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RISK-INTEGRATED FINANCIAL ANALYSIS OF A FIRM'S STRATEGIC FIXED-COST SPENDING

ABSTRACT

A firm's fixed-cost spending, as opposed to its variable-cost spending, creates its operating risk, i.e., its exposure to an operating loss. This paper explores the quantitative dimensions of the operating risk and profitability of a firm's fixed-cost spending. My findings are: (1) a firm's ratio of total fixed cost [TFC] to its total contribution margin [TCM] represents the firm's degree of operating loss exposure [DOLE] to uncertain economic swings, which is a direct measure of operating risk; and (2) the computed profit-to-risk gap [if zero or positive] can indicate the financial sustainability of the firm's strategic fixed-cost spending initiatives. The DOLE and the profit return on TFC, [P/TFC] of financially sustainable firms are in their equilibrium at 61.8%. Fixed-cost spending decisions may use this equilibrium rate as the minimum required profitability on the relevant fixed costs and the maximum allowed risk. This paper demonstrates valuable applications of this risk-integrated framework in a sustainability analysis of two firms in the pharmaceutical industry.

Keywords: profit return on fixed-cost investment [P/TFC], operating risk, the degree of operating loss exposure [DOLE], profit-to-risk gap, profit and risk equilibrium, financial sustainability

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INTRODUCTION

A firm's strategic initiatives often involve upfront spending of substantial fixed costs, such as outlays for R&D and design, acquisition of tangible and intangible assets, long-term leases, and similar financial commitments. Given uncertainties over its sales outlook, the firm is exposed to an operating loss and assumes operating risk due to fixed-cost spending. On the other hand, the firm's spending on variable costs can be made flexibly and in proportion to the firm's actual sales volume. Therefore, operating risk is created only by the firm's fixed-cost spending.

The firm assumes operating risk to maximize its operating profit. When the firm wants to remain financially sustainable, it needs to neutralize its operating risk with the profit return from its fixed-cost spending. To effectively manage its operating risk, the firm may consider measuring and monitoring both the operating risk and the profit return from fixed-cost spending. McNally and Tophoff (2016) describe the role of management accounting and financial professionals today, stating, "Risk management: it's what we do!" To help equip business students with a practical operating-risk management framework, management accounting textbooks must integrate operating risk within their cost-volume-profit analysis and related decision and evaluation models. The primary research questions of this paper are:

(1) Within the cost-volume-profit analysis model, what is a direct measure of the operating risk created by a firm's fixed-cost spending?

(2) What is the measure of profit return on the same fixed-cost spending?

(3) Can the risk and profit return be integrated together into a single framework that may yield a "profit-to-risk" gap as a net financial impact of a firm's fixed-cost spending?

(4) Can the "profit-to-risk" gap be used to assess a firm's financial sustainability and perform related financial analysis?

RELATED STUDIES: OPERATING RISK COVERAGE IN MANAGERIAL ACCOUNTING TEXTBOOKS

The cost-volume-profit [CVP] analysis chapters of U.S. managerial accounting textbooks universally set forth their primary learning objective: the ability to use CVP analysis in "profit" planning. However, many texts also introduce two terms that may indicate "risk." They are the safety margin ratio [SMR] and operating leverage [OL] number. For the present study, I reviewed fifteen U.S. managerial accounting textbooks to determine: (A)

the nature of margin of safety and OL; and (B) their potential applications in risk analysis (Kang, 2016, updating Kang's 2013 survey). My findings from this review are as follows.

Except for Hartgraves and Morse (2012), fourteen (14) of the 15 titles [or 93.3%] quantify the margin of safety [MOS] in units and dollars as they present their break-even charts. Of the 15 titles, nine (60% of the sample) also offer a safety margin ratio [SMR]. Six of the 15 titles (40%) do not include the SMR. They are Hartgraves and Morse (2012); Horngren (2014); Davis and Davis (2014); Hilton and Platt (2014); Maher et al. (2012); and Wild and Shaw (2014).

The MOS is "the difference between sales and sales at the break-even point," and "it measures the "cushion" that a particular level of sales provides. It tells . . . how far sales could fall before the company begins operating at a loss" (Weygandt et al. 2015: 201). An SMR is "the ratio of the MOS dollars to sales" (Weygandt et al. 2015: 201). Weygandt et al. (2015: 236) elaborate on the practical uses of SMR in risk evaluation as follows:

1. "Management continuously evaluates the adequacy of the margin of safety in terms of such factors as the vulnerability of the product to competitive pressures and downturns in the economy," and
2. "We [external financial analysts] can also evaluate the relative impact that changes in sales would have on . . . two companies by computing the SMR," and "the difference in their SMRs also reflects the difference in risk between the two companies." (237, emphasis added) Here "risk" is defined by this book as the "risks and rewards [that are] related to increasing or decreasing sales." (236, emphasis added)

This "risk" may be the operating risk that this paper intends to quantify. The SMR appears to be a symptom of the underlying risk and only reflects operating risk. The causal determinants of SMR do not exist in these books.

All 15 titles (100% of the sample) present operating leverage [OL]. Unlike the SMR, OL is absent within the break-even graph but appears under a separate subheading, often titled "cost structure." OL is a measure of the volatility of profit changes . . . to sales volume changes, with their uniform formula for OL stated as: "total contribution margin / operating profit." Weygandt et al. (2015: 235) emphasize "the relative proportion of fixed versus variable costs" in the "cost structure" of a firm, and the "choice of cost structure should be carefully considered [by the firm's management]." The cost structure

determines the operating leverage and "impacts" (Weygandt et al. 2015: 236) or "affects" (235) the profitability of a firm as well.

Of the 15 titles, 11 (73.3% of the sample) present OL only, without any discussion of SMR and no attempt to define OL's possible inverse relation with SMR. They are Brewer et al. (2008); Edmonds et al. (2014); Hartgraves and Morse (2012); Horngren (2014); Hilton and Platt (2014); Jimbalvo (2016); Maher et al. (2012); Sawyers et al. (2013); Warren et al. (2014); Whitecotton et al. (2013); and Wild and Shaw (2014).

Only four titles (26.67% of the sample) discuss OL and SMR together under the subheadings of "Cost Structure," "Operating Leverage," or "Risk Analysis" in their cost-volume-profit analysis chapters, achieving some degree of integration of these terms [Braun et al. (2013); Davis and Davis (2014); Weygandt et al. (2015); and Mowen et al. (2014)]. However, their discussions about relationships between SMR and OL are either non-existent or incomplete. For example, all textbooks state a single, concise formula for operating leverage, "OL = Total contribution margin / Profit," but they do not explain its determinants. However, they do not offer a concise formula for SMR, which could be the inverse of the OL formula.

In summation, all fifteen (100%) U.S. managerial accounting textbooks:

A. neither identify nor quantify any driver or determinant of OL and SMR;

B. neglect to note an inverse relationship between SMR and OL;

C. fail to quantify operating risk; and

D. do not integrate operating risk with profit-return in their cost-profit-volume analysis.

OPERATING RISK AS THE PROPORTION OF FIXED COST TO CONTRIBUTION MARGIN

All U.S. management accounting textbooks present margin of safety [MOS] and explain it within the context of their cost-volume-profit graphs. Meanwhile, 60% of the samples reviewed also present a safety margin ratio [SMR]. They define MOS as the gap between a firm's total revenue [TR] and its break-even revenue, and SMR is the ratio of the MOS to TR. They also uniformly state that the break-even revenue can be determined by this formula: (TFC / CMR), where CMR is the ratio of total contribution margin [TCM] to TR. Therefore, a firm's MOS is TR – (TFC / CMR). Since the SMR is the ratio of the MOS to TR, a new expression for SMR is: SMR = (TR – (TFC / CMR)) / TR - - - - Eq. Conventional SMR.

In the Conventional SMR equation above, one may multiply the division's upper and lower sides by CMR: SMR = (TR x CMR – TFC) / (TR x CMR). Since the product of TR and CMR is TCM, the safety margin ratio may be restated as SMR = (TCM – TFC) / TCM - - - - Eq. SMR 0. This Eq. SMR 0 states that a firm with zero fixed costs can have its SMR of 1 and be perfectly safe regarding uncertainties over the amount of TCM return. As the firm makes fixed-cost spending, its "degree of safety" (Kang, 2014) becomes less than perfect.

In Eq. SMR 0 above, Kang (2014) divides the upper and lower sides of the division by TCM. SMR is now stated as the complement of the TFC-to-TCM ratio: SMR = 1 – (TFC / TCM) - - - - - - - - - - - Eq. SMR 1. In the Eq. SMR 1, one finds that an increasing TFC-to-TCM ratio drives down the SMR, and vice versa. In that case, what is the TFC-to-TCM ratio? Kang (2016) terms it DOLE, the "degree of operating loss exposure" due to fixed-cost spending: DOLE = TFC / TCM - - - - - - - - - - - - - - Eq. DOLE 0.

DOLE is a direct measure of operating risk. A firm's TFC exposes it to an operating loss while enabling it to earn TCM. The degree of operating risk the firm assumes is the proportion of the TFC to the TCM return. Therefore, the TFC-to-TCM ratio is the firm's degree of operating loss exposure [DOLE]. It is noted that the calculated DOLE is solely due to fixed-cost spending because variable-cost spending can be made flexibly and in proportion to the firm's actual sales volume.

A firm's operating risk manifests itself as the firm's break-even ratio [BE%]

A firm's break-even ratio [BE%] is the ratio of the break-even revenue [BER] to the firm's total revenue [TR]. As noted earlier, the break-even revenue [BER] is determined conventionally by this formula: (TFC / CMR). Since CMR is the ratio of total contribution margin [TCM] to total revenue [TR], the break-even revenue formula becomes BER = TFC / (TCM / TR). The BE%, the ratio of BER to total revenue, TR, can be stated as: (TFC / (TCM / TR)) / TR. Here, the BE% can be restated as (TFC x (TR / TCM)) / TR; and again, restated as BE% = TFC / TCM - - - - Eq. BE%. Since the TFC-to-TCM ratio is the operating risk, a firm's break-even ratio [BE%] displays the firm's operating risk ratio.

The estimation and uses of operating risk ratio in computing the firm's break-even volume. Internal managers of a firm, having access to the firm's financial data for a period under review, can estimate the firm's BE% as: (TFC / TCM). Then, they can proceed to multiply the

estimated operating risk ratio [i.e., DOLE] by TR to calculate the firm's break-even revenue, as follows:

Break-even Revenue = (TFC / TCM) x TR - - - Break-even formula using the operating risk ratio.

Break-even Revenue = DOLE x TR - - - Break-even formula using DOLE.

The complement of risk, SMR, is the "degree of safety" from making a net operating loss

Eq. SMR 1 earlier stated a firm's safety margin ratio [SMR] at a point in time as the complement of the TFC-to-TCM ratio: SMR = 1 – (TFC / TCM) - - - Eq. SMR 1.

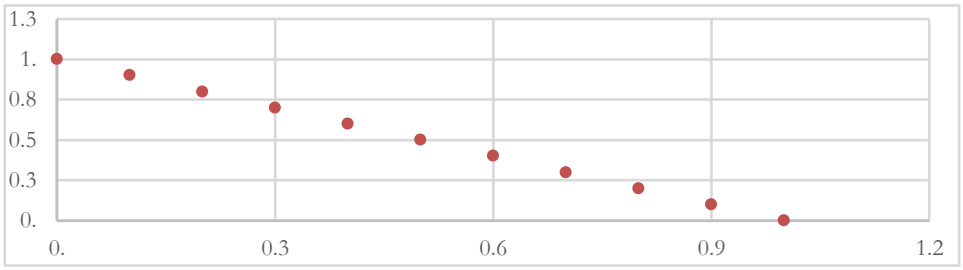
Table 1 lists the SMRs for various TCF-to-TCM ratios that range from 0 to 1, and then Figure 1 plots the SMRs. A firm's safety margin ratio [SMR] is 1 when TFC = 0 and the TFC-to-TCM ratio = 0. Then, the SMR decreases as the TFC-to-TCM ratio increases.

Figure 1 shows that SMR decreases when the TFC-to-TCM ratio increases, and vice versa. The TFC-to-TCM ratio was earlier termed DOLE, the "degree of operating loss exposure" due to fixed-cost spending. The safety margin ratio complements DOLE: SMR = 1 – DOLE - - - - Eq. SMR 2. Being a complement of risk, SMR is the "degree of safety" (Kang 2014) that a firm can afford to the firm's external economic turbulence and other external uncertainties.

Table 1. The TFC-to-TCM ratio as the determinant of SMR

TFC-to-TCM ratio	SMR
0	1
0.1	0.9
0.2	0.8
0.3	0.7
0.4	0.6
0.5	0.5
0.6	0.4
0.7	0.3
0.8	0.2
0.9	0.1
1	0

Figure 1. The TFC-to-TCM ratios as X; the SMRs as Y



The operating leverage [OL] as a "symptom" of risk and an inverse of SMR

The operating leverage [OL] of a firm is a measure of the volatility of profit to changes in its sales volume, according to all 15 textbooks surveyed. The texts uniformly measure the OL using this formula: OL = TCM / Profit - - - - - -Eq. uniform OL formula.

Given that profit results from TCM after subtracting TFC, the OL formula can be restated as OL = TCM / (TCM – TFC). Then, by dividing both the upper and lower sides of the division by TCM, a new formula for operating leverage [OL] is obtained, as follows: OL = 1 / (1 – (TFC/TCM)) - - - - - - -Eq. OL1. In the Eq. OL1, the OL is determined by the TFC-to-TCM ratio.

Since the Eq. SMR 1 states that SMR = 1 – (TFC / TCM), operating leverage [OL] can be restated as the inverse of a firm's SMR: OL = 1 / SMR - - - - - - - Eq. OL2.
In Eq. OL2, OL is the inverse of SMR. Therefore, the product of OL and SMR of a firm is 1: OL x SMR = 1. Also, given the textbook formula for OL = TCM / Profit [in Eq. OL formula above], Kang (2014) finds that: SMR = Profit / TCM - - - Eq. SMR formula.

All 15 U.S. textbooks surveyed state that the operating leverage of a firm as the volatility of its profit changes in response to sales changes. However, they erroneously imply that this profit volatility indicates the firm's operating risk. Operating leverage [OL] is not the risk itself; it is only a profit volatility "symptom" (Kang 2016) of the underlying operating risk.

The behavior of operating leverage [OL]

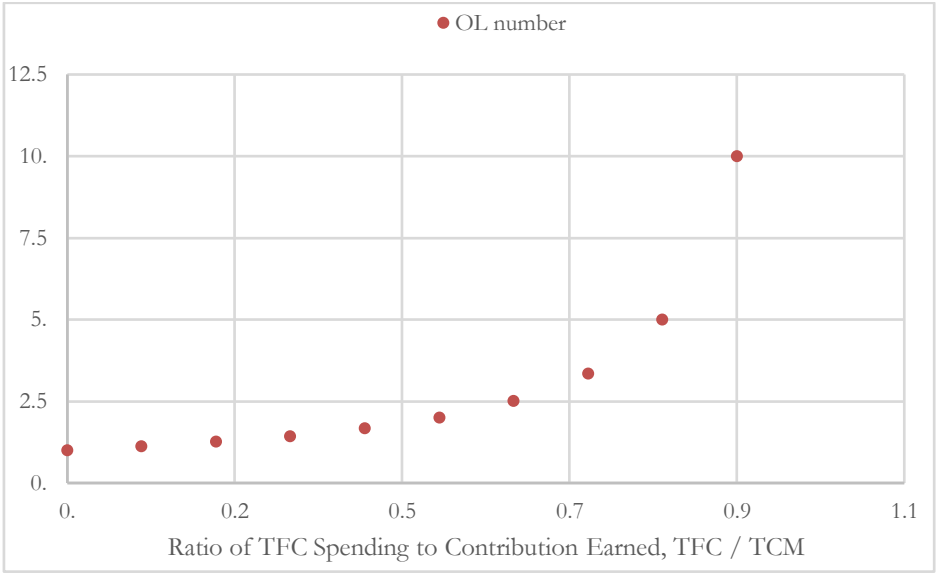
Table 2 lists the OL numbers for various TCF-to-TCM ratios using the Eq. OL1 that says OL = 1 / (1 – (TFC/TCM)), and then Figure 2 plots the OL numbers.

Table 2. The TFC-to-TCM ratio and the OL numbers

TFC-to-TCM ratio	OL number
0	1
0.1	1.11
0.2	1.25
0.3	1.43
0.4	1.67
0.5	2
0.6	2.5
0.7	3.33
0.8	5
0.9	10
1	Indefinite

Figure 2 shows that OL increases geometrically when the TFC-to-TCM ratio increases, and vice versa. When Figures 1 and 2 are examined together side by side, one finds the TFC-to-TCM ratio drives both SMR and OL. Since the TFC-to-TCM ratio is a direct measure of operating risk, SMR and OL must be two different symptoms of the underlying operating risk. The SMR is the degree of "safety" and is the complement of operating risk. The operating leverage [OL] of a firm is the degree of "volatility of its operating profit" but is inversely related to its safety margin ratio [SMR].

Figure 2. The TFC-to-TCM ratio as X, and Operating Leverage [OL] as Y



AN INTEGRATIVE VIEW OF THE RISK AND PROFIT RETURN OF A FIRM'S FIXED-COST SPENDING

The operating risk, as defined earlier under the third subheading, is a firm's degree of operating loss exposure (DOLE) due to the firm's fixed-cost spending. There, in Eq. DOLE 0, the DOLE is stated as the TFC-to-TCM ratio: DOLE = (TFC / TCM). This formula for DOLE answers the first primary research question of this paper. The second research question is: What is the measure of profit return on the same fixed-cost spending?

A firm's profit [P] is its TCM earning minus TFC. Therefore, the firm's profitability of its fixed-cost spending: [P / TFC] = [(TCM – TFC) / TFC] - - - - - - Eq. Profit-return on TFC, Level 0. In this Level 0 equation, one may divide the division's upper and lower sides by TFC to generate a new expression for the profitability: [P / TFC] = [(TCM / TFC) – 1] - - - - - - - - - - - - - - Eq. The Profit-return on TFC, Level 1.

The TCM-to-TFC ratio (TCM / TFC) in this Level 1 may transform into two familiar terms. First, since the TCM-to-TFC ratio is the inverse of the DOLE (TFC / TCM), this Level 1 equation changes into an eye-opener: [P / TFC] = [(1 / DOLE) – 1] - - - - - Eq. Profit-return on TFC, Level 1{a}.

Second, since a firm's TCM return from TFC is (TCM / TFC), the Level 1 equation changes into another eye-opener: [P / TFC] = [(TCM return from TFC) – 1] - - - - - - Eq. Profit-return on TFC, Level 1{b}.

Graphs that integrate risk & profitability of fixed-cost spending

This section describes the specific steps that one may take to graph the behaviors of (1) operating risk; 2) the profit return from a firm's fixed-cost spending; (3) a "risk vs. return" model that integrates both the operating risk and profit return from the fixed-cost spending; and (4) a "profit-to-risk gaps" graph.

Table 3. The [TFC/TCM], DOLE and the profit return on fixed-cost spending

TFC/TCM	Operating Risk (DOLE)	Profit-to-Risk Gap ([P/TFC] – DOLE)	Profit-Return on TFC (P/TFC)
0	0		
0.1	0.1	8.900	9.000
0.2	0.2	3.800	4.000
0.3	0.3	2.033	2.333
0.4	0.4	1.100	1.500
0.5	0.5	0.500	1.000
0.6	0.6	0.067	0.667
0.7	0.7	-0.271	0.429
0.8	0.8	-0.550	0.250
0.9	0.9	-0.789	0.111
1	1	-1.000	0.000
1.1	1.1	-1.191	-0.091
1.2	1.2	-1.367	-0.167

The charts are made from a single spreadsheet (in Table 3) that includes DOLE rates and operating profit-return rates for a range of TFC-to-TCM ratios.

Step 1 draws the operating risk [DOLE] in Figure 3.

Step 2 draws the TFC's profit-return curve in Figure 4 from the precalculated numbers under the column titled, "Profit-Return on TFC (P/TFC)," in Table 3.

Since the TCM return from TFC is the inverse of DOLE, the TFC's profit-return curve in Figure 4 reflects: [(the inverse of DOLE) – 1].

Step 3 draws the operating risk [DOLE] and the profit return [Profit/TFC] from TFC spending together in Figure 5.

Figure 3. The operating risk level (DOLE) chart

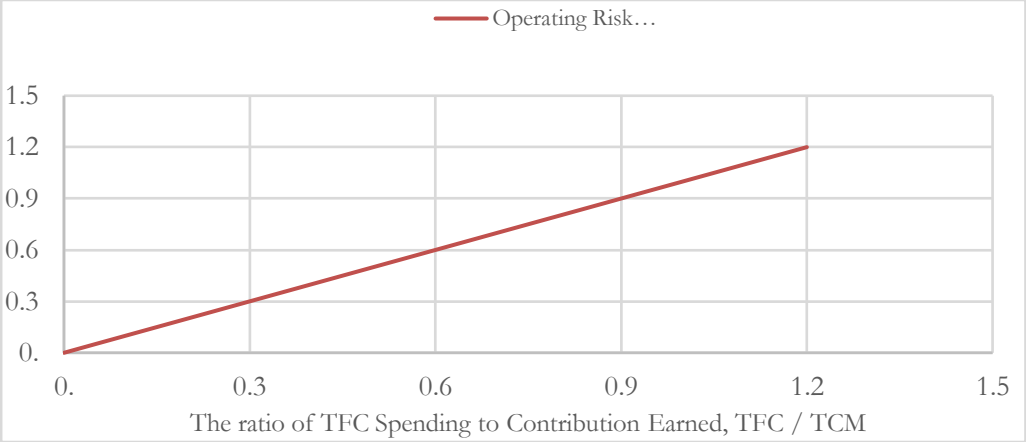


Figure 4. The profit return on fixed costs curve

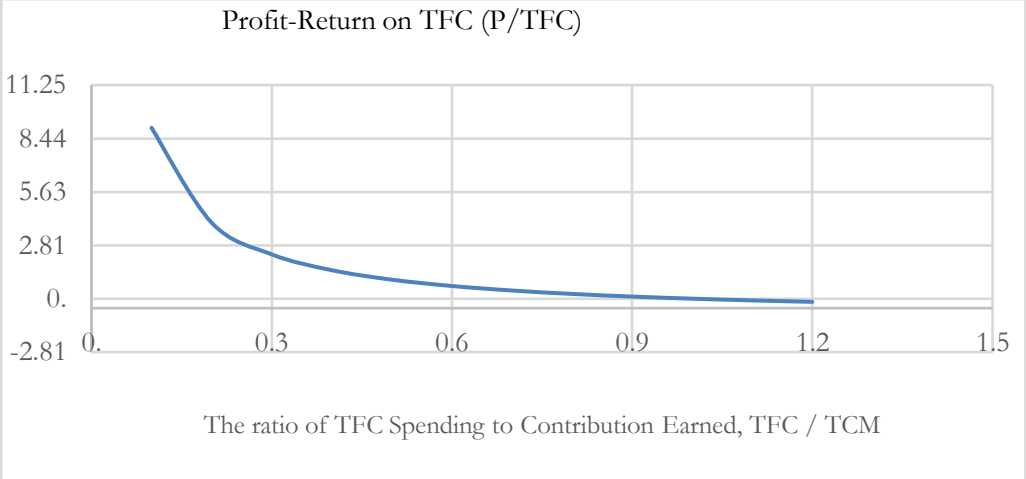
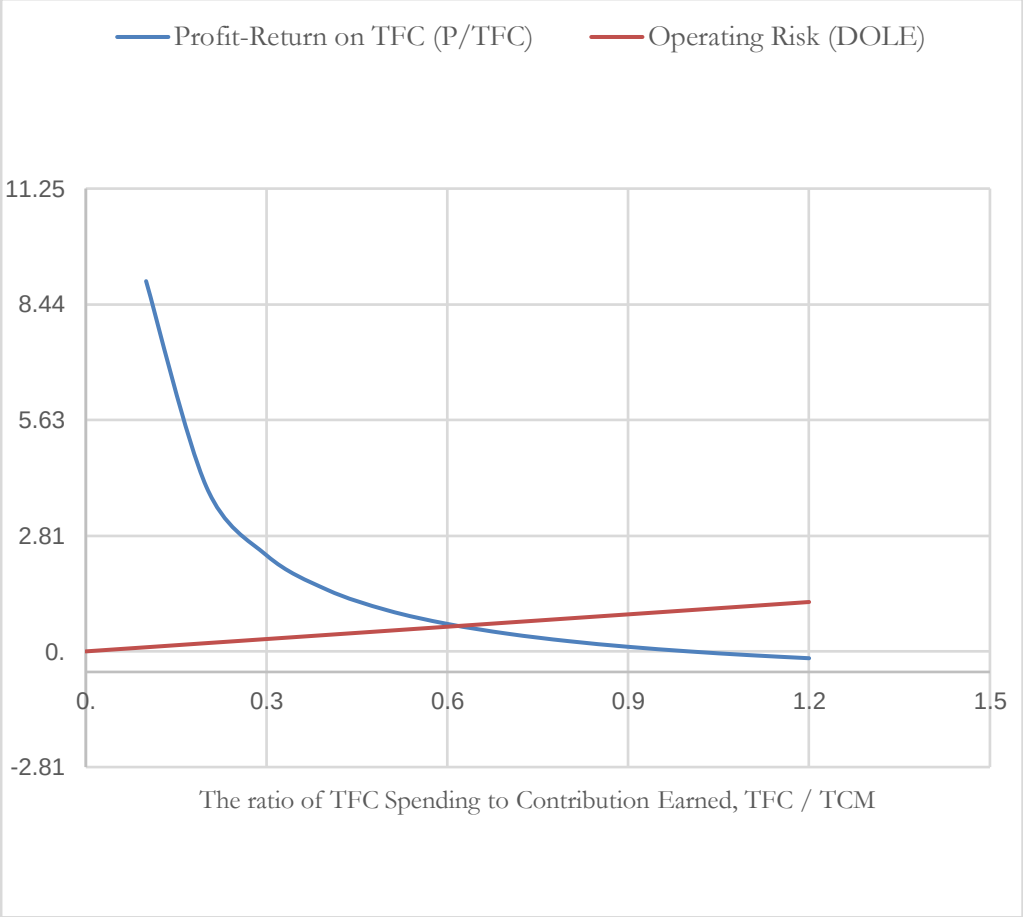


Figure 5. The DOLE [as a straight line] and the TFC's profit return curve



In summation, Table 3 shows that both the degree of operating loss exposure [DOLE] and profit return on total fixed cost spending [Profit/TFC] have a common determinant: the ratio of TFC spending to TCM earning [i.e., TFC/TCM]. Figure 3 plots the DOLE ratios, while Figure 4 plots the rates of profit return on fixed costs. Then, Figure 5 plots both risk [DOLE] ratios and profit-return [Profit/TFC] rates, with their equilibrium at 0.618033956. The root cause of the operating risk is a firm's fixed-cost spending. Therefore, the firm's operating risk management must focus on fixed-cost spending. This risk-neutralizing equilibrium is likely to be observed when a firm strives for its financial sustainability in the long term. Moreover, when multiple firms compete in an

industry, the eventual survivors are expected to show their operating risk [DOLE] ratios stay below this equilibrium rate.

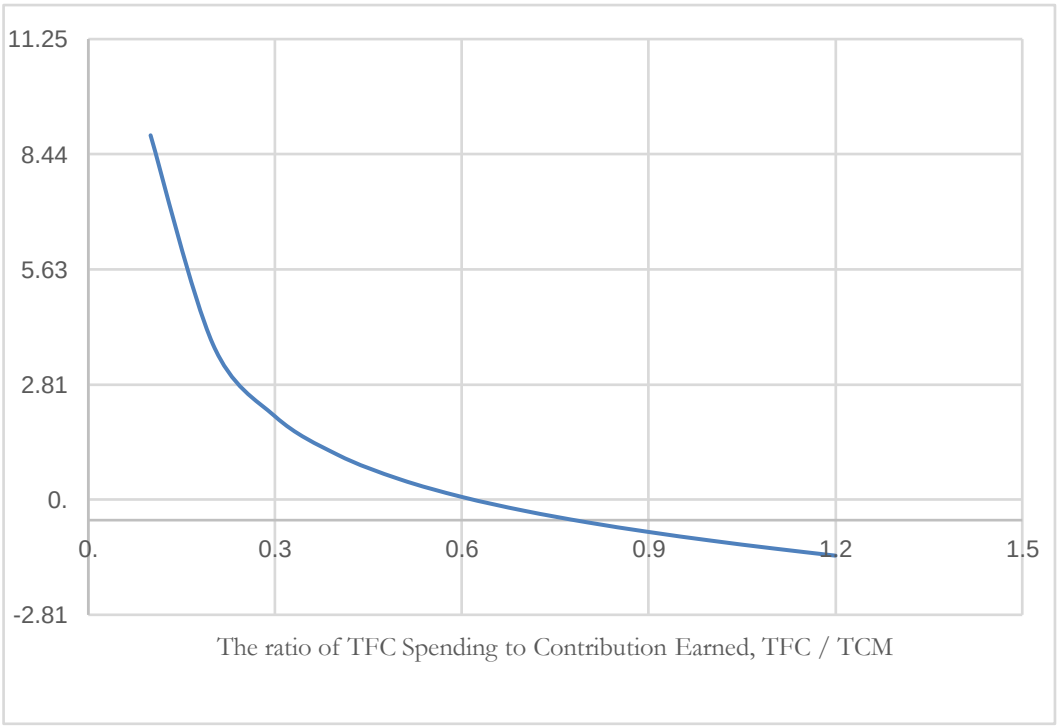
The profit-to-risk gap as the net financial impact of a firm's fixed-cost spending

Now I revisit Table 3 to highlight the numbers shown under the column titled "Profit-to-Risk Gap" [(P/TFC) – DOLE]. These numbers measure the profit-to-risk gaps for varying ratios of (TFC / TCM). `

Figure 6 plots the profit-to-risk gaps. One may note that as the level of TFC/TCM [indicated on the X-axis] increases, the size of the profit-to-risk gap decreases, and when the ratio of TFC/TCM reaches 0.6, the gap becomes a minuscule 0.0666667. Beyond this point, the gap numbers turn negative.

As the TFC/TCM ratio on the X-axis gets 0.618033956 [noted earlier as the equilibrium rate], the gap approaches zero (0). The gap approaches zero at the TFC's risk-return equilibrium point where the profitability on fixed-cost spending [Profit/TFC] equates the operating risk [TFC/TCM].

Figure 6. TFC's "profit-to-risk" gaps curve



If a firm's profit-to-risk gap is 0, its strategic fixed-cost spending initiatives can be judged "risk-neutral." This firm's strategic initiatives involving fixed-cost spending make a profit return [61.8%] sufficient to neutralize or offset the accompanying operating risk, which is also 61.8%. If this firm continues its sound operating risk management, it will achieve financial sustainability even in the long term.

If a firm's profit-to-risk gap is positive (+), it may be taking a cautious "risk-averse" position concerning its strategic initiatives. On the other hand, if a firm's profit-to-risk gap is negative (–), it may be taking an unduly aggressive "risk-taking" position in its strategic initiatives involving fixed-cost spending.

The estimation and use of operating risk, profitability, and the profit-to-risk gap from fixed-cost spending

Internal managers of a firm having access to financial data, including the TFC and TCM amounts of the firm, as well as the firm's operating profit [P], can estimate (1) the firm's rate of operating-profit return on its TFC and (2) the firm's operating risk ratio [DOLE]. Then, they may decide to compare the estimated profit return rate and the risk ratio to determine the firm's "profit-to-risk gap," which can indicate the firm's financial sustainability [if positive, or zero] or un-sustainability [if negative].

A RISK ANALYSIS CASE STUDY, USING DOLE AND THE PROFIT-TO-RISK GAP

This section presents a financial analysis case [adapted from Jiambalvo (2016: 168)] focused on operating risk.

Equillion, Inc. and Storis, Inc. are two companies in the pharmaceutical industry. Equillion has high fixed costs related to R&D. Storis, however, does little R&D. Instead, the company pays for the right to produce and market drugs that other companies have developed. The amount paid is a percentage of sales. Thus, Storis has high variable costs and low fixed costs.

There are three acronyms in the financial schedule, as follows:

TVC stands for total variable cost.

TCM stands for total contribution margin.

TFC stands for the total level of fixed costs per period.

Table 4. Income statement numbers for two (2) pharmaceutical companies

Income Statement Items	Equillion Inc.	Storis Inc. (S Co.)
Sales	$150,000,000	$150,000,000
TVC	-$37,500,000	-$90,000,000
TCM	$112,500,000	$60,000,000
TFC	-$90,000,000	-$37,500,000
Profit	$22,500,000	$22,500,000

Required: 1. Calculate the safety margin ratio [SMR] for each of these two companies in the pharmaceutical industry.

Solution: The SMR formula in textbooks is: SMR = (TR – Break-even TR) / TR. Therefore, a typical student solution proceeds in two steps in sequence: first, calculate "the break-even TR" using the formula: Break-even TR = TFC / (TCM / TR), and second, get the SMR for each firm, as follows.

E's break-even TR = $90m / ($112.5m / 150m) = $120m; then E's SMR = (150m – 120m) / 150m = 0.2. Similarly, for S Co., $93,750,000 to break even, and SMR = (150m – 93.75m) / 150m = 0.375.

Required: 2. Calculate the operating leverage number for each company.

Solution: The formula found in all textbooks surveyed states OL = TCM / Profit. Using this formula, E's OL = $112.5m. / $22.5m. = 5 times; while S's OL = $60m. / $22.5mi. = 2.6667 times.

Required: 3. Calculate the expected percentage change in profit for a 20 percent increase (and for a 20 percent decrease) in each company's sales.

Solution: The solution to Requirement 2 earlier has the OL number for each company. If sales changed by a 20% increase (and decrease), E's profit would increase by 100% (and decrease by 100%) because the OL of 5 times +20% (and –20%) in sales. On the other hand, S's profit would increase by 53% (and decrease by 53%) because the OL of 2.6667 times +20% (and –20%) in sales.

Required: 4. Which company is riskier?

Solution: E appears to be riskier than S in two ways. Suppose the analyst focuses on a firm's operating leverage. In that case, E company has a higher OL, so it exhibits a higher

"volatility" of profit changes and appears to be in a higher risk-taking position. If the analyst instead focuses on a firm's margin of safety, E company has a lower SMR; it is in a lower safety position.

An enhanced solution to Requirement 4 above, using DOLE and profit-to-risk gap

The Requirement 4 above may be solved using my proposed DOLE, P/TFC, and profit-to-risk gap as follows.

E Co.'s operating risk, as measured by its DOLE of 0.8 (= TFC of 90m / TCM of 112.5m), is much higher than the long-term sustainable maximum allowable rate of 0.618, which the preceding section notes. Furthermore, the TFC's profitability [P/TFC] is 0.25 (= Profit of 22.5 m / TFC of 90m), while the DOLE is 0.8, and the firm's profit-to-risk gap is negative: – 0.55. The TFC's profitability is deficient to cover the operating risk. Therefore, E company is overly risky. E Co. has failed the risk management over its R&D spending on new drug innovations.

On the other hand, S Co. has a DOLE of 0.625 vs. P/TFC of 0.60; the TFC's profitability is very slightly deficient to cover the loss exposure. It is basically risky-neutral [with an exceedingly small profit-to-risk deficit of – 0.025]. E Co. is riskier than S Co.

CONCLUSION AND IMPLICATIONS

A firm's strategic initiatives often involve spending substantial fixed costs upfront. Given uncertainties over its sales outlook, the firm is exposed to an operating loss and assumes operating risk due to such fixed-cost spending. The firm assumes operating risk to maximize its operating profit. If the firm wants to remain financially sustainable, it needs to neutralize its operating risk with the operating-profit return from its fixed-cost spending. Therefore, both the operating profit-return and risk must be measured, monitored, and managed. To help equip business students with a practical operating-risk management framework, management accounting textbooks must integrate operating risk within their cost-volume-profit analysis and related decision and evaluation models.

U.S. managerial accounting textbooks commonly present their CVP analysis model as a "profit" planning tool. However, they also offer two terms that may indicate "risk": safety margin ratio [SMR] and operating leverage [OL]. I reviewed fifteen (15) U.S. managerial accounting textbooks to learn that they: (a) neither identified nor quantified any driver or determinant of OL and SMR, (b) did not note an inverse relationship between SMR and OL, and (c) failed to quantify operating risk. In response, I raised my

initial research question as follows: Within a cost-volume-profit analysis model, is there a direct measure of the operating risk created by a firm's fixed-cost spending? My inquiry has produced the following first three findings.

Finding 1: The proportion of a firm's fixed cost [TFC] to its contribution margin [TCM] represents the degree of the firm's operating loss exposure [DOLE] that its fixed-cost spending creates, and this DOLE is a direct measure of the operating risk. DOLE complements the firm's safety margin ratio [SMR]. DOLE is also its break-even ratio [BE%], the proportion of a firm's total revenue [TR] needed to break even.

Finding 2: The single, common determinant of both SMR and operating leverage [OL] is the firm's ratio of total fixed cost to the total contribution margin: SMR = 1 – (TFC / TCM); OL = 1 / (1 – (TFC / TCM)). As the TFC-to-TCM ratio [i.e., DOLE, the firm's operating risk] grows, the "degree of safety" [measured by the SMR] deteriorates proportionately, while the profit volatility [measured by the OL] increases geometrically.

Finding 3: Conceptually, OL and SMR are inverse to each other. Quantitatively, OL x SMR = 1. Given the textbook formula for OL = TCM / Profit, I find SMR = Profit / TCM.

My review of the same fifteen textbooks also revealed that they did not integrate operating risk with profit-return in their cost-profit-volume model and related financial analysis. In response, I raised my second research question as follows: Can we integrate both the operating risk and operating-profit return from fixed-cost spending into a "risk-and-return framework" that may yield a "profit-to-risk" gap as a measure of the net financial impact of a firm's fixed-cost spending? My inquiry has produced two additional findings as follows.

Finding 4: The proportion of a firm's operating profit [P] to its fixed cost [i.e., P / TFC] represents the rate of operating profit return from the firm's fixed cost spending. Given its DOLE number, the firm's P/TFC is the inverse of the DOLE minus 1 [i.e., (1 / DOLE) – 1].

Finding 5: Subsequently, the pairs of DOLEs and P/TFC numbers for different TFC-to-TCM ratios [ranging from 0 to 1] are entered into a single framework that shows "profit-to-risk gaps" for different TFC-to-TCM ratios. The DOLE and P/TFC rates of financially sustainable firms are in their equilibrium at 61.8%, a rate at which their P/TFC and DOLE share. At this equilibrium point, a zero [0] profit-to-risk gap occurs, and the operating profit return on fixed-cost spending [P/TFC] neutralizes the operating risk [DOLE] that the same spending creates.

Applications

This "risk-and-return integrated framework" can be applied to CVP analysis, related incremental decisions, and subsequent evaluations. Applications include the following.

A. The basic applications for external analysis: The "profit-to-risk gap" computed from the financial data of a firm may indicate the firm's operating risk management capability and its financial sustainability in the long term. If a firm's profit-to-risk gap is 0, its strategic fixed-cost spending initiatives can be judged "risk-neutral." If the gap is positive (+), its strategic spending initiatives can be judged "risk-averse." On the other hand, if the gap is negative (–), they can be judged "unduly risk-taking." The earlier subsection titled, "A RISK ANALYSIS CASE STUDY . . ." has demonstrated a valuable application of this risk-integrated framework in a comparative risk analysis of two firms in the pharmaceutical industry.

B. The basic applications for internal analysis, decision and evaluation: A firm's risk-integrated decisions and subsequent performance evaluations on strategic fixed-cost spending initiatives may focus on both the operating profit return rate [P/TFC] and the operating risk rate [DOLE]. The computed "profit-to-risk" gap can indicate the degree of success or failure of the firm's operating-risk management. When a firm pursues financial sustainability, it may use the equilibrium rate [61.8%] as the minimum required operating profitability on the relevant fixed costs and the maximum allowed operating risk in decisions and evaluations involving strategic fixed-cost spending initiatives.

C. Other valuable applications may include but are not limited to financial-sustainability evaluation, bankruptcy prediction, loan-risk rating, acquisition targets valuation, disinvestment decision, and various decision and evaluation cases that call for risk-integrated financial analysis.

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