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Wealth Creation Principles

An Economic Foundation for Profitability and its Fade as Quality Risk Factors

April 2016

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Key Points:

- Numerous practitioners and academics have published evidence that high quality firms outperform lower quality firms. Definitions of quality vary widely. We have observed a similar effect using HOLT quality factors.
- We apply and extend the logic of Fama and French (2015) to show an economic foundation exists for profitability and its sustainability as quality risk factors.
- When betting on durable quality, investors are exposed to the risk that long-term profitability might be disrupted and that operating returns will fade prematurely. Investors require a premium for this duration risk. Quality is not for free.
- We build economic arguments for value, profitability, and fade as risk factors. We show that all growth is not created equal, and expose the weaknesses of asset growth as a risk factor.
- The HOLT eCAP classification is reliable and exhibits precision (high positive prediction rate) as an indicator of quality. It helps identify companies with a high level of persistent profitability (CFROI® that fades slowly).

This paper investigates the following key questions:

- What are the economic reasons for risk factors articulated in asset pricing theory?
- Is quality a justifiable risk factor?
- If so, what are its attributes?
- Is it contradictory to have a low market beta **and** a quality risk premium for quality stocks?

Introduction

Inadequacies in the Capital Asset Pricing Model (CAPM) and its single risk factor *beta* to fully explain stock returns led to the hunt for a more complete theory.

The latest thinking centers around empirical risk factors, which broke to the fore in Fama and French's seminal three-factor model published in 1993. The first factor remains systematic *market* risk (beta) with the addition of *size* and *value* risk factors. The size effect refers to small caps outperforming large caps and was discovered by Banz (1981). Ang (2014) states that this factor has largely disappeared, but it continues to survive in most risk factor models and in today's investment parlance.[1] Value refers to stocks with high book-to-price (*B/P*) outperforming stocks with low B/P. Stocks with high B/P are *value* stocks while those with low B/P are considered *growth* stocks.

Academic researchers identified stock price *momentum* as an anomaly, which led to the 1997 publication of Carhart's four-factor model. Stocks with high relative price performance over the previous six to twelve months (winners) outperform stocks whose price performance was comparatively poor over the same period (losers). It should not be possible to earn superior returns from such a simple strategy in well-functioning markets. Behavioralists cite the momentum effect as evidence that markets are inefficient (see Jegadeesh and Titman (1993)).

It is worth noting that except for market risk, each of these factors is an empirical discovery. Explanations for their relevance come in two basic flavors: economic risk or behavioral. Economic risk factors are persistent. They might vary with economic and risk appetite cycles but the risk factor has an underlying economic reason. Behavioral inefficiencies are ephemeral and should be taken advantage of immediately. They should disappear after discovery. The momentum anomaly presents a conundrum since it is well-known yet still chased by investors.[2] Momentum has been a successful

[1] Ang writes, "The past tense is appropriate here, because since the mid-1980s there has not been any significant size effect." Dimson, Marsh, and Staunton (2015) are more equivocal and state that today "the magnitude of the premium would command less attention than in the past, and would not suggest there was a major 'free lunch' from investing in small caps." Asness, Frazzini and Pedersen (2014) claim that controlling for quality resuscitates the otherwise moribund size effect. Size is still employed as a proxy factor in the HOLT discount rate model. There are periods when and regions where the market-implied premium between small and large caps diverges significantly.

[2] Dimson, Marsh, and Staunton (2015) state that "despite there being no satisfactory explanation for expecting a premium from the momentum factor, there has historically been a large momentum premium over a very long research period. However, the premium is volatile, the strategy is

feature of the HOLT Scorecard since its introduction in 2003 (the other factors are *operational quality* and *value*).[3]

Numerous practitioners and academics have published evidence that quality may be a risk factor. Fama and French (2015) recently proposed a five-factor model which adds company profitability and investment to their three-factor model. We apply and extend the logic of Fama and French to show an economic foundation exists for profitability and its sustainability as risk factors.

Stock Valuation 101 and Economic Risk Factors

An economic risk factor is one that can be explained by asset pricing theory. A simple discounted cash flow (*DCF*) valuation model can be derived for a stock with a constant return on equity *ROE*, equity growth rate g, and cost of equity r_e.

(1)
$$P = \frac{E_1(1-g/ROE_\infty)}{(r_e-g)}$$

The stock price is *P* and *E1* is next year's earnings per share. The numerator represents the free cash flow to equity providers (*FCFE*), which grows at a constant rate into perpetuity. The numerator also represents the sustainable dividend of Gordon's dividend discount model (the term g/ROE_∞ is the retention ratio). We have given *ROE* the subscript *infinity* to remind ourselves that this *ROE* is assumed to last forever – it is not simply next year's return on equity.

Instead of assuming an exogenous cost of equity and using the value drivers to calculate an intrinsic stock price, let's reverse the process. We will assume the share price accurately reflects all market knowledge and calculate the stock's expected return, designated with a capital letter, R_e. After substituting $E1 = B \times ROE$ (*B* is the opening equity book value) and a bit of algebraic juggling, we can write an expression for the stock's expected return R_e.

(2)
$$R_e = \frac{B}{P}(ROE_\infty - g) + g$$

Here's where the fun begins! We can observe the effect on the expected return by tweaking each driver while holding all other drivers constant. Let's begin with *B/P*.

Book-to-Price

First let's compare two identical companies where all the drivers are equal except *B/P*, which differs by a marginal amount of *Δ(B/P)*. Inspection of equation (2) indicates that the company with the greater *B/P* should have a greater expected return. Voila! Value should trade at a premium to growth, which is what is observed in practice, and why it is a widely recognized risk factor. Value stocks are riskier than growth stocks and command a risk premium (the high minus low *HML* factor of Fama and French).

We can test the sensitivity of a stock's expected return by taking its partial derivative with respect to *(B/P)* which we diagram in Figure 1.

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costly to implement, and as we saw in 2009, a pure winner minus loser strategy can lead to major losses from time to time, when momentum traders get whiplashed by a sharp reversal in the market." Fama and French (2015) make the rational argument that "if variables such as size and momentum help forecast returns, they must implicitly do so by improving forecasts of profitability and investment or by capturing horizon effects in the term structure of expected returns."

[3] For more on the HOLT Scorecard and HOLTfolio styles, please refer to David Rones, Richard Curry, and Greg Williamson, "HOLT Lens Scorecard and Screening", Credit Suisse HOLT Investment Strategy, March 2015.

$$\Delta R_e = (1 - g/ROE_\infty) \times \Delta\left(\frac{B}{P}\right)$$

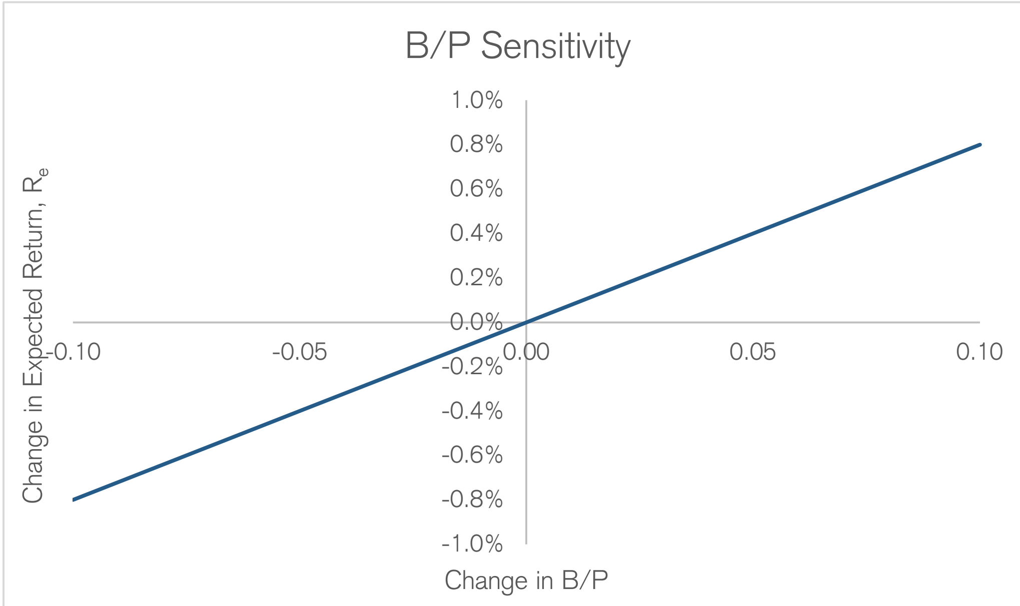

Figure 1. The sensitivity of expected return to B/P for a company where B/P = 0.5, g = 2% and ROE = 10%. An increase in B/P leads to an increase in expected return. This relationship is strictly true and implies the existence of a value risk premium.

Behavioralists argue that investors are too optimistic about growth stocks and too pessimistic about value stocks. As a result, prices overshoot and mean reversion restores balance. Risk advocates argue that value stocks are riskier because they are more exposed to financial and existential distress. We won't take sides but have shown there is an economic rationale for a value premium.

Return on Equity

Firms earning operating returns above their cost of capital are economic value creators, and cheered on to grow as long as they can earn excess returns on incremental investment.[4] Companies generating operating returns below their cost of capital are value destroyers and should curtail growth.[5] These shareholder value principles are apparent by inspection of equation (1). High and sustainable *ROE* indicates quality operating performance.

Let's compare two identical companies where all the drivers are equal except *ROE*, which differs by a marginal amount of *ΔROE*. The **magnitude** of *ROE* is an indicator of a firm's quality. Inspection of equation (2) indicates that the company with the higher *ROE* should have a higher expected return. As counter intuitive as it may initially seem, high quality should possess a premium relative to low quality. This phenomenon has been widely observed and inhabits many recent factor models although the definition of quality varies (see our report "The Measure of Quality"). Risk advocates argue that high profitability poses greater risk than low profitability due to competitive threats from firms seeking attractive profits. There is also duration risk. In other words, it is more difficult to maintain high ROE far into the future, and this implies that distant cash flows are riskier than near-term cash flows. Competition is the gravity that pulls these high flyers toward the cost of capital.

We can test the sensitivity of a stock's expected return by taking its partial derivative with respect to *ROE* which we diagram in Figure 2.

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[4] We dispense with the term *economic* when referring to value creators or value destroyers for the sake of simplicity, but it is implied throughout the paper. We distinguish between *economic value* (value creators/destroyers), which refers to residual earnings in excess of that demanded by investors, and the term *value* used in value/growth, which refers to stocks trading at high B/P.

[5] An exception can be articulated for early life cycle firms and rapidly expanding firms with lagging asset utilization. In these cases, low operating returns are expected to vastly improve. Our derivation is representative of mature firms.

$$\Delta R_e = \frac{B}{P} \times \Delta ROE_\infty$$

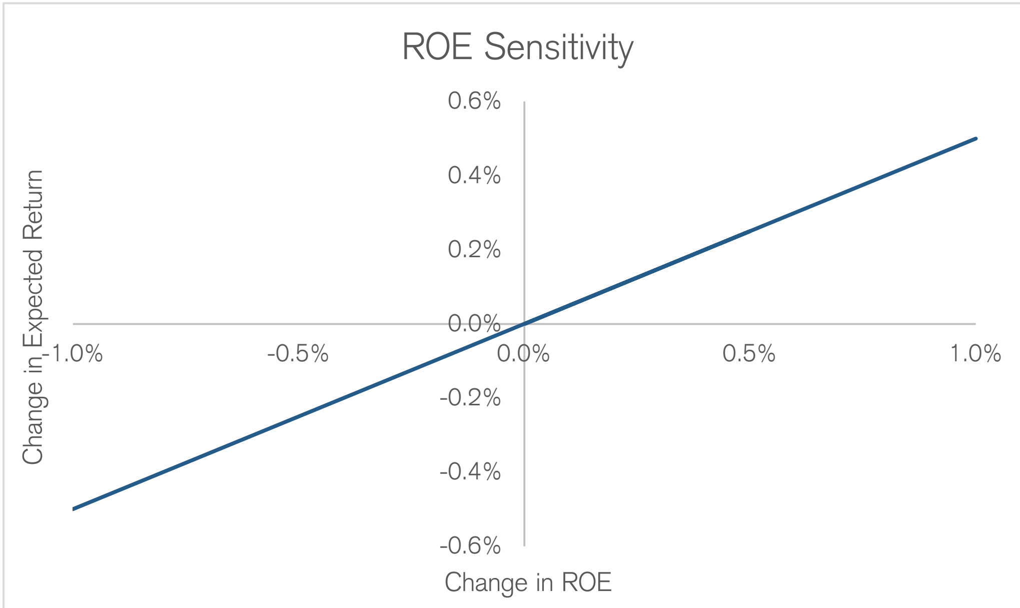

Figure 2. The sensitivity of expected return to ROE for a company where B/P = 0.5, g = 2% and ROE = 10%. An increase in ROE leads to an increase in expected return. This relationship is strictly true and implies the existence of a quality risk premium.

We've shown there is an economic reason for a quality premium but there is a subtle implication in the math that is easily overlooked. ROE is assumed to be constant forever. This is economically challenging since excess operating returns attract competitors which generally results in lower future profitability. How many high return businesses have lasted forever? The hidden attribute implicit in this formulation is that high *ROE* is sustainable. In other words, quality has the elements of operating return (level) AND sustainability (time). It is crucial that any definition of quality include both aspects. What if operating returns aren't durable and fade sharply?

Asset growth

This variable doesn't generally feature in factor risk models and for good reason – it is extremely volatile and exhibits low persistence (see "Prepared for Chance"). Asset growth makes the grade as the investment factor in the Fama-French five-factor model.[6]

The expected return equation (2) indicates that not all growth is created equal. Firms with *ROE* below the cost of equity lose value as equity growth increases. Growth only creates value when a company is generating operating returns above its cost of capital. These relationships are patently clear after reconfiguring equation (1) in terms of price-to-book.

(3) $$\frac{P}{B} = \frac{(ROE_\infty - g)}{(r_e - g)}$$

The partial derivative of equation (2) with respect to growth illustrates the dilemma for expected returns.

$$\Delta R_e = \left(1 - \frac{B}{P}\right) \Delta g$$

[6] The term *g* in equation (1) specifically refers to equity growth. In this paper, we treat asset and equity growth synonymously. Though this treatment is strictly true only when a firm's gearing D/E remains constant, we assume no loss of generality for the purposes of this paper. Because book equity growth can be noisy, Fama-French and other researchers tend to use total asset growth as a proxy for investment.

There are three growth regimes:

- *B/P* < *1* means the company is trading at a premium to its book value and an increase in growth suggests an increase in expected return. Asset growth should attract a risk premium for ‘growth’ stocks (companies with high *P/B*). Highly profitable growth is difficult to maintain.
- *B/P* = *1* means the company is trading at book, ROE equals the cost of equity, and growth has no impact. A firm that perpetually meets its cost of capital generates no additional value. Every dollar of investment returns one dollar in present value for a net present value (NPV) of zero. In a highly competitive market, this should be true of most firms.
- *B/P* > *1* indicates the company is trading at a discount to its book value and an increase in growth suggests a decrease in expected return. Asset growth is not rewarded with a risk premium for deep value companies. They should simply stop growing.

We illustrate these regimes in Figure 3. The takeaway is that asset growth is not a clear cut risk factor. Because growth isn't persistent, we would shy away from its use as a factor.

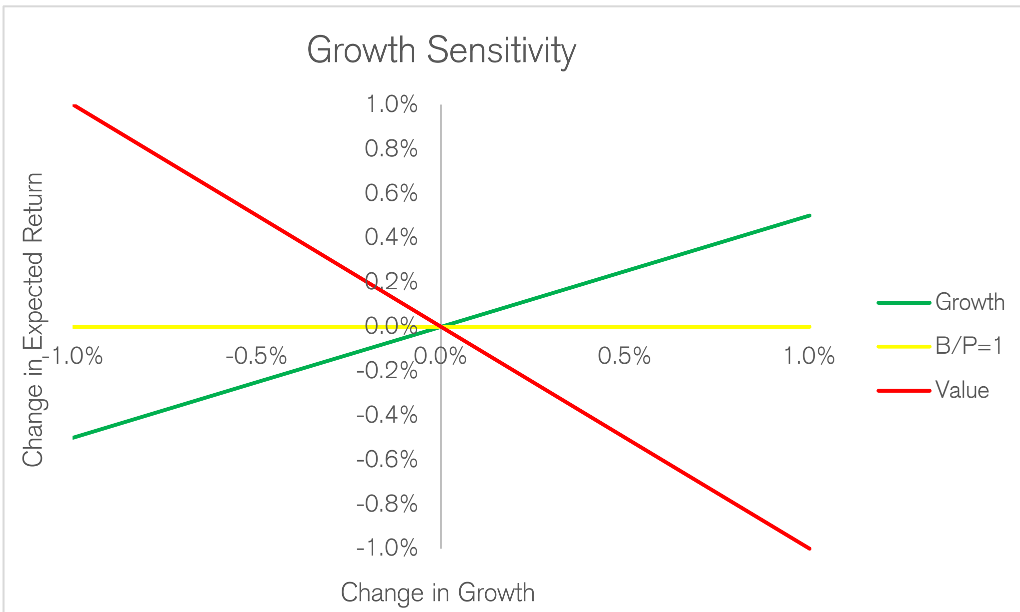

Figure 3. The sensitivity of expected return to asset growth for companies where g = 2% and B/P equals 0.5 (growth), 1.0 (value neutral) and 2.0 (value). An increase in growth leads to an increase in expected return for firms trading at a premium to book but has the opposite effect for companies trading at a discount. There is not a strict relationship between growth and an associated risk premium.

Fama and French specify an investment factor in their five-factor model that uses asset growth as a proxy. Their *CMA* risk factor stands for conservative minus aggressive and expects a risk premium for firms with low asset growth relative to high asset growth. We showed that the opposite should hold true for firms with high and resilient profitability. We will return to this point.

Factoring in Sustainability

A noteworthy feature of the HOLT valuation model is that it assumes operating returns are not perpetual and that they eventually fade to an opportunity cost of capital. This assertion is based on years of empirical research that demonstrate return on capital mean reverts (see for example “Modeling Persistence in Corporate Profits by Industry”).

In the previous section we assumed a perpetual return on equity, which is an implicit assumption in most DCF models. Let's relax this assumption and introduce an adjustable fade rate *f*. The fade driver controls the rate at which *ROE* fades to the cost of equity. A rate of 100% indicates immediate reversion, and a rate of 0% indicates no fade and perpetual excess profitability. You can think of the fade driver as a profitability attenuator. The derivation of equation (4) is shown in Appendix A.

(4) $$P = B \times \frac{(ROE_1 - g + f)}{(r_e - g + f)}$$

We were explicit about the perpetual nature of ROE_∞ in our earlier formulation, which we now relax to next year's *ROE1*. In equation (4), *ROE* fades to the cost of equity r_e at an exponential rate of *f* which is illustrated in Figure 4. Note that *P/B* equals one when *ROE* equals the cost of equity. Setting the fade rate to zero leads to the growing perpetuity formulation of equations (1) and (3).

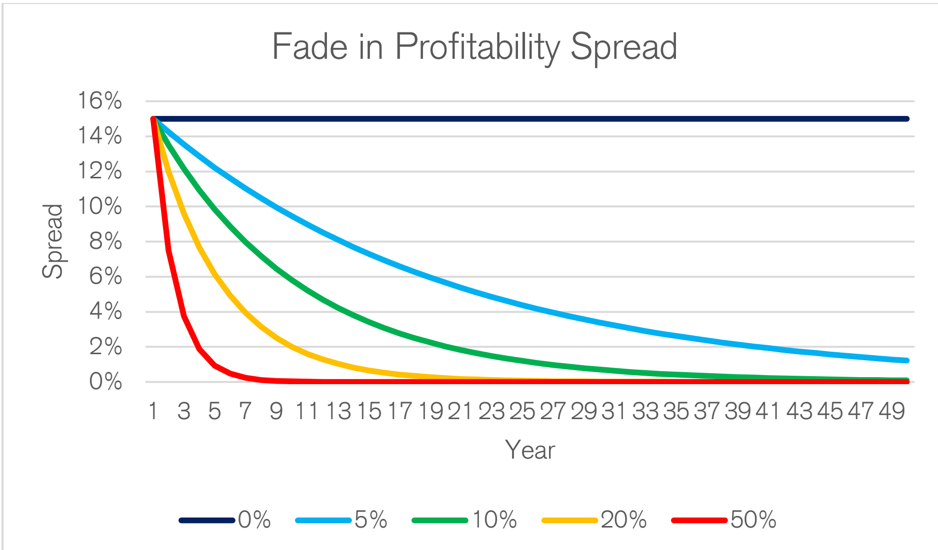

Figure 4. A starting excess spread of 15% is graphed decaying at different fade rates, e.g., ROE1 = 25% and re = 10% for a spread of 15%. A rate of 0% produces no fade and a rate of 100% would be for immediate fade.

Fade is the complement of persistence *(1 – f)*, which we've investigated at length (see "Modeling Persistence in Corporate Profits by Industry"). Corporate profitability is sticky, meaning it tends to persist. The degree of persistence varies from industry to industry. Firms in the Household & Personal Products industry exhibit strong persistence (slow fade) while Energy companies display weak persistence (quick fade). Whether explicit or not, fade is a key driver in any discounted cash flow valuation. Most DCF models include a growing perpetuity that assumes zero fade in profitability. We believe this is inaccurate and can be readily addressed by the addition of a fade driver.

We can repurpose expression (4) into the expected return for a stable company undergoing fade.

(5) $$R_e = \frac{B}{P}(ROE_1 - g + f) + g - f$$

This is a significant advance because it splits spot profitability, *ROE1*, from its sustainability, *f*. Companies with significant competitive moats exhibit slow fade while those in highly competitive industries display quick fade. Fortunately, the differential behavior of *ROE*, growth and *B/P* remain similar. The value factor *B/P* and spot quality factor *ROE1* still imply positive risk premiums. What does sustainability imply?

Fade

Exponential fade is the mirror image of compound growth. And like growth, the fade factor exhibits contingent behavior. The partial derivative of equation (5) illustrates this point.

$$\Delta R_e = \left(\frac{B}{P} - 1\right) \Delta f$$

There are three fade regimes:

- *B/P < 1* means the company is trading at a premium to its book value and an increase in fade (drop in sustainability) suggests a decrease in expected return. All things being equal, a firm that fades slowly will have a higher expected return than another that fades at a faster rate. Sustained quality is rewarded with a higher risk premium.
- *B/P = 1* means the company is trading at book and fade has no impact. A firm that perpetually meets its cost of capital generates no economic value. Every dollar of investment returns one dollar in present value for a net present value *(NPV)* of zero. In a highly competitive market, most firms should fall into this camp.
- *B/P > 1* indicates the company is trading at a discount to its book value and an increase in fade (quicker return to equilibrium) suggests an increase in expected return. Increased fade is rewarded with a risk premium for deep value companies. In other words, healthy cyclicals should earn a premium to value traps. Quality or its resuscitation is rewarded with a risk premium.

We illustrate these regimes in Figure 5. Sustainability is a critical consideration if quality is a risk factor. It is more difficult to maintain an impressive *ROE* into perpetuity than for a few years, which underscores that duration has risk. However unintuitive this may seem for elite quality companies, it has mathematical support and its analog exists in bond markets.

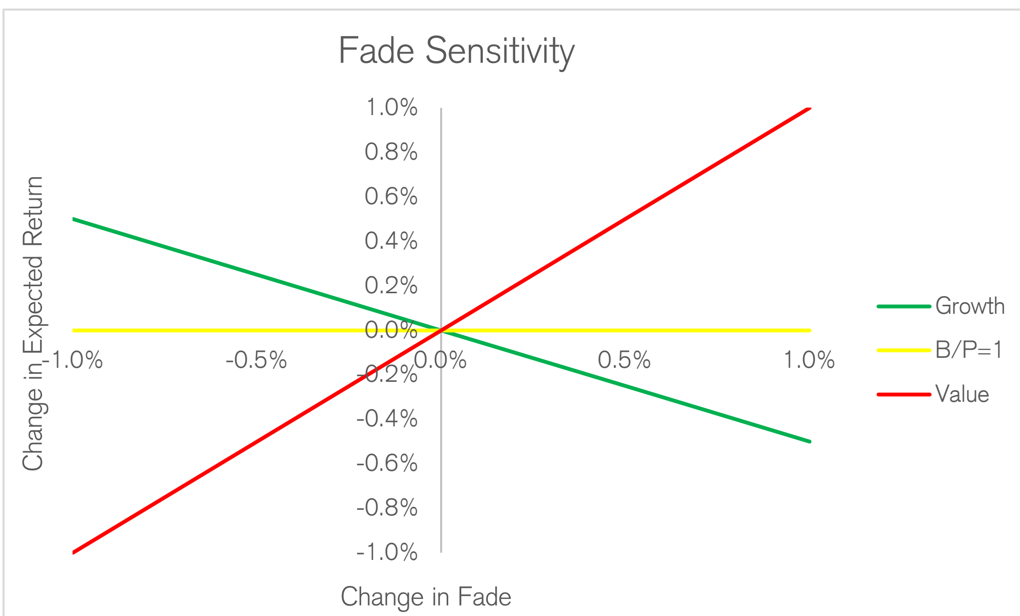

Figure 5. The sensitivity of expected return to fade rate for companies where g = 2%, f = 10%, and B/P equals 0.5 (growth), 1.0 (value neutral) and 2.0 (value). An increase in fade leads to an increase in expected return for firms trading at a discount but the opposite for companies trading at a premium. Sustainability is rewarded for value creators while rapid recovery is rewarded for value destroyers.

Implications

The introduction of a fade factor leads to profound insights which we'll separate into value and growth elements.

Value *(B/P > 1)*

The recovery of cyclical dogs gets rewarded over dire value traps. This result might seem odd, but it makes perfect sense. Value traps have operating returns that remain perpetually low and only recover slowly, if at all. In other words, they are predictably dire. Cyclical dogs that display recovery reveal hope and its associated volatility. The risk premium lies in assessing the rate of recovery. Deep value investors seeking extra juice should bet on cyclical dogs. The rub lies in insuring that cyclical dogs haven't become value traps. Because value stocks tend to be highly sensitive to market movements, we would expect the beta of systematic market risk to exceed one, which is generally observed in practice.

Growth *(B/P < 1)*

The name *growth* for low *B/P* stocks is unfortunate. A stock can trade at a vast premium to book and have low asset growth if it possesses a high and stable operating return (see equation (4) for validation). We favor splitting stocks that trade at a premium into three buckets (see "Star Performance"):

- Cash Cows possess attractive operating returns but low asset growth.
- Stars have attractive operating returns and high growth expectations.
- Question Marks are early lifecycle companies that have poor operating performance but possess healthy expectations for future growth and profitability.

Asset growth should be rewarded for growth stocks but it is volatile and lacks persistence, so we would not recommend it as a reliable risk factor.

On the other hand, profitability tends to persist and its sustainability is embedded in the fade rate. Slower fade for companies with impressive operating returns should result in a higher expected return. Quality should have an associated risk premium due to the risk from cash flow duration. But there's a gotcha lying in wait. Because quality stocks tend to be less sensitive to immediate market movements, we would expect the beta of systematic market risk to be less than one, which is generally observed in practice. How do we explain this paradox?

Here is where your head might start to hurt. How is it possible to reconcile a quality risk premium and a market beta less than one? The explanation has to do with the dual nature of quality which has both a spot (level) and time (duration) component. Profitability is sticky, so short-term market movements reveal themselves in traditional beta. When economic disaster strikes, quality stocks have safer operating returns than cyclical stocks and thus lower beta. Long-term quality requires a long-term bet that profitability will remain high. Long-term quality investors such as Warren Buffett are betting against gravity, which is not fully captured in beta. You have to be very sure that a quality firm's economic moat is built to last and is unlikely to be disrupted. The risk factor is the fade rate. The sensitivity of economic profit duration to different growth and fade rates is shown in Figure 6.[7] The duration risk of quality is particularly acute when fade is expected to be negligible and growth buoyant.

EP Duration Table (years)

		Fade			
	1.9	0%	5%	10%	50%
	0%	11.0	7.3	5.5	1.8
Growth	2%	13.8	8.4	6.0	1.9
	4%	18.3	9.8	6.7	1.9
	6%	27.5	11.8	7.5	1.9

Figure 6. The sensitivity of economic profit duration to different growth and fade rates when the cost of equity equals 10%. An increase in fade leads to a sharp deterioration in excess spread duration. Growth exacerbates the duration risk, particularly when fade is non-existent and operating returns are assumed to be perpetual.

[7] We calculated the Macauley duration of a positive economic profit stream for different rates of investment growth and excess spread $(ROE_1 - r_e)$ fade. This approach is more insightful than calculating the duration of future cash flows. The present value of future economic profits is equivalent to the *NPV* of a firm's present and future investments. The duration is the weighted-average life of the discounted economic profits: $Duration = \sum_{n=1}^{\infty} n \times PV(EP_n) / \sum_{n=1}^{\infty} PV(EP_n)$

The Way Forward

The weaknesses of ROE as a measure of profitability are well documented. Besides its sensitivity to accounting shenanigans and financial leverage, we have found it to be unreliable and a poor predictor of quality (see "The Measure of Quality"). A superior measure of operating performance is cash flow return on investment (CFROI). It has an economic foundation as a profitability measure and is reliable. CFROI can be coupled with stability tests, which we first implemented in 2006, to indicate which firms have empirical competitive advantage periods *(eCAP)*, or moats that protect profitability. These firms have an 86% probability of remaining highly profitable over subsequent five-year investment horizons.

Investment *(CMA)* as a factor is short on economic rigor and consistency. We've shown that not all growth is created equal. Although Fama and French state that all things being equal, higher book equity growth indicates lower expected returns, they do not actually hold profitability equal. The same earnings streams but different changes in equity would mean that incremental ROE differs, and thus profitability profiles are different (see Appendix B). A practical difficulty lies in separating the effects of profitability fade and asset growth. We believe it is imperative to include fade as a driver. Our eCAP methodology has a high positive prediction rate of identifying companies with high CFROI and low fade. A future report will test how the expected returns of different asset growth rates coupled with eCAP behave.

The general relationships we showed for expected return and *ROE* can be extended to return on invested capital *(ROIC)* and *CFROI* for firms with constant growth and fade rates (see Appendix C). By extension, all of the risk relationships we cited for *ROE*, growth and fade will ring true for *CFROI*, growth and fade.

- A risk premium should exist for companies with low HOLT P/B (value) relative to high HOLT P/B (growth).[8] Empirical evidence agrees. Economic P/E and HOLT P/B have been value factors in the HOLT Scorecard since 2003, e.g., companies with low HOLT P/B tend to outperform those with higher HOLT P/B.
- A risk premium should exist for companies with high and sustainable CFROI relative to low CFROI businesses. CFROI level and increase in value creation are quality factors in the HOLT Scorecard. We have presented evidence that CFROI is an excellent measure of profitability and that our eCAP methodology exhibits precision and reliability as a detector of quality (see "The Measure of Quality"). Quality has a dual nature reflected in forward CFROI and its long-term fade rate. Elite quality has a risk premium related to duration risk.
- All growth is not created equal. Value creators (CFROI exceeds cost of capital) should grow, and value destroyers should fix their businesses. It is irrelevant whether cost of capital businesses grow or contract. A general rule for asset growth is not applicable. Also, unlike profitability, growth is not persistent, which makes it unreliable.

Summary

The quality risk premium is not accidental or anomalous. Economic rationale supports profitability – or more specifically its sustainability – as a risk factor. Quality has a dual nature reflected in forward profitability and its long-term fade rate. Duration risk, which increases with lower expected fade, is a critical aspect of quality as a risk factor, and this facet is not fully captured by market beta. Quality is not for free.

CFROI is a superb measure of profitability and our eCAP methodology exhibits precision (high positive prediction rate) and reliability as a detector of quality.

[8] The HOLT P/B is defined as market enterprise value divided by inflation-adjusted net assets. Economic P/E equals HOLT P/B divided by CFROI.

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Appendix

A. <u>Intrinsic Equity Value and Fade</u>

We examined the valuation case where ROE is constant. We will relax this condition and assume that while the equity account grows at a constant rate of g, the spread of *(ROE – r_e)* decays to zero, or mean-reverts at a fade rate *f*. The *ROE* in the first forecast year is ROE_1 and the initial economic profit EP_1 is $(ROE_1 - r_e) \times B_0$ where B_0 is the opening book equity. The economic profit decays to zero when the fade rate exceeds the growth rate, eliminating the unrealistic assumption of perpetual excess returns.

$$ROE_i = (ROE_1 - r_e)(1-f)^{i-1} + r_e$$

$$EP_i = (ROE_i - r_e) \times B_{i-1} = (ROE_1 - r_e) \times (1-f)^{i-1} \times (1+g)^{i-1} \times B_0$$

$$EP_i = EP_1 \times [(1-f) \times (1+g)]^{i-1}$$

$$P = B_0 + \sum_{i=1}^{\infty} \frac{EP_1 \times [(1-f) \times (1+g)]^{i-1}}{(1+r_e)^i}$$

The last equation simply states that a firm's equity value is equal to its equity book value plus the present value of future economic profit streams (economic profit to equity providers is also known as *residual income*). This value is equivalent to the present value of future free cash flows to equity providers. When economic profits are zero, price should equal book value. Companies that earn positive economic profits should trade at a premium to book while those that produce negative economic profits should trade at a discount to book. The present value of future economic profits is equivalent to the net present value *(NPV)* of the firm's existing and future projects.

The price equation has the exact form of a growing perpetuity! Fade is essentially *negative* growth. The analytical solution is simply:

$$P = B_0 + \frac{EP_1}{[r_e - (1+g)(1-f) + 1]} \cong B_0 + \frac{EP_1}{[r_e - g + f]}$$

For our purposes, the term *(1 + g)(1 – f)* can be approximated by *(1 + g – f)* which simplifies the math for intrinsic price and expected return.

$$P = B \times \frac{(ROE_1 - g + f)}{(r_e - g + f)}$$

$$R_e = \frac{B}{P}(ROE_1 - g + f) + g - f$$

The introduction of a fade driver makes these relationships far more realistic and useable. We can easily extend our treatment to *ROIC* and *CFROI*.

B. Investment *CMA* as a Risk Factor

Fama and French (2015) include investment as a risk factor in their five-factor model. The rationale appears to be straight-forward but in fact, profitability does not remain equal. They start with the DCF equation for the market value of a firm's stock price M_t.

$$\frac{M_t}{B_t} = \frac{1}{B_t}\sum_{\tau=1}^{\infty}\frac{E[Y_{t+\tau} - dB_{t+\tau}]}{(1+r)^{\tau}}$$

This equation should be instantly recognizable albeit with a few more letters and subscripts. The numerator represents the expected *E[…]* value of earnings *Y* minus the change in book equity *dB*. The left-hand side is the price-to-book ratio at time *t* (which we set to zero in our derivations). Fama and French write that "for fixed values of B_t, M_t, and expected earnings, higher expected growth in book equity – investment – implies a lower expected return." This is defined as the conservative minus aggressive (*CMA*) risk premium.

Our issue with this formulation is that expected earnings might remain fixed, but profitability differs. Higher expected growth in book equity means that the incremental return on equity is relatively lower. In other words, profitability is fading faster despite all things being equal except equity growth. Thus growth and fade are being mixed up and confused, which detracts from the economic rationale for *CMA* as a risk factor. We believe it is more insightful to specify profitability *(ROE)* and its fade as drivers along with growth. If we were to reformulate Fama and French's test, we would recommend the expression:

$$\frac{M_t}{B_t} = \frac{1}{B_t}\sum_{\tau=1}^{\infty}\frac{E\left[Y_{t+\tau}\left(1 - \frac{g_{t+\tau}}{ROE_{t+\tau}}\right)\right]}{(1+r)^{\tau}}$$

The parameters are book-to-market, equity growth and *ROE*. Expected earnings are an output based on the beginning book equity, equity growth series and *ROE* series. Expected earnings are not a driver. Fade is embedded in the behavior of the *ROE* series.

C. Expected Return for Capital Providers

The intrinsic enterprise value and return to all capital providers can be derived by replacing book equity with invested capital, and *ROE* by return on invested capital *(ROIC)*. In this case, growth refers to growth in invested capital and fade is for the decay of *ROIC* to the weighted-average cost of capital *(WACC)*.

$$R = \frac{Invested\ capital}{Enterprise\ value}(ROIC_1 - g + f) + g - f$$

The expected return *R* is to all capital providers. The starting $ROIC_1$ fades at a constant rate of f while invested capital grows at a constant rate of g.

Because *CFROI* is measured relative to inflation-adjusted gross investment *(IAGI)*, the measure of book-to-price is more complicated and requires adding back inflation-adjusted accumulated depreciation to enterprise value. To be exact, the beginning of year CFROI should be calculated and include an economic depreciation based on the cost of capital. This introduces a circularity. The approximation below is close enough for our purposes. The expected return is to all capital providers.

$$R = \frac{IAGI}{Gross\ enterprise\ value}(CFROI_1 - g + f) + g - f$$

The general behavior of profitability, growth and fade remains the same. What matters in practice is the reliability of each profitability measure. CFROI is the most robust metric.

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