Sustainability of Earnings: A Framework for Quantitative Modeling of Strategy, Risk, and Value

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Abstract

The value of a firm derives from its future cash flows, adjusted for risk, and discounted to present value. Much of the existing literature addresses the quantitative techniques for calculating probability distributions of future cash flows, calculating values of risk adjustment factors, and calculating values of discount factors. Yet strategy and strategic risk – for example, the risk of adverse consequences arising from the actions of new competitors, governmental intervention, customer changes, etc. – often cannot easily be incorporated into this quantitative framework. As a result, strategic concerns are addressed in a parallel track of qualitative analysis, which supplements the quantitative analysis but never integrates with it. The goal of this paper is to propose in detail a quantitative framework in which strategic considerations can be incorporated into a quantitative model of the value of the firm. The resulting framework seeks to measure not only the amount, growth rate, and variability of earnings, but also the firm's "sustainability of earnings" and value in the face of strategic forces.

Keywords. Strategy, Risk, Value, ERM, Sustainability of Earnings.

1. INTRODUCTION

Strategy is a source of risk to the firm and thus ought to be included within enterprise risk management (ERM), enterprise risk analysis, and measurement of the firm's value. Yet while detailed quantitative models describe other sources of risk such as financial risk, operational risk, and hazard risk, the quantitative apparatus for incorporating strategy into a model of the firm is often underdeveloped or simply lacking. As a result, analysts address strategic forces in a parallel track of qualitative analysis, which supplements the quantitative analysis but cannot integrate with it.

This paper proposes a detailed framework in which strategic considerations can be incorporated into a quantitative model of the firm. Such a framework incorporates a scenario-based paradigm, which allows one to develop a range of future strategic conditions; one must estimate the likelihood of such conditions materializing and what the ramifications would be for the firm's earnings. This framework thus requires one to reflect upon and estimate the relative vulnerability of the firm's earnings to changes in the strategic landscape; or, equivalently, the invulnerability or "sustainability" of the firm's earnings with respect to strategic forces. By incorporating strategic forces into the quantitative risk model, one captures a broader range of variability in future earnings. Such a model could be used for measuring risk and volatility in a classic risk modeling framework; further, following the

paradigm of Panning [4], one can use such a framework to calculate the value of a business based on its future earnings. This has particular application to the problem of estimating the relative value of two businesses with differing degrees of earnings sustainability in the face of strategic forces. It also provides a pathway towards quantifying a cost-benefit evaluation of expenditures on strategic maneuvers designed to enhance the firm's strategic posture.

1.1 Research Context

Slywotzky and Drzik [7] address strategy and strategic risk, but their focus is on deploying countermeasures to strategic risk. Their treatment is mostly qualitative; although they state the importance of estimating the likelihood and severity of various strategic risks, this recommendation leads only to a risk map that does not integrate into an overall quantitative risk model of the firm. Mango [3] provides a general introduction to strategic risk issues, with a focus on scenario planning and risk modeling; he notes the lack of precision in the terms "strategy" and "strategic risk". Schelling [6] serves as our starting point for how strategy is defined in this paper, leading to the crystallization by Porter [5]. We incorporate our risk model of strategy into the framework for the value of the firm developed by Panning [4], who was not addressing strategy per se but rather the risk of downside financial variability; the framework nevertheless is suitable for our purposes. Finally, we note that an antecedent to the proposed model can be found in Feldblum [2], who proposed the approach at a more granular policy level rather than at the business unit or firm level.

1.2 Objective

The objective of this paper is to describe a practical framework that can incorporate the quantitative modeling of risks emanating from a firm's strategic position.

2. STRATEGY

2.1 Schelling and the Theory of Games

In this paper, we will use as a starting point the description presented by Schelling [6]. He notes that in the field of Game Theory, a game of strategy refers to:

> "[a situation] in which the best course of action for each player depends on what the other players do. The term is intended to focus on the interdependence of the

adversaries' decisions and on their expectation about each other's behavior".

Schelling directs our attention to how the firm's results can be affected by other players whose rational actions interact with and impact upon the firm. This point is crucial because so much of current practice in the property-casualty insurance industry focuses on modeling the variability of a firm's financial results based on fortuitous events, for example property damage claims from natural catastrophes or liability claims from car crashes. Thus Schelling's definition of strategy, focusing on the actions of competing players, leads us to consider a category of risk that is not currently encapsulated in other risk categories such as operational risk, hazard risk, or financial risk.

2.2 Buffet's Economic Moat and Porter's Five Forces

Our focus on the actions of other players leads us to consider competition and competitive forces. How do competitive forces potentially affect the firm? One vivid metaphor, articulated by Warren Buffet, is the "economic moat". The idea behind this metaphor is to consider the relative safety or vulnerability of a business's earnings and value in the face of competitive forces.

In order to gain greater insight into competitive forces, we invoke the classification system devised by Porter [5]. To describe competition, he details the Five Forces that govern the competitive landscape:

1. Threat of new entrants
2. Jockeying for position among current competitors
3. Bargaining power of suppliers
4. Bargaining power of customers
5. Threat of substitute products
6. [Threat of government intervention]

2.3 Sustainability of Earnings

Porter's classification accentuates that a firm's current earnings and value are potentially vulnerable to the competitive forces of suppliers, customers, and new competitors. Thus in evaluating a business, one must consider not only the amount of the business's earnings and

the growth rate of its earnings, but also its "sustainability of earnings".

We define "sustainability of earnings" as the likelihood that a business's earnings will not be eroded by the strategic moves of competitive forces.

Sustainability of earnings provides a framework for evaluating the value of a firm, the price of an acquisition, and the value of a business unit or product line within a conglomerate.

For example, in the property-casualty insurance industry, one can ask of each line of business:

1. Threat of new entrants:
    a. What kind of barriers to entry does this line of business have?
        i. To what extent does it require hard to obtain, specialized, technical underwriting skills?
        ii. To what extent does it require access to distribution channels?
        iii. To what extent does obtaining business require a proven track record of claims paying and reliability?
2. Bargaining power of suppliers:
    a. To what extent do the suppliers of capital have pricing power and availability power over this business?
        i. To what extent does writing this line of business require the support of suppliers of reinsurance capital?
        ii. Could the business easily switch to alternative forms of capital, including capital markets instruments such as cat bonds, or, alternatively, rely on the firm's held equity capital?
3. Bargaining power of customers:
    a. To what extent do customers have the ability to change their purchasing behavior?
        i. Do they have the ability and willingness to choose not to purchase the insurance product that the firm offers and simply

retain the risk for themselves?

All of these questions are relevant whenever:

1. A conglomerate's senior management is measuring the value of various subsidiaries or lines of business in its portfolio of products and businesses.
2. A company is estimating how much to pay to acquire another company or to pay for new talent to develop a new line of business.
3. Senior management is evaluating strategic moves to enhance the value of the firm and thus to increase its stock price.

3. MODELING

One might desire to describe strategy and competitive forces via a quantitative or even a probabilistic model, especially a probabilistic model that incorporates other sources of risk to the firm, such as financial risk and hazard risk. How might one go about doing so? By focusing on sustainability of earnings, we can begin to develop such a framework.

3.1 Modeling the Risk to the Firm: Single Period Variability of Earnings

We can model any of the competitive forces described by Porter as a random variable. As an example, let's focus on one particular competitive force: the threat of new entrants.

Let X be a random variable with a Bernoulli probability distribution:

Probability	Outcome	State	Description
p	1	success	No new competitor enters the business
1-p	0	failure	A significant new competitor enters the business

In order to implement such a model, one would need to estimate the probability of a new competitor entering the business. Some examples of how to estimate this probability, including using expert opinion, can be found in Appendix B of the monograph "Overview of Enterprise Risk Management" [1].

In addition to estimating the probability of a new competitor entering the business, one

should also evaluate the severity of such an event on business's amount of earnings, as noted by Slywotzky and Drzik [7]. In the context of a full probability distribution model of earnings, a new competitor could affect not only the firm's mean level of earnings but also the shape, volatility, and downside of its earnings.

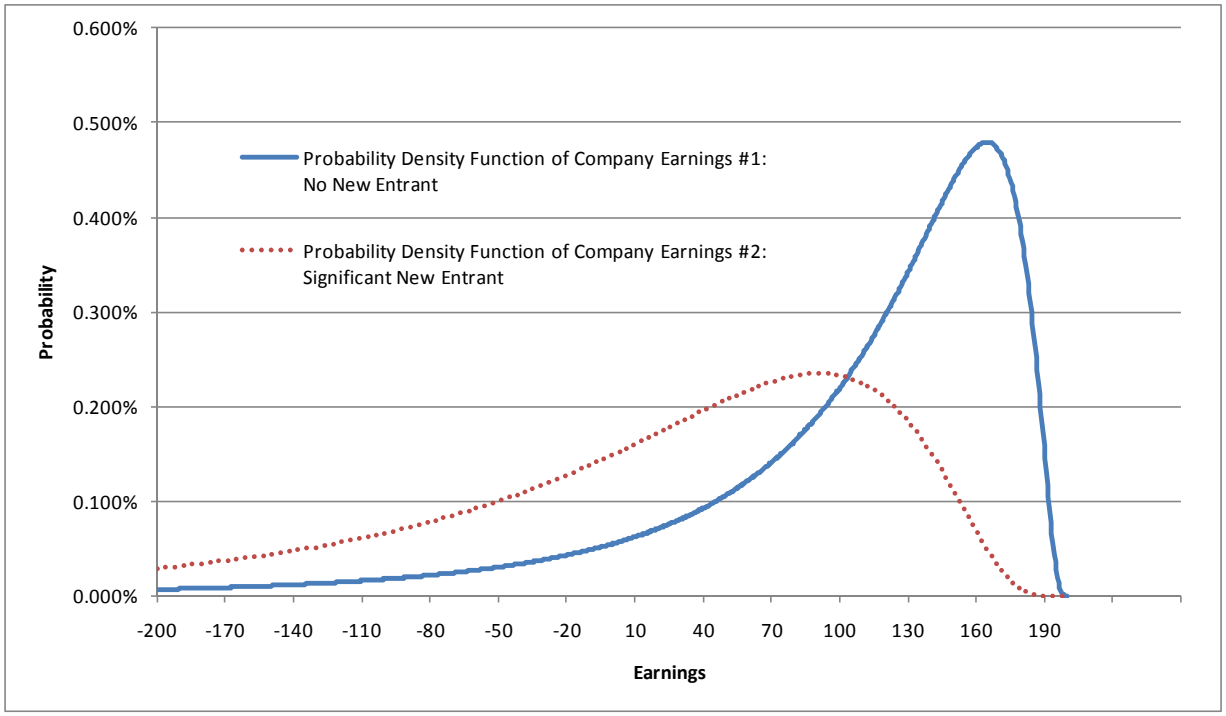
Thus one could stipulate as follows:

Probability	Description	Ramification
P	No new competitor enters the business	Company earnings follow distribution function $F_1(x)$
1-p	A significant new competitor enters the business	Company earnings follow distribution function $F_2(x)$

For example:

1. Simulate a uniform distribution on [0,1]
    a. If simulated output is on the interval [0,p] then you have a "success", no new competitor has entered.
        i. Simulate the business's earnings via probability distribution #1.
    b. If simulated output is on the interval (p,1] then you have a "failure", a significant new competitor has entered the business.
        i. Simulate the business's earnings via probability distribution #2.

Exhibit 1



While this example deals with the probability of a significant new competitor entering the business, a similar approach can be used for the other forces, such as the probability of a major shift in pricing by suppliers or a major shift in purchasing behavior by customers.

3.2 Modeling the Value of the Firm

Until now we have focused on the sustainability of earnings in one future period, which accentuates the range of outcomes for the firm. How can measuring the sustainability of earnings translate into measuring value?

Here we invoke the framework developed both by Feldblum [2] and Panning [4], albeit in modestly different contexts. Feldblum addresses customer persistency, the probability that a particular customer will continue to purchase the insurance product, in evaluating the profitability of various types of customer segments and insurance contracts. Panning addresses the larger question of the value of the firm; he focuses on the probability of the

firm having sufficient capital to survive its own downside financial events. Here we will deploy the same approach in order to measure the value of the firm in the face of a competitive force such as a potential new entrant to the business.

Following Panning's model, we set the value of the firm equal to the present value of its future expected earnings:

Let:

E = expected earnings at time 1

DF = 1 / (1+r) = earnings discount factor

Value = $\sum E * DF^t$

Value = E * DF/(1-DF) = E * (1/r)

Now let's introduce an earnings growth factor:

GF = (1+g)

Value = $\sum E * GF^{t-1} * DF^t$

Value = E * DF/(1-GF * DF) = E * (1/(r-g))

These equations for value mimic the standard results in financial textbooks. They incorporate earnings, discounting, and growth.

Now let's introduce strategic concerns and sustainability of earnings in the face of competitive forces.

Let:

- p = annual probability of "success" = no significant new competitor enters the business in a given year.
- 1-p = annual probability of "failure" = a significant new competitor enters the business in a given year

We'll also make two simplifying assumptions:

1. The company's earnings become zero when a significant new competitor enters the business
2. Once a new competitor enters the business, no competitors drop out, and the

company's earnings prospects remain thereafter at zero.

Now we can say that in order for the company to realize earnings at time t, it must have a string of strategic "successes" such that no significant new competitor has entered the field.

Therefore:

$$E_t = p^t * E * GF^{t-1} + (1-p^t) * 0 = p^t * E * GF^{t-1}$$

Then:

$$\text{Value} = \sum E * p^t * DF^t * GF^{t-1}$$

$$\text{Value} = E * p * DF / (1 - GF * p * DF)$$

Therefore, when p, the "sustainability of earnings" against competitive forces, is higher, the value of the business under consideration is higher.

Exhibit 2 shows a simplified numerical example of two hypothetical businesses. Firm A has higher earnings than Firm B, but Firm B has a forecast higher likelihood of sustaining its earnings in the face of competitive threats. Therefore, Firm B has a higher value; Firm A's higher earnings are offset by a lower Price-to Earnings (P/E) multiple, while Firm B's wider "economic moat" is reflected in its higher P/E multiple. Thus deploying Panning's model allows one to estimate, within a quantitative model of the firm's value, how much a firm's strategic position is worth.

Exhibit 2

		Firm A	Firm B
(1)	E = expected earnings	100.0	90.0
(2)	r	10.0%	10.0%
(3)	DF = 1/(1+r)	90.9%	90.9%
(4)	g = growth rate	5.0%	5.0%
(5)	GF = 1+g	1.05	1.05
(6)	p	96.0%	98.0%
(7)	1-p	4.0%	2.0%
(8)	Value	1043.5	1242.3
(9)	P/E multiple	10.4	13.8

Notes

(8) = (1) * { (6) * (3) } / {1 - (5) * (6) * (3) }

(9) = (8) / (1)

3.3 Modeling the Value of Strategic Maneuvers

We can use the model of the value of the firm not only to compare two different businesses, but also for a given firm to evaluate two alternative strategic moves.

Let's say a firm is considering whether or not to increase its expenditures on initiatives that will increase the sustainability of earnings. For example, it might be considering increasing expenditures on advertising to enhance brand name recognition. Or it might be thinking about increasing research and development expenditures; the product enhancements from the additional R&D are not foreseen as increasing the firm's earnings, but rather the enhanced product offering could serve as a barrier to entry to potential competitors. Or the firm might be contemplating spending more money on customer loyalty programs.

In all of these instances, the firm ought to forecast whether the benefit of the plan exceeds the cost. While ultimately there would be several different perspectives influencing the final decision, one would ideally like to be able to contribute a quantitative analysis as one component of the decision making process.

First we would need a basic description of the key aspects of the firm in its current state.

We'll start with the same information for Firm A as in Exhibit 2: we assume the firm has earnings of 100 and an annual probability p of sustainability of 96%, i.e. (1-p) probability of 4% that a new competitor will enter the business and decimate the firm's earnings. Now the firm is considering how much (if any) additional expenditures it should make to strengthen its strategic position and reduce the likelihood of a new entrant to the market. Since the firm is currently spending some money on these activities and its probability p of sustainability is 96%, we assume that the additional expenditures will increase this probability from 96% at a minimum towards a maximum of 100%.

Let's estimate a function that will help describe this relationship:

p = initial probability of sustainability

1-p = complement of p; maximum amount of improvement in p

x = additional new expenditures (as a % of current earnings) to enhance sustainability

f(x) = additive amount of percentage points of improvement in p = (1-p) * x / (x + k)

k = estimated parameter; for example, 10%

g(x) = improved probability p of sustainability = p + f(x) = p + (1-p) * x / (x + k)

In our example:

p = 96%

1-p = 4%

k = 10%

Then:

f(x) = 4% * x / (x + 10%)

g(x) = 96% + 4% * x / (x + 10%)

Exhibit 3

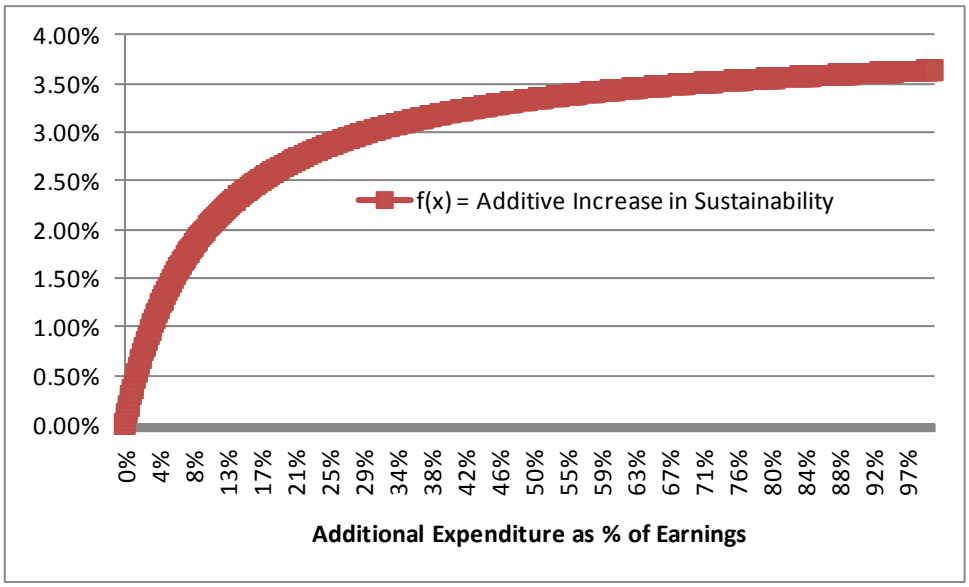
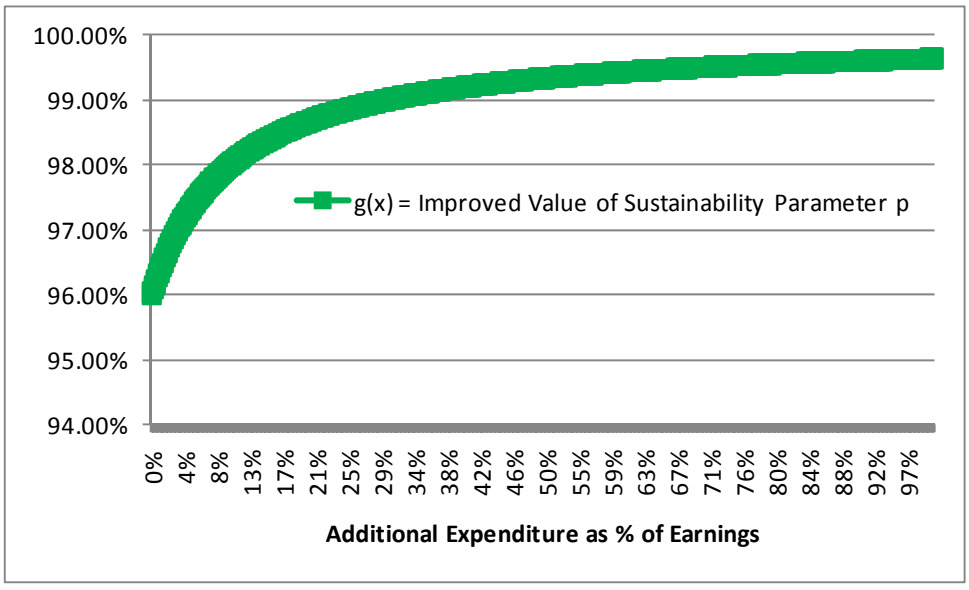


Exhibit 4



Now recall from Section 3.2 that the formula for the value of the firm depends upon earnings, growth, discount factor, and probability p of sustainability:

Value = E * p * DF / (1 – GF * p * DF)

Therefore, each choice of additional expenditure will generate not only a revised amount of earnings and a revised parameter p, but also a revised quantity for the value of the firm:

Exhibit 5

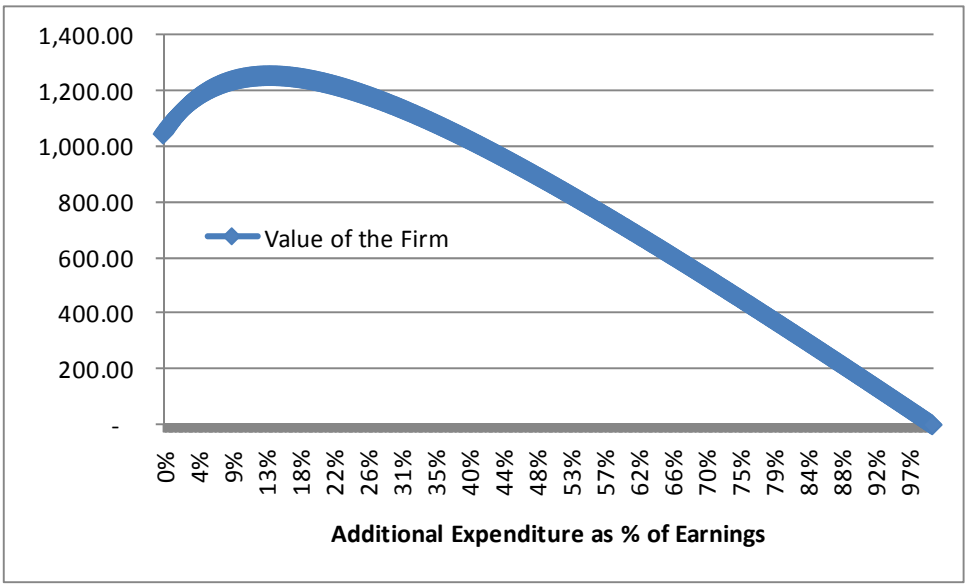


Exhibit 5 highlights that in this numerical example, choosing to increase expenditures on strategic moves would increase the value of the firm, so long as the expenditure does not consume too much of the firm's earnings. At some tipping point, however, one reaches a level such that further increases in expenditure actually reduce the value of the firm. This decrease in value occurs because the additional enhancement to sustainability is more than offset by the reduction in earnings. Yet for small and medium sized increases in expenditures, the value of the firm increases. The analysis framework allows one to calculate the optimal amount to invest in new strategic maneuvers in order to maximize the value of the firm.

4. CONCLUSIONS

A firm ought to be concerned about strategy and competitive forces. It should therefore integrate strategy considerations both when measuring holistically the firm's total risk as well

as when seeking to maximize the firm's total value. In order to do so, we introduce the framework of "sustainability of earnings"; the various strategic forces that are described qualitatively in the strategy literature can thus be quantified as sources of risk whose outcomes can be described via probabilistic models. Such an approach allows one to incorporate strategic forces into the existing framework of probabilistic enterprise risk models. It also allows one to incorporate strategic considerations when calculating the value of a business, when comparing the relative attractiveness of two different businesses, and when calculating the benefits of various strategic maneuvers.

5. REFERENCES

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