increased you might expect that DOL will decrease. Contribution margin per sales dollar is ($3.00 – $2.00)/$3.00 = 33.3% and the new EBITDA margin is ($3.00 × 250,000 – $2.00 × 250,000 – $40,000) ÷ ($3.00 × 250,000) = 28.0%. In this

new environment, DOL = 0.333 ÷ 0.280 = 1.19. Consistent with our expectation, operating leverage for DEF Ltd. is lesser than operating leverage for ABC Ltd.

The EBITDA margins for ABC and DEF companies are 13.6% and 28%, respectively. The DOL's for ABC and DEF are 1.47 and 1.19, respectively. Notice that the firm with the greatest EBITDA margin has the lowest DOL and vice versa.

3.2.3 EBITDA Margin as an Inverse Risk Measure

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EBITDA Margin As An Inverse Risk Measure: 21 Minutes

There are a number of reasons that DOL is difficult to use in practice. Therefore, it is generally preferable to use the EBITDA margin as an inverse measure of operating leverage than DOL. This use of the EBITDA margin presumes that contribution margin and fixed costs are held constant, which is not always the case.

First, DOL requires an estimation of variable cost. This estimate requires a decomposition of *all* expenses into fixed costs and variable costs. For many expenses this classification is difficult or at least arbitrary. Even worse, some types of expenses may be partly fixed costs and partly variable costs. For these expenses, the relevant portions must be determined. Second, DOL is unstable at sales levels close to break-even. At break-even sales, DOL is infinitely large; at negative EBITDA, DOL is meaningless. These problems do not arise if an analyst uses EBITDA margin as an inverse measure of operating risk.

The EBITDA margin requires no decomposition of expenses into fixed costs and variable costs. Any representation of expenses can be used as long as this representation is before interest, tax, depreciation and amortization. For example, we know from Chapter 2 that we can calculate EBITDA with the financial accounting calculation, which is Sales less Costs of Sales less General and Administrative Expenses (before depreciation and amortization). In addition, because this decomposition is commonly available in an income statement, the EBITDA margin is easy to calculate. Further, the EBITDA margin does not become unstable around break-even sales. Its calculation and interpretation at negative EBITDA remains unchanged.

The chapter 2 appendix shows average EBITDA margins for industries in the US and Canadian economy, sorted in descending order. You can use this ranking as an *inverse* measure of operating risk. For the industry quartile averages, as EBITDA-margin decreases from the first quartile to the last quartile, estimated DOL increases.

3.2.4 Break Even Sales and Operating Risk

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Firms often use *break-even* sales as a "minimum standard" benchmark for their operating performance. Break-even sales, either in units or in dollars, make EBITDA equal zero. This means that break-even *unit* sales for a period equals fixed cost divided by contribution margin per unit. Break-even *dollar* sales for a period is fixed cost divided by contribution margin per dollar.

Contribution margin and fixed costs are important components of DOL, EBITDA margin and break-even sales. Because both DOL and break-even sales increase with fixed costs and decrease with contribution margin, break-even sales can be used not only as a benchmark for operating performance but also as a measure of operating risk. If a particular firm is able to reduce its fixed costs, both break-even sales and DOL decrease.

The following table summarizes a number of operating efficiency and operating risk measures for ABC and DEF companies described above. Contribution margin and EBITDA margin, which are operating efficiency measures, are inversely related to operating leverage measured by DOL. Break-even sales, which is an inverse measure of operating efficiency, is a direct measure of operating leverage. In particular, if actual $SALES are close to break-even $SALES, then the business is likely in some financial distress.

Performance Measures for ABC Ltd. and DEF Ltd.					
	CM/$	EBITDA margin	DOL	Break-even (units)	Break-even (dollars)
ABC Ltd.	20%	13.6%	1.47	80,000	$200,000
DEF Ltd.	33.3%	27.4%	1.22	40,000	$120,000

Exhibit 3.1: Operating Efficiency and Operating Risk

(3.3) Estimating [CM/$] [5]

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Estimating CM/$: 13 Minutes

In the previous subsection, we presumed that unit sales variation is the only source of risk faced by firms. The degree of operating leverage, which arises out of this representation of EBITDA variability, is therefore a measure of sales-based risk. While Sales might be the most significant determinant of EBITDA variability, randomness in expenses also contributes to EBITDA variability. In this subsection we examine the extent to which dollar sales does, in fact, explain EBITDA variation.

Consider the following regression representation of EBITDA for a firm:

$$EBITDA = [CM/\$] * \$SALES - FC + \tilde{\epsilon}$$

where,

$CM/\$$	*contribution margin per dollar of sales,*
$\tilde{Sales}$	*random* dollar sales per period
FC	total per-period fixed costs,
$\tilde{\varepsilon}$	*random* variation in EBITDA not explained by variation in dollar sales

[5] An understanding of the details of this section requires elementary statistics and regression analysis. Readers without this background may skim this section for the fundamental ideas.

In this EBITDA regression representation, there are two sources of randomness: $SALES and expenses. The perturbation term, $\tilde{\varepsilon}$, represents randomness in expenses unrelated to revenues. The perturbation $\tilde{\varepsilon}$ represents random variation in variable cost per unit or in fixed cost per period.[6]

Readers who are familiar with statistical analysis will recognize the above representation of EBITDA variation as a simple *linear regression*. In this regression, EBITDA is the dependent variable and Sales is the independent (or explanatory) variable. If we track EBITDA and dollar sales for a number of quarters or years, we can use the techniques of regression analysis to estimate the parameters of our EBITDA regression. In particular, the estimate of the slope coefficient in the regression (EBITDA on dollar sales) is an estimate of contribution margin per dollar sales. Recall that contribution margin per dollar sales is the amount going to the "bottom line" from one dollar of incremental sales (before fixed costs). In addition, the intercept estimates the negative of fixed costs, -FC.

In sub-section 3.3.2 below, with the above regression representation of EBTIDA we estimate CM/$, FC, and DOL for Canadian Pacific Railway.

The spreadsheet below estimates contribution margin per dollar sales for 309 industries in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016). Because contribution margin is before fixed costs, whereas EBITDA margin is after fixed costs, it is typically the case that contribution margin is greater than EBITDA margin. The difference between estimated contribution margin per dollar sales and EBITDA margin is an indication of fixed cost per dollar of sales. Of course, because contribution margin is estimated and is not equal to *actual* contribution margin (which is unobservable), it is possible for average estimated

[6]Recall that the definition of fixed costs is that they do not vary with dollar sales. Random variation unrelated to dollar sales is consistent with this definition.

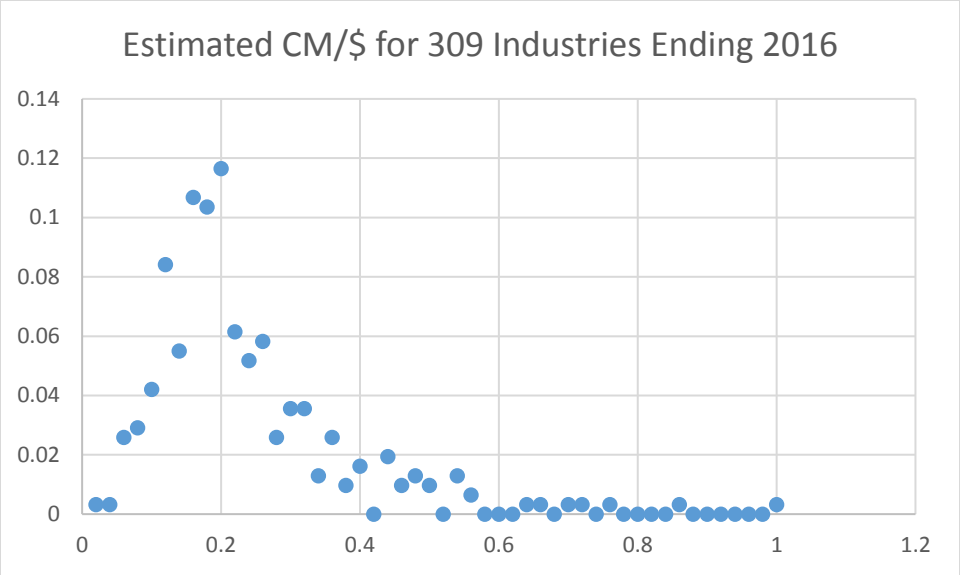
contribution margin by industry to be *less* than EBITDA margin. This anomaly appears for a few industries in the spreadsheet.[7]

Contribution per Dollar Sales Estimates for 309 US and Canadian Industries

The average CM/$ (contribution per dollar sales) for a US and Canadian industry ending in 2016 is about 22.3%. Notice that the average CM/$ for industry exceeds the average EBITDA margin for an industry (12.7%). This means that the average DOL for a US and Canadian industry is DOL = (CM/$)/(EBITDA margin) = 0.223/0.127 = 1.75.

The below chart plots relative frequencies of estimated CM/$ by industry. The relative frequencies center at about 20% (the median) but the average estimated CM/$ is greater (22.3%) because there are some industries with exceptionally great CM/$ (almost up to 100%).

[7] The above representation of EBITDA variability, when treated as a regression equation, presumes a *linear* relation between EBITDA and dollar sales. In fact, the relationship can be non-linear. In particular, if the relation is concave from below (i.e., contribution is not constant but decreases as dollar sales of a firm increases), the estimate of contribution margin from the simple linear regression can in fact be lesser than average EBITDA. This situation gives the appearance that fixed costs are negative! You can address this problem with more complicated regression methods than I am willing to discuss in this chapter.



Even for financial analysts working inside a firm, it is difficult to separate fixed portions of expenses from variable portions of expenses. This difficulty impedes the calculation of variable expense that is required to determine contribution margin. The coefficient on Sales in the EBITDA regression is a convenient, easy, and objective way to calculate CM/$. This regression does not require a subjective allocation of expenses into variable and fixed.

3.3.1 EBTDA Risk and Revenues

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In the regression of EBITDA on dollar sales, another measure of interest is the *coefficient of determination*, which we often refer to as R^2. R^2 measures the fraction of dependent variable variation that the independent variable explains. R^2 takes on values between zero and one and measures the fraction of EBITDA variability that $SALES explains. In the below spreadsheet, we report R^2 by industry under the column title R^2. Firms that have high (low) R^2 values exhibit high (low) revenue-related variation in EBITDA. Low revenue-related variation in EBITDA implies relatively great expense-related variability in EBITDA.

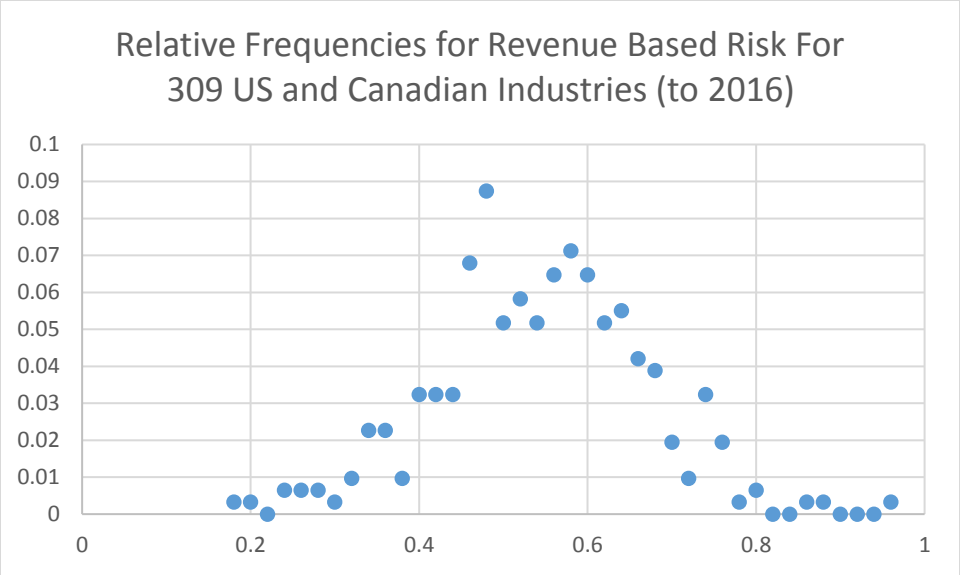
For a particular firm, a high R^2 indicates that EBITDA variability arises mostly from variation in revenues. Firms that depend heavily on marketing tend to have high R^2 values. Also, firms that use standard, well-proved technology rather than innovative technology also tend to have higher R^2 values, an example is the *Investment Advice* industry, SIC code 6282. On the other hand, firms that use more innovative technology, and that are more production oriented, tend to have lower revenue-based EBITDA variability. *Electronic Computers,* SIC code 3571, is an example of one such industry.

Characterizing and recognizing the relative sources of EBITDA variability is important to any firm's strategic planning. The source of EBITDA variability identifies both potential operating problems and strategic opportunities. While it is important for all firms to control costs, a firm with relatively high revenue-based risk is likely to improve its operating performance to the greatest extent by focusing its strategic planning effort on its marketing function. On the other hand, a firm with relatively low revenue-based EBITDA variability is likely to find that cost control is key to maintaining and enhancing operating performance.

The spreadsheet below reports revenue based risk for 309 industries in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016).

Revenue Based Risk 309 US and Canadian Industries (ending 2016)

The below chart plots revenue based risk for 309 industries in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016). Revenue based risk centers at about 60% for most industries. This indicates that the preponderance of risk for most industries is from sales rather than expenses. Some industries have revenue based risk as low as about 20%, whereas, other have revenue based risk close to 100%.



3.3.2 Canadian Pacific Railway

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In this subsection, we estimate contribution margin per dollar sales, [CM/$], fixed operating costs, FC, and DOL for Canadian Pacific Railway (CPR). There are at least two reasons that a financial analyst might want to estimate these corporate characteristics. First, because DOL is the ratio of [CM/$] to the EBITDA margin, if we estimate [CM/$], we can estimate DOL to assess the operating risk of a business. Second, because $EBITDA = [CM/\$] * SALES - FC$, if we estimate [CM/$] and FC, then we can forecast future *EBITDA* with a sales forecast. A forecast of EBITDA is the first step in forecasting free cash flow, which is a fundamental component of asset valuation for businesses. Financial analysts use this methodology for a number of purposes, including making investment recommendations. We develop free cash flow valuation more fully in chapter 10 of this book.

We begin by retrieving quarterly EBITDA and SALES data for CPR from the COMPUSTAT database (a commercial product of Standard and Poor's Corporation). The spreadsheet below

reports 51 quarters of EBITDA and SALES data from 1'st quarter 2001 to 1'st quarter 2015. Numbers are in millions of dollars. You can view this data in the embedded spreadsheet below. In addition, the video on the right illustrates how you can use RESEARCH INSIGHT the graphical user interface for the COMPUTSTAT database to access quarterly EBITDA and quarterly SALES. I did this for CPR but you can do this for any publicly traded US or Canadian company that you might be interested in.

Canadian Pacific Railway	**EBITDA and SALES from the COMPUSTAT database**

We divide EBITDA by SALES, quarter by quarter, to find the quarterly EBITDA margin. Averaged over 51 quarters, CPR's EBITDA margin is 33.3%. The average EBITDA margin for a typical industry in the US and Canadian economy is about 12%, so CPR is more profitable per dollar of sales than a typical industry (we made this observation in chapter 2).

The following table summarizes the regression estimation, which we take from the above spreadsheet. At each cell location, you can see the function that produces the result below.

CM/$	FC/Q	R^2	Average EBITDA Margin	DOL
0.415	79.2	0.826	0.333	1.25

There are a number of estimates of interest from this regression analysis.

First, the coefficient on the SALES variables estimates [CM/$], which is 0.415. This number tells us that for every extra dollar sales, CPR increases EBITDA by $0.415. The quarterly average EBITDA margin is 0.333. Notice that CM/$ exceeds the EBITDA margin.

Since, DOL= $\frac{[CM/\$]}{EBITDA\ M\arg in}$, and we have determined that the EBITDA margin is 33.3%, an estimate of CPR's DOL is 0.415/0.333 = 1.25 A typical industry in the US and Canadian economy has a DOL of about 2, and therefore, CPR has below average operating leverage compared to a typical industry.

Third, R^2 in the regression of EBITDA on SALES is 82.6%. This value is much greater than a typical industry in the US and Canadian economy (about 55.6% in chapter 2 industry ratios), which means that more of CPR's operating risk arises from revenues than is the case for a typical US and Canadian industry. This observation is consistent with our presumption in DOL that the primary source of business risk in a firm's operations is SALES variability.

Finally, in the above table we estimate CPR's fixed operating costs per quarter to be 79.2 million dollars per quarter.

(3.4) Customer Price Sensitivity and Break-Even $SALES

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Price-elasticity of demand is one of the most important and enduring measures in the study of economics and business. The absolute value of demand price-elasticity is customer price-sensitivity. Economists use the term "Demand Price-Elasticity," whereas, business professionals use the term "Customer Price-Sensitivity" more often. Customer price sensitivity is the percentage decrease in quantity demanded from a one percent increase in price that a business charges it customers. This is an important measure because it determines product pricing strategies for profit-maximizing businesses. Companies that sell products with high price sensitivity cannot set high

prices (relative to unit variable cost) because otherwise their unit-sale loss is so great as to have a pronounced adverse impact on revenue. This adverse impact is greater compared to a business that sell products with lesser price sensitively.

The marketing literature argues that business should invest in "brand loyalty" to reduce customer price sensitivity so that they can follow premium product pricing strategies. The quote below from Moisescu and Allen (2010) illustrates this business view,

> "Traditionally, among the advantages of a high degree of brand loyalty, the branding literature includes the ability to apply premium pricing policies…."

Many years ago, Lerner (1932) showed that for a profit maximizing business, price sensitivity of their customers is the inverse of contribution margin per dollar sales,

$$\text{Customer Price Sensitivity} = \frac{\mathbf{1}}{CM/\$}$$

So, if we rearrange the regression from section (3.3) above, we can estimate customer price sensitivity as the simple regression of SALES on EBITDA. In addition, the intercept estimates break-even $SALES measured as the ratio of FC to [CM/$],

$$SALES = \left(\frac{1}{CM/\$}\right) * EBITDA + \frac{FC}{CM/\$} + \tilde{v}$$

Data for this regression is in the below spreadsheet, which is more or less the same as the data spreadsheet from section 3.3.2 but we switch the "Y" and "X" variates. Now, we regress $SALES on EBITDA.

Canadian Pacific Railway

From the above spreadsheet, the table below gives the result of regressing $SALES on EBITDA.

$\frac{1}{CM/\$}$	$\frac{FC}{CM/\$}$
1.99	340.4

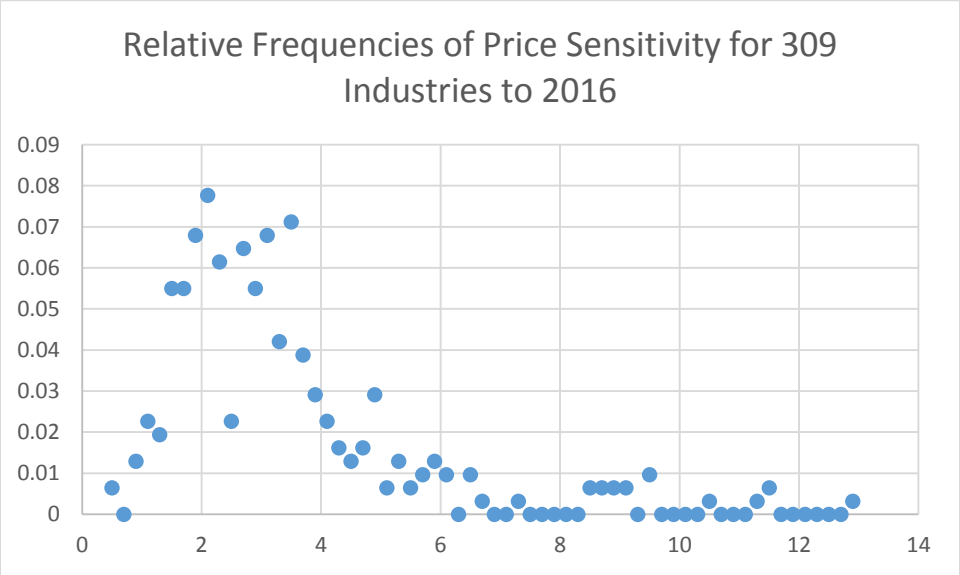
The estimate of customer price sensitivity for CPR is 1.99. Thus, for CPR, a one percent increase in their prices (freight rates) decreases the demand for their transportation services by 1.99%.

We estimate CPR's break-even $SALES at about $340.4 million per quarter. Since the spreadsheet indicates that average quarterly $SALES is well over a billion dollars for CPR, they are far from financial distress that break-even $SALES would engender. This observation is consistent with CPR having modest operating leverage.

For comparison purposes, the below spreadsheet reports price sensitivity for 309 industries in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016). Price sensitivity is important in financial analysis because it tells us about the relative competitiveness of an industry (or firm). A firm or industry with high price sensitivity faces great competition. A small increase in their product or service price leads to a very great fall in their sales as customers switch to competitors.

Price Sensitivity for 309 US and Canadian Industries (ending 2016)

The below chart plots price sensitivity for 309 industries in the US and Canadian economy (with data from COMPUSTAT by quarter from 2000 and ending 2016).



The median industry price sensitivity is about 2.81 and the average is about 3.27. The average is higher than the median because there are some industries with exceptionally high price sensitivity. These industries face exceptional competition. A small increase in their product or service prices leads to a great fall in their $SALES as customers leave and go to competitors.

Because CPR has price sensitivity that equals 1.99, which is below both the median and the mean over industries in the US and Canadian economy, it appears that they face less competition than does a typical company. In this case, they can pursue a premium product pricing strategy with

relative impunity. The reason that CPR faces less competition than does a typical firm or industry in the US and Canadian economy is because of barriers to competitors entering their industry because of high depreciable asset expenditures required (like, rail ties, box cars, locomotives).

The tables below give the 6 industries in Canada and the United States with the highest and the 6 industries with the lowest average price sensitivity. Industries with the highest average price sensitivity and, thus, the greatest competition, are in the wholesale and retail industries. Industries with the lowest average price sensitivity and, thus, the least competition, are either in primary extraction industries (petroleum, natural gas, and metal ores) or they are financial.

Industries with Highest Average Price Sensitivity

(Most Competitive Industries)

SIC	Industry Name	Average Price Sensitivity	# Firms
5172	Wholesale Petroleum	14.554	19
5122	Wholesale Drugs, Proprietaries, Druggists' Sundries	12.776	15
5500	Retail Auto-Dealers and Gas stations	11.386	25
5190	Wholesale – Miscellaneous Nondurable goods	11.328	7
5150	Wholesale Farm Products and Raw Materials	11.24	6
5399	Miscellaneous Retail and General Merchandise stores	10.335	5

Industries with Lowest Average Price Sensitivity

(Least Competitive Industries)

SIC	Industry Name	Average Price Sensitivity	# Firms
1311	Crude Petroleum & Natural Gas	0.893	341
6111	Federal & Federally Sponsored Credit Agencies	0.775	6
6795	Mineral Royalty Traders	0.725	5
1040	Gold & Silver Ores	0.704	93
1090	Miscellaneous Metal Ores	0.496	9
6351	Surety Insurance	0.392	18

(3.5) Financial Leverage

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Beyond operating leverage above, corporate debt use is a second determinant of the risk shareholders face. A firm's combination of financing sources is called its *financial structure* (or its *capital structure*) and the choice as to how much debt to use is called the financial structure problem. In the current section, we illustrate that debt-financing imposes additional risk on shareholders beyond that which exists from a firm's business investments in the first instance. There are advantages and disadvantages to shareholders of corporate debt financing. The two primary advantages to shareholders of corporate debt financing, higher average ROEs and *tax shields*, which arise from the tax deductibility of interest payments. The disadvantage of corporate debt financing for shareholders is greater risk.

Financial Leverage Example: 31 Minutes

Consider ABC Company, which has the following invested capital balance sheet:

Invested Capital for ABC Ltd.	
Invested Capital = $3 million	Debt = $1 million Equity = $2 million

Equity on the invested capital balance sheet represents all of the accounting "equity" accounts (share capital plus retained earnings). ABC's tax rate is 40% and ABC pays interest on debt at a rate of 10% per annum. Suppose that ROIC before tax takes one of three values: 8%, 12% or 16% per annum. Assume these outcomes to be equally likely, so that expected ROIC is equal to the intermediate value, 12%. The following table calculates and reports shareholder ROE at each possible operating scenario.

ROE Variability for ABC Ltd.	
After-Tax ROIC	**ROE**
(1 – 0.40) × 8% = 4.8%	$= \frac{0.6*(0.08*3-0.1*1)}{2} = 4.2\ \%$
(1 – 0.40) × 12% = 7.2%	$= \frac{0.6*(0.12*3-0.1*1)}{2} = 7.8\ \%$
(1 – 0.40) × 16 = 9.6%	$= \frac{0.6*(0.16*3-0.1*1)}{2} = 11.4\ \%$

In the first row of the above table operating profitability of ABC is below average. How do we know this? The obvious answer is that the before tax ROIC of 8% is below ABC's 12% average ROIC before tax. However, beyond that obvious answer we know from chapter 2 that ROE and ROIC (after tax and after depreciation) are relative benchmarks for one another. When one is high they are both high and then ROE exceeds ROIC. When one is low they are both low and then ROE is below ROIC. End of chapter problem #19 establishes exactly what we mean by "high" and "low." The solution to that question shows that "if" ROIC equals ROE, then the both equal the after tax interest rate on debt. So, if one is above the after tax interest rate on debt, then they both are and ROE>ROIC. On the other hand, if one is below the after tax interest rate on debt, then they both are and ROE<ROIC.

In the example we are studying, the after tax interest rate on debt is 0.6*0.1=6% per annum. In the first row of the table above, since the after tax ROIC is 4.8% and because this is less than 6%, this is a below average year for operating profitability. Further because ROIC after tax is less than the after tax interest rate on debt (6%) we also expect ROE to be less than 6% and, further, we expect that ROE < ROIC. The first row of the above table confirms these expectations (ROE=4.2% < ROIC after tax = 4.8%). In this first row for ROE, 0.08*3 is ROIC before tax (EBITDA/IC) times

IC which produces EBITDA (no depreciation in this problem). The term 0.1*1 is the $ interest payment on one million dollars of borrowing. The "2" in the denominator is book-equity from the above invested capital balance sheet.

When the operating performance of ABC is below average (ROIC after-tax = 4.8%, which is less than 6%), ABC shareholders do even worse. ROE is not only less than 6% but in addition ROE = 4.2% < ROIC after tax = 4.8%. This shortfall highlights the downside risk of debt use. When a firms operating results are poor, shareholders do worse that the firm as a whole (the firm's performance for shareholders is ROE and the firm's performance over-all is ROIC after tax and after depreciation). Debt financing *accentuates* the adverse effect of below-average operating performance of the business for shareholders. The "lows" are lower for shareholders compared to the entire business.

On the other hand, if ABC's operating performance is above average, it earns a 9.6% after-tax ROIC. Since 9.6% exceeds 6% (the after tax interest rate on debt) the third row of results in the above table is an above average year for ABC in their profitability. Further because 9.6% > 6% we expect ROE to exceed 6% and, further, we expect ROE to exceed 9.6%. In this case, ABC shareholders do even better that the firm as a whole, ROE > ROIC after-tax and after depreciation (that is, 11.4% > 9.6%). This result highlights the upside potential of corporate debt use for shareholders. Debt use accentuates above-average corporate operating performance for shareholders. The "highs" are higher for shareholders compared to the entire business.

The middle row of results in the above table represents an average year for ABC in their operating profitability. Even an average year for ABC is a relatively good year. How do we know this? Because ROIC after tax and after deprecation is 7.2%, which exceeds 6%. Further because 7.2% > 6% we expect ROE to exceed 6% and, further, we expect ROE to exceed 7.2%. In this case, ABC shareholders do better that the firm as a whole, ROE = 7.8 > ROIC = 7.2% (after-tax and after depreciation). This comparison of business returns illustrates the average benefit of corporate debt financing for shareholders. As long as a business can invest at a before tax business return

(ROIC) that exceeds the interest rate on its debt, then average ROE will exceed average ROIC. In our example, ROIC before tax = 12%, which exceeds the interest rate on debt. In this case, the average ROE = 7.8% exceeds the average ROIC after tax = 7.2%. Shareholders accrue the average benefit of corporate debt use. Of course, there are also risk "costs" to shareholders, which we should also consider.

For shareholders, debt financing by the firm accentuates both the benefits of favorable operating performance and the adverse consequences of unfavorable operating performance. One way to measure the risk faced by the shareholders of ABC is with the range of ROE variability, 11.4% – 4.4% = 7.2%

3.5.1 ROE Variability and Debt Financing

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Financial Leverage Again: 22 Minutes

Consider a hypothetical reorganization of the financial structure of ABC. Suppose that ABC borrows another 1 million dollars with an annual interest rate of 10%. With the proceeds of this sale, ABC buys back 1 million dollars of its common shares from shareholders. We presume the change in the financial structure of ABC is presumed to take place with no impact on ABC's operating activities. In order words, ABC's contribution margin, fixed cost, dollar sales, etc., are all unaffected by financial structure. Let us refer to this new firm as DEF Ltd. DEF is identical to ABC on its operating side, but DEF financed its operations with more debt than ABC. The following table summarizes the invested-capital financing by DEF Ltd.

Invested Capital for DEF Ltd.	
Invested Capital = 3 million	Debt = 2 million Equity = 1 million

The following table calculates and reports after-tax ROIC and return on equity for shareholders of DEF Ltd. at each of three possible outcomes for after-tax ROIC:

ROE Variability for DEF Ltd. **(DEF uses more debt financing than ABC)**	
After-Tax ROIC	**ROE**
(1 – 0.40) × 8% = 4.8%	$= \frac{0.6*(0.08*3-0.1*2)}{1} = 2.4\ \%$
(1 – 0.40) × 12% = 7.2%	$= \frac{0.6*(0.12*3-0.1*2)}{1} = 9.6\ \%$
(1 – 0.40) × 16 = 9.6%	$= \frac{0.6*(0.16*3-0.1*2)}{1} = 16.8\ \%$

In the first row of the above table and the ROE calculation 0.1*2 is the interest payment on debt, which is higher than for ABC Company because DEF Company has borrowed more than has ABC company. In addition, the "1" in the denominator is book equity, which is lesser for DEF company compared to ABC Company.

Notice that the left column of after-tax ROIC calculations for DEF is identical to ABC Company. The interpretation of this observation is that the operating risk of a business does not change as it finances its business investment with more or less debt. However, debt financing accentuates risk for shareholders. Debt financing does not create nor alter business risk. It does however accentuate risk that shareholders bear (which is why it is called financial *leverage*).

In a below average profitability year, with an after-tax ROIC of 4.8%, ROE for DEF shareholders is less than ROE for ABC shareholders (i.e., 2.4% < 4.2%). Greater debt use accentuates the effects of poor operating performance for shareholders. On the other hand, greater debt use also accentuates good operating performance. At a 9.6% after-tax ROIC, ROE for DEF shareholders is greater than ROE for ABC shareholders (i.e., 16.8% > 11.4%).

We can measure the additional risk that shareholders of DEF bear compared to shareholders of ABC with the range of ROE. For DEF Ltd., the range of ROE is 14.4% (16.8% - 2.4%). This range is greater than 7.2%, the ROE range for ABC Ltd (11.4% - 7.2%). This example illustrates that debt use by a firm increases risk which shareholders bear.

The fact that debt imposes incremental risk on shareholders does not imply that firms should avoid debt. Debt use also confers advantages on shareholders. One of these advantages is that, as long as the average pre-tax ROIC exceeds the cost of debt, shareholders earn a higher average rate of return as a consequence of debt financing. For example, average ROE's for shareholders of ABC and DEF are 7.8% and 9.6% respectively. The shareholders of DEF bear additional risk but they also earn a higher average rate of return on their investment.

Second, there are tax advantages of debt use. ABC's average yearly tax bill is $(0.40)\times[(0.12)\times\$3m - (0.10)\times\$1m] = \$104{,}000$. On the other hand, DEF's tax bill is $(0.40)\times[(0.12)\times\$3m - (0.10)\times\$2m] = \$64{,}000$. DEF has a lesser tax bill because debt increases the tax deductions a profitable firm may claim.

In sum, the use of debt financing increases risk, but it can also increase expected return. Depending on the economic environment, each firm may find net gains in value by either substituting debt financing for equity, or by substituting equity financing for debt. It is possible that, in some economic environments, the risk disadvantage of debt use is exactly offset by the return advantage of debt use.

(3.6) Summary

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There are two fundamental determinants of the investment risk faced by shareholders of a firm. The first we refer to as operating leverage. Operating leverage measures the percentage change in EBITDA for each one-percent change in Sales. All else equal, shareholders face greater risk if they invest in firms with higher operating leverage. Important determinants of a firm's operating leverage are contribution margin per sales dollar, fixed costs, and $SALES. Greater contribution margin decreases operating leverage. Greater fixed costs increase operating leverage. Greater $SALES decrease operating leverage.

Firms have only modest influence over their operating leverage. Cost reductions and revenue increases reduce operating leverage, but oftentimes, these factors are determined by the economic environment and not at managers' discretion.

Firms have more discretion in the choice of financial leverage. Debt financing increases the risk of shareholders' returns. Nonetheless, if a firm can invest in real assets to earn an average before-tax ROIC that exceeds the interest rate on debt, greater debt use increases *average* ROE. Greater expected ROE is an advantage of using additional debt.

(3.7) Suggested Reading

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George W. Blazenko, Freda Eddy-Sumeke, and Yufen Fu. "Business Profit and Consumer Price Sensitivity." *Journal of Business and Economic Management*, Vol 2, No. 6, (2014), 84-96.

George W. Blazenko, "Corporate Leverage and the Distribution of Equity Returns," *Journal of Business Finance and Accounting* Vol. 23, (1996), 1097-1120.

Yufen Fu and George W. Blazenko. "Returns for Dividend Paying and Non-Dividend Paying Firms." *International Journal of Business and Finance Research*, Vol. 9, No. 2, (2015), 1-15 (lead article).

Lerner AP (1934). The concept of monopoly and the measurement of monopoly power. *Rev. Econ. Stud.* 1(3):157-175.

Moisescu OI, Allen B (2010). The relationship between dimensions of brand loyalty: an empirical investigation among Romanian urban consumers. *Manage. & Marketing Challenges for the Know. Soc.* 5(4):83-98.

(3.8) Problems

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1. ***DOL, Break-even Sales, and EBITDA Margin.*** For the fiscal year 2000, ABC had a degree of operating leverage of 1.5 and a net operating margin of 20%. For 2000 break-even dollar sales was $1,200,000. What was ABC's EBITDA? What were ABC's dollar sales for 2000?

Solution

2. ***DOL, ROIC, ROE.*** ABC Company has a contribution-margin per dollar sales of 20%. Fixed costs are $30,000 per annum. ABC has invested capital of $3,000,000. Trade capital and net fixed assets represent 60% and 40% of invested capital respectively. Invested capital has been financed with $1,200,000 in short-term debt and $1,800,000 in equity. The interest rate on short-term debt is 10% per annum. ABC's tax rate is 23%. Depreciation, which is also equal to capital cost allowance, is 5% of beginning-of-period net fixed assets.
   a) What is the degree of operating leverage at break-even sales?
   b) Does the degree of operating leverage increase or decrease with dollar sales? Explain.
   c) Find the level of dollar sales for the upcoming year such that ROIC after tax and after depreciation is equal to ROE. Use beginning of period invested capital and equity for ROIC and ROE respectively.

Solution

3. ***DOL and Break-even Sales.*** If break even sales increases (in either dollars or units), operating leverage has also increased. Discuss and comment on this assertion.

Solution

4. ***Corporate Debt Use.*** Comment on the following assertion. "Firms should not use debt to finance their business activity because it imposes additional risk on shareholders."

Solution

5. ***DOL, EBITDA-margin.*** ABC Company has a contribution margin per dollar sales of 32% and an EBITDA margin of 20%. What is ABC's degree of operating leverage?

Solution

6. ***DOL, ROIC, and ROE.*** ABC Company has a tax rate of 40%. Their invested capital is $3,000,000. This investment is financed with short-term debt and with equity. Their debt to equity ratio is 2.0. "Equity" represents all of the accounting equity accounts. The interest rate on ABC's short-term debt is 6% per annum. ABC has a contribution margin per dollar sales of 32%. In the upcoming year, ABC's dollar sales are predicted to be $2,400,000. Also in the upcoming year, depreciation on ABC's fixed assets will be $200,000. Based on these predictions, ABC expects that in the upcoming year, their rate of return on invested capital (after tax and after depreciation) will be equal to their rate of return on equity. Both the rate of return on invested capital and the rate of return on equity are calculated as "beginning of period" with respect to the prediction year.
   Required: Based on the given information, find ABC's degree of operating leverage for the upcoming year (based on predicted sales).

Solution

7. ***DOL, ROIC, and ROE.*** ABC Company has a tax rate of 40%. Invested capital is $3,000,000. This investment is financed with short-term debt and with equity. Currently, ABC is financed with $1,500,000 of short-term debt and with $1,500,000 of equity. Equity is the sum of retained earnings and share-capital. ABC's trade-capital to invested capital ratio is 55%. The interest rate on ABC's short-term debt is 7% per annum. In the upcoming year, at predicted sales of $2,760,000, ABC's rate of return on invested-capital (after tax and after depreciation) is equal to its rate of return on equity. Both the rate of return on invested capital and the rate of return on equity are calculated as "beginning of period" with respect to the prediction year. Fixed operating costs in the upcoming year are expected to be $207,000. Also, in the upcoming year, depreciation on ABC's net fixed assets (which is the same as CCA) will be 10% of the opening balance. No capital expenditures or asset sales are expected in the prediction year. Also, none of ABC's short-term debt will be paid down over the upcoming year.
   Required: Find ABC's predicted degree of operating leverage for the upcoming year.

Solution

8. ***Financial Leverage***
   Comment on the following assertion: "Because of financial leverage, the rate of return on equity (ROE) for a firm in a particular year is always greater than its rate of return on invested capital (ROIC, after tax and after depreciation)." Use no numerical examples in your response.

Solution

9. DOL.

At dollar sales of $4,000,000, ABC Company Limited has an EBITDA-margin of 20%. Their break-even dollar sales for a year are $2,000,000. Break-even sales are defined as dollars sales for which EBITDA (from core operations) is zero.

Required: What is ABC's Degree of Operating Leverage at sales of $3,000,000?

Solution

10. DOL.

ABC Company has a contribution-margin per dollar sales of 25%. Fixed operating costs (before tax, depreciation, and interest) are $300,000. ABC has invested capital of $4,000,000. Trade capital and net fixed assets are 34% and 66% of invested capital respectively. Invested capital has been financed with $1,200,000 in short-term debt and $2,800,000 in equity. The interest rate on short-term debt is 10% per annum. ABC's tax rate is 40%. Depreciation, which is also equal to capital cost allowance, is 5% of beginning-of-period net fixed assets. Other things equal, ABC's predicted rate of return on invested capital after tax and after depreciation for the upcoming year (using beginning of period invested capital) is 24%.

Required: What is ABC's degree of operating leverage at predicted dollar sales?

Solution

11. DOL.

Comment on the following assertion. "A principal determinant of the Degree of Operating Leverage (DOL) is corporate debt use." Use no numerical examples in your response. A complete response is required for full marks.

Solution

12. DOL

ABC Company Ltd. has a contribution margin per dollar of sales of 25%. Their degree of operating leverage (DOL) is 1.25 when dollar sales are $2,000,000 per annum.
Required: Find ABC's break-even annual dollar sales (break-even in terms of EBITDA).

Solution

13. **ROIC and Corporate Debt Use**.

Comment on the following assertion. "A primary determinant of a firm's rate of return on invested capital (after tax and after depreciation) is corporate debt use." Use no numerical examples in your response. A complete response is required for full marks.

Solution

14. DOL

ABC Company Ltd. has fixed operating costs of $200,000 per annum. Their degree of operating leverage (DOL) is 1.25 when dollar sales are $2,000,000 per annum.
Required: Find ABC's annual dollar sales that break-even in terms of EBITDA.

Solution

15. DOL.

Comment on the following assertion. "Because a firm's EBITDA margin is before fixed operating costs, whereas, contribution margin per dollar sales is after fixed operating costs, EBITDA margin exceeds contribution margin per dollar sales, and therefore, the degree of operating leverage (DOL), which is contribution margin per dollar sales divided by EBITDA margin, must be lesser than or equal one." State whether you agree or disagree with the assertion and if so, why, and if not, why not. Discuss the aspects of the assertion that you agree with and those that you do not agree with. Use no numerical examples in your response. A complete response is required for full marks.

Solution

16. DOL

ABC Limited has a degree of operating leverage (DOL) of 1.25 when dollar sales are $2,000,000 per annum.

Required: Find ABC's annual dollar sales that break-even in terms of EBITDA. Recall that break-even dollar sales are fixed operating costs divided by contribution margin per dollar sales. You need not determine these amounts separately, but only their ratio.

Solution

17. Financial Leverage.

Comment on the following assertion. "When a firm does well on its business investments, that is, EBITDA is high, the rate of return on invested capital (ROIC) is correspondingly high and exceeds the rate of return on equity (ROE). On the other hand, when a firm does poorly on its business investments, ROIC is low and is below ROE." State whether or not you agree with the assertion and then explain why. Use no numerical examples in your response. A complete response is required for full marks.

Solution

18. DOL and ROIC.

If ABC Company's per annum sales equal $4,000,000, then their EBITDA margin is 20% and their degree of operating leverage (DOL) is 1.5. On the other hand, if ABC's ROIC (rate of return on invested capital after tax and after depreciation with end of period invested capital) equals their ROE (rate of return on equity with end of period book equity) then, dollar sales equal $3,000,000 per annum. ABC pays interest on their debt at the rate of 8% per annum. ABC's corporate tax rate is 40%. ABC's depreciation expense is $300,000 per annum.

Required: Find the dollar amount of ABC's end of period invested capital.

Solution

19. A Benchmark for ROIC and ROE

ABC Company has debt and common equity in its financial structure. The interest rate on ABC Company's debt is 10% per annum. The corporate tax rate is 40%. In 2006, ABC's ROIC (after tax and after depreciation) equals ROE. For 2006 what was ABC's ROIC?

Solution

20. **EBITDA Increases with $SALES**

ABC Company Ltd. has a contribution margin per dollar sales of 20% and fixed annual operating costs of $1,000,000. If ABC's EBITDA margin is 15%, what are dollar sales? Given the same assumed facts, but the EBITDA margin is 18%, what are dollar sales (other things equal).

Solution

(3.9) Chapter Index

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