Accounting-based Estimates of the Cost of Capital: A Third Way

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Abstract

This paper offers an approach for estimating the cost of capital from observed accounting information and compares the resulting estimates to so-called implied cost of capital (ICC) calculations and those from asset pricing models. The approach is based on two ideas. First, buying expected earnings growth is risky; thus, any variable that predicts expected earnings growth that is at risk of not being realized is potentially an indicator of the cost of capital. Second, accounting principles induce earnings growth that ties to risk; thus, an accounting number generated under these principles potentially indicates of the cost of capital. The paper combines such numbers into a cost-of-capital estimate. The estimates perform well in validation tests, in contrast to the alternatives that are the current standards.

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1. Introduction

Considerable research in finance is devoted to developing models that deliver a measure of the cost of capital (otherwise called the expected return, the discount rate, or the required return). While the structure of no-arbitrage asset pricing models is understood as a matter of theory, the endeavor has been frustrated by difficulties in identifying common factors, the risk premiums for these factors, and the sensitivities of asset returns to the factors. In response, accounting information has been brought to the task. One approach estimates the so-called implied cost of capital (ICC) as the internal rate of return that reconciles current price to earnings forecasts and a long-term growth rate. A second approach imputes the estimate from models that make assumptions about the evolution of accounting numbers and their connection to prices. This paper proposes a third accounting-based approach and compares the approach to the alternatives.

The approach is based on two ideas. First, as in Penman, Reggiani, Richardson, and Tuna (2015), the expected return can be expressed in terms of the expected earnings yield and expected earnings growth. Second, expected earnings growth is at risk under accounting principles. Accordingly, buying earnings growth is risky and accounting numbers generated under these accounting principles indicate that risk and the associated expected return. Such numbers have been identified in Penman and Zhu (2014) as exhibiting the prescribed properties, and Penman and Yehuda (2015) show further that these accounting variables are contemporaneously priced in the market as the "discount-rate news" in the Campbell (1991) return decomposition.

This paper picks up where these papers left off. It applies a formal process for identifying relevant accounting variables, and then combines them into a cost-of-capital (expected return) estimate. The identified variables are selected by satisfying the following requirements. First, they connect *a priori* to earnings growth and risk under accounting principles. Second, they not only predict earnings growth empirically but also indicate the risk that growth will not be realized. Third, they predict stock returns. The resultant cost-of-capital estimate is out of sample, and demonstrably exhibits these same empirical properties out-of-sample.

The paper then compares the estimate to alternatives, including ICC estimates and those from asset pricing models. The comparison is based on out-of-sample prediction of forward returns and the risk in those returns rather than in-sample goodness-of-fit criteria. Out-of-sample forward returns are, of course, those that investors are interested in. Our estimate satisfies these validation tests while the alternatives largely fail.

We find that the relevant accounting information is not incorporated in ICC estimates. Growth expectations enter into the ICC, but we show both analytically and empirically how the ICC calculation fails to capture the associated risk. While ICC estimates have had difficulty it predicting returns, our estimates robustly do so.

Cost-of-capital estimates from the Capital Asset Pricing Model (CAPM), implemented with historical betas, have little relation to our estimates, nor do they predict actual returns. However, our estimates predict forward betas, so the ability of CAPM estimates to predict actual returns improves with updated beta estimates implied by the accounting information.

In the parlance of asset pricing, our cost-of-capital estimates are based on "characteristics" rather than "factors." As it turns out, the Fama and French (1993) three-factor model and Fama and French (2015a) five-factor extension incorporate some of the information we identify as important, as does the investment model in Hou, Xue, and Zhang (2015a). However, in the construction of "factor-mimicking portfolios" and the estimation of sensitivities to those factors, this information is packaged in such a way to produce expected-return estimates that correspond little to ours and which fail to validate against actual realized returns. We do find that the sensitivity of returns to the Fama and French book-to-price factor is increasing in our cost-of-capital estimate (as our analysis predicts it should), as does sensitivity (beta) to the market factor. However, sensitivity to the other factors in the five-factor model and the Hou, Xue, and Zhang (2015a) model vary little with our cost-of-capital estimate, even though those factors are nominally based on similar accounting information. Our estimates indicate expected returns that are not explained by these pricing models, and the amount of unexplained expected return is increasing with our cost-of-capital estimate.

1.1 Accounting-Based Approaches: ICC

The ICC approach warrants particular attention because it is applied extensively in accounting research to answer the question: What is the effect of X on the cost-of-capital? (where X can be accounting methods, disclosure, auditing, regulations, corporate governance mechanisms, and more). The ICC has also been applied to validate asset pricing models, in Hou, Xue, and Zhang (2015b), for example. The approach is applied in Claus and Thomas (2001), Gebhardt, Lee, and Swaminathan (2001), Easton, Taylor, Shroff, and Sougiannis (2002), Easton (2004), and Gode and Monhanram (2003), to name just a few.[1] By and large, the approach has not been particularly successful in validation tests, though more recent papers that add refinements show some improvement.[2] Most strikingly, the research has had difficulty in predicting average returns, a

[1] For review and evaluation of this research, see Easton and Mohanran (2005, 2016), Botosan and Plumlee (2005), Easton (2007), Botosan, Plumlee, and Wen (2011), and Echterling, Eierle, and Ketterer (2015).

[2] See, for example, Huang, Natarajan, and Radhakrishnan (2006), Nekrasov and Ogneva (2011), Hou, van Dijk, and Zhang (2012), Larocque (2013), Mohanram and Gode (2013), Ashton and Wang (2013), Fitzgerald, Gray, Hall, and Jeyaraj (2013), Lee, So, and Wang (2015), and Li and Monhanram (2014).

property required of a valid estimate.[3] This is quite remarkable given that many accounting numbers (with less pretense to being the expected return) readily predict returns (and robustly so), for example, earnings-to-price (E/P), book-to-price (B/P), accruals, and asset growth.

Our approach differs from ICC estimation in the seven ways.

First, the cost of capital is inferred from accounting observables (in the present) rather than analysts' forecasts and/or assumptions about future growth rates. Analysts' forecasts, said to be subject to behavioral biases, have proven to be a frustration in estimating the ICC.[4]

Second, in contrast to many ICC papers that specify the same growth rate for all firms, expected growth varies over firms. Thus observables that indicate the cost of capital do so because they indicate variation in growth rates in the cross section.

Third, growth connects to risk. Rather than viewing the cost of capital, r, and the growth rate, g, as separate inputs in estimating the ICC, our approach incorporates the idea, advanced in Ohlson (2008) and Penman and Reggiani (2013) and supported by the evidence, that r and g are related: Higher expected growth implies higher risk on average. In the typical reverse engineering exercise that elicits the ICC, $r - g$ is an input in the so-called "terminal value" of the valuation model assumed for the purpose. An increase in g with no effect on r has quite different implications for price (from which the ICC is inferred) than a corresponding increase in g that leaves $r - g$ (and price) unchanged because r increases along with g. While some ICC papers (like Easton, Taylor, Shroff, and Sougiannis, 2002, and Nekrasov and Ogneva, 2011) allow for variation of growth rates in estimating the ICC, our approach connects that variation to risk and

[3] See Easton and Monahan (2005 and 2016), Guay, Kothari, and Shu (2011), and Botosan, Plumlee, and Wen (2011), for example.

[4] Hou, van Dijk, and Zhang (2012) substitute forecasts based on accounting observables for analysts' forecasts but maintain assumptions on growth rates for the long run.

the cost of capital. Thus, it renders quite different cost of capital estimates to these papers that estimate *r* and *g* jointly as separable inputs.

Fourth, the approach embeds accounting principles that govern the recognition of earnings and tie expected earnings growth to risk. Accounting numbers that indicate the cost of capital (in the first point above) are identified as numbers that indicate risky growth expectations, both as a matter of accounting principle and with empirical support to that effect.

Fifth, while the ICC is estimated as a constant over all future time—a feature that is inconsistent with no-arbitrage if the cost of capital is time-varying—the estimation is amenable to predicting changes over time.

Sixth, while the ICC has a circularity problem—estimates that employ price cannot be used in valuations to challenge the price—our estimates, estimated and validated out of sample, can be applied in equity analysis.

Seventh, the resulting cost of capital estimates predict returns robustly out of sample and exhibit other characteristics typically associated with risk.

The key conceptual points that differentiate our approach from the ICC are the *third* point that ties growth to risk and the recognition of the accounting principles that make the tie in the *fourth* point. To sharpen the comparison of the approaches, the paper estimates the ICC and growth rates under the Easton, Taylor, Shroff, and Sougiannis (2002) procedures and finds that, not only do the cost of capital estimates differ significantly from ours, but the implied growth rates that are jointly estimated bear little resemblance to the expected growth that indicates risk and which is at the core of our approach. The procedures in Gebhardt, Lee, and Swaminathan (2001) handle growth differently but the resultant cost-of-capital estimates also have little correspondence with ours. That said, we do not carry out a comprehensive comparison against all ICC measures, but many of these assume a constant growth rate over firms.

1.2 Accounting Based Approaches: Estimates from Parametric Accounting Models

A second accounting-based approach attempts to add the necessary accounting structure by assuming, in addition to clean-surplus accounting, a parametric process that governs the evolution of earnings. Assumed fixed parameters project future earnings from current earnings and book values, and also imbed the discount rate (cost of capital). As prices are based on expectations of future earnings with a discount for risk, the parameters also connect earnings and book values to prices. Accordingly, the discount rate (the cost of capital) is implied by observed accounting numbers, prices, and estimates of the parameters.

In this vein, Lyle, Callen, and Elliott (2013) assume the Ohlson (1995) "unbiased accounting" with autoregressive accounting dynamics to yield an expression for the cost of capital, with parameters estimated in sample then applied out of sample to produce cost of capital estimates. Christodoulou, Clubb, and McLeay (2016) apply similar dynamics but without incorporating prices. Lyle and Wang (2015) embrace the Voulteenaho (2002) tautology to describe the expected return in terms of log book-to-price and expected log book return on equity (ROE) and then assume that log ROE evolves under an AR(1) parameter such that ROE is expected to equal the cost of capital in the long run (and thus market values equals book value in expectation). The cost of capital for future periods is then estimated by applying the parameter estimate to observed book-to-price and ROE. Chattopadyhay, Lyle, and Wang (2015) apply a similar framework but allow expected ROE and the cost of capital to differ by a constant in the long run (with book-to-market correspondingly different from 1.0 in expectation).

These approaches are based on observables rather than forecasts and allow for a changing cost of capital. Thus, like the *first* and *fifth* points above, they contrast with the ICC approach. And, like the *seventh* point, the estimated cost of capital does predict returns. However, the papers are not in accord with the accounting they employ. The Voulteenaho (2002) tautology introduces book-to-price and ROE in log form but, while Ohlson (1995) shows that GAAP book values and earnings honor the Miller and Modigliani (1961) dividend irrelevance property so foundational to valuation theory, this property is violated in log form; the evolution of log book-to-market and log ROE is determined by payout. Further, the assumed parameterization is critical. Though not often recognized, the parameters imbed accounting principles for measuring earnings, but there is no explanation of the type of accounting implicitly assumed and how it reveals risk. Nor is there an explanation that the accounting is representative of GAAP accounting used in the estimation.[5]

As Feltham and Ohlson (1995) demonstrate, conservative accounting yields expected growth, the feature in the *second* and *third* points above that distinguish our approach from ICC estimation and also from these papers. An autoregressive assumption implies that, for the typical case of price greater than book value, the premium of price relative to book value declines over time. However, expected earnings growth (over that from retention) implies an increase in premiums, as shown in Penman, Reggiani, Richardson, and Tuna (2015). It is the accommodation of growth and its connection to risk in the *second* and *third* points that thus distinguishes our paper from these papers as well as the ICC approach. In addition, the *fourth* point connects GAAP accounting to growth and risk. Rather than governed by an assumed fixed

[5] The autoregressive assumptions is usually explained by “the forces of competition” that are said to drive book rates of return towards the cost of capital overtime, but there is no explicit recognition of the accounting that also determines the book rate of return.

parameter, the accounting evolves over time with the resolution of risky growth expectations, and it is this process that produces numbers that inform about the expected return.[6]

We contrast our approach with the parametric approaches here to be comprehensive, but do not compare the estimates empirically in this paper. That is partly done in Penman and Yehuda (2015) where the comparison is to the papers that assume the Voulteenaho (2002) model with an autoregressive assumptions: Those papers produce expected return estimates that are at variance with consistency conditions required of a valid expected-return estimate. We do note, however, that Lyle, Callen, and Elliott (2013) estimates of expected returns incorporate some of the accounting variables underlying our estimate (though for different reasons) and are significantly associated with actual future returns out of sample.

1.3 A Caveat

Before proceeding we bring the standard *caveat*. In estimating the cost of capital, we employ observed stock prices and validate against observed returns. Thus, we assume that market prices are set efficiently to yield expected returns commensurate with risk, the assumption under which most empirical analysis in asset pricing proceeds, as do the aforementioned accounting approaches.

As we pool data over a large set of firms and a long time period, it is only required that prices are efficient on average. Further, our analysis explicitly connects expected returns to risk and supplies validation with the data; observables that indicate the expected return connect to risk *a priori*, and the resulting cost-of-capital estimates are empirically associated with pricing and fundamental (non-price) features that one identifies with risk.

[6] That said, our approach does not provide an explicit relation between accounting numbers and returns, an admirable feature of these papers. On the other hand, that relation is by assumption and it is this assumption that is at issue. Penman (2016) provides a detailed critique of the parametric approaches.

That said, without a benchmark of the "true" cost of capital, we in no way close the market efficiency debate. One cannot deny alternative behavioral explanations for our findings without further tests against those alternatives. The *caveat* remains: Despite evidence to the contrary, we could be picking up expected returns due to mispricing. Nevertheless, the estimates of expected returns that we produce are based on actual investor experience over many years. They are persistently observed, indicating they are returns that investors should expect. If they are persistent "abnormal returns," then we have documented persistent mispricing, but we have also documented that the so-called "abnormal returns" come with risk, bearing a further *caveat*.

2. The Third Way

We turn the approach for estimating the ICC around: Rather than estimating an ICC from current prices and earnings forecasts and then asking (for validation) whether that estimate predicts stock returns, we estimate the cost of capital by predicting stock returns directly. Validation is then established out of sample. In a large sample representative of ex ante expectations, those returns are, of average, the expected return to investing at the price that is the input to the ICC calculation. They are also returns associated with the realization of the (analysts') earnings forecasts input to the ICC and thus, on average, the returns indicated by those expectations if they were unbiased.

However, the accounting observables that predict those returns are identified, not by data dredging to "see what works," but under organizing principles that connect the accounting numbers to risk and the expected return.

2.1 Organizing Principles

The first organizing principle is from the framework of Penman, Reggiani, Richardson, and Tuna (2015) that explicitly connects the expected stock returns to accounting numbers: Given clean-surplus accounting, the expected stock return for the forward year is given by the forward earnings yield plus the price-denominated expected change in the premium of price over book value during the forward year. That premium, in turn, is driven by expected earnings growth. The benchmark case is that of no-growth where the expected change in premium is zero and the expected return is equal to the expected earnings yield. Growth (over normal growth from retention) implies an increase in the premium. Thus, any variable the predicts forward earnings and subsequent earnings growth that investors deem to be at risk will capture the discount in price for that risk and accordingly will indicate the expected return (the cost of capital). Penman (2016) elaborates and the appendix to Penman, Reggiani, Richardson, and Tuna (2015) demonstrates with examples.

The second organizing principle concerns the accounting that connects growth to risk. To introduce the ideas, consider the book-to-price ratio (B/P) that features so prominently in asset pricing models. A (presumably riskless) U.S. government bond fund has B/P = 1: One trades in and out of the fund at book value (NAV). However a risky equity fund also has B/P = 1, so B/P cannot differentiate risk and return in this case. The reason is the accounting: Mark-to-market accounting (or fair value accounting, more generally) takes away the ability of B/P to indicate risk. So, if B/P has anything to do with risk and the expected return in the more typical case of B/P ≠ 1, it might have something to do with accounting that departs from fair value accounting.

The alternative accounting to fair value accounting is so-called historical cost accounting which, apart from investment funds and some financial assets and liabilities, is pervasive. An accounting principle, the so-called realization principle, drives historical cost accounting and connects accounting numbers to risk and potentially the cost of capital: Book value increases with the recognition of earnings but, under uncertainty, the recognition of earnings is deferred until the uncertainty is resolved. Thus, the delay in the recognition of earnings that are expected in the stock price indicates earnings at risk (of not being realized) while realized earnings reflect risk that has been resolved.

The principle is applied in recognizing revenues only when the uncertainty about receiving cash is largely resolved—usually on making a "realized" sale with an enforceable receivable. In asset pricing terms, earnings are recognized only when the firm can book a low-beta asset, cash or a near-cash (discounted) receivable. Until that point, revenue recognition is deferred as higher beta, an expectation at risk of not being realized (the customer may not materialize. Deferred earnings amount to expected earnings growth and the accounting thus connects that growth to risk.

A second accounting principle reinforces the connection: Under so-called (unconditional) conservatism, assets are not booked (to book value) when earnings from the investments are particularly uncertain; rather they are expensed against earnings immediately. R&D, advertising, and promotion (brand building) are the classic examples, but the accounting is pervasive, applied to investment to develop supply chains and distribution chains, employee training and retention, software development, start-up and organization costs, and more. Conditional conservatism—writing down booked assets on lowered expectations but refusing to recognize anticipated gains until realized—reinforces this accounting upon arrival of updating information. The consequence of this accounting is to reduce current earnings and induce higher subsequent earnings (growth) that now attracts no expense amortization. But that growth, too, is tied to risk: The investments are expensed because of uncertainty about outcomes.[7] In contrast, investment that is booked to

[7] The accounting is explicitly tied to risk (or "the uncertainty of future benefits") in FASB Statement No. 2 and IAS 38 on R&D accounting and IAS 37 on the recognition of contingent assets and liabilities.

the balance sheet (and does not reduce earnings) are deemed to be of lower risk; in contrast to R&D, inventory and plant investments are made with a saleable product in view.

This characterization is not conjecture; it is a description of how accounting works—subject to judgement and earnings management, to be sure—that is familiar to a student in a beginning "Accounting Principles" course. There is no imperative that the risk recognized by the accounting principles is priced risk, of course. However, intuition suggests that stocks with realization expected in the more distant future are more sensitive to shocks to the risk premiums. Indeed, Chen (2016) takes this point to develop a consumption-based pricing model where expected growth is priced with a higher expected return. The connection of the two accounting principles to risk and the expected return has also been documented empirically. On the first accounting principle, Penman and Reggiani (2013) find that the deferral of earnings recognition (and the consequent higher expected earnings growth) forecasts how realized earnings differ from expectation, and that risk is reflected in cross-sectional differences in stock returns. On the second principle, Penman and Zhang (2015) document that conservative accounting also predicts both cross-sectional differences in returns and the risk of realizing earnings. Ketterer, Eierle, and Tsalavoutas (2016) find that, adjusting growth rates with the conservative accounting measures in Penman and Zhang (2015), yields substantially different ICC from those calculated with the same growth rate for all firms.

The application of these two organizing principles can be illustrated with a simple valuation model with a constant cost of capital, *r*, and constant growth rate, *g*. Given full payout, the valuation,

$$P_t = \frac{E_t(Earnings_{t+1})}{r - g}$$

(with positive $E_t(Earnings_{t+1})$) is equivalent to a discounted dividend valuation, the no-arbitrage valuation (for a constant r) that is the foundation for all equity valuation.[8] Thus,

$$\frac{E_t(Earnings_{t+1})}{P_t} = r - g\ .$$

In the case of no expected growth, $r = \frac{E_t(Earnings_{t+1})}{P_t}$, the benchmark case in Penman, Reggiani, Richardson, and Tuna (2015). The standard view is that expected growth, g, adds to price and thus decreases the E/P ratio (and increases the P/E ratio). But, that is only so if r is held constant while g varies. If r increases with g, one for one, $r - g$ does not change, nor does price; expected growth is discounted in the price because it is risky. More generally, the first organizing principle recognizes that E/P is not solely based on expected earnings growth, but also on the risk that the expected growth may not be realized.

The second organizing principle concerns the accounting for $Earnings_{t+1}$ in this model: The deferral of earnings recognition and expensing risky investments reduces $Earnings_{t+1}$. For a given P_t that embeds an expectation of total life-long earnings (for both t+1 and after), lower $Earnings_{t+1}$ implies higher subsequent earnings and, on the lower base of $Earnings_{t+1}$, higher earnings growth, g, in the denominator. If the growth so induced is pure accounting noise—it's just accounting!—there is no effect on price or r. If the added growth pertains to positive-NPV growth, the growth adds to price. However, if the growth from earnings deferral is tied to risk, the growth adds to r rather than price. If so, a higher g implies a higher r.

[8] The full payout assumption is unimportant. Payout (retention) other than full payout adds to earnings growth, g, but does not add value under M&M conditions. The valuation isolates the growth that potentially affects price and the expected return, r, and at the same time is M&M consistent. A constant cost of capital is, of course, objectionable if no-arbitrage is implied, but the model here is just for illustration. Our approach lends itself to estimating changing r.

Thus, a given E/P ratio, $\frac{E_t(Earnings_{t+1})}{P_t} = r - g$, can involve a high *r* with a high *g* or a low *r* with a low *g*, and the investor is left with the task of finding information that discriminates. The accounting that connects risk to growth has the potential to supply that information. A matrix of nested portfolios in Exhibit 1 below illustrates how the relevant information might be elicited. First, form portfolios on E/P ratios in the cross-section such that firms in each portfolio have the same E/P and thus the same $r - g$. Second, identify information which indicates earnings growth under the accounting principle that connects that growth to risk. Third, within each E/P portfolio, further sort firms into portfolios based on that information. Exhibit 1 displays a 5 × 5 set of portfolios formed along these lines.

Exhibit 1. A Portfolio Formation Scheme that Identifies Expected Earnings Growth, *g*, that is Related to Risk and the Cost of Capital, *r*.

Accounting Indicators of g		***LOW E/P***	***2***	***3***	***4***	***HIGH E/P***
	E/P = *r* − *g*	-17.5	1.3	5.6	8.3	12.3
	LOW g	*Low r*	*Low r*	*Low r*	*Low r*	*Low r*
	2	↓	↓	↓	↓	↓
	3	↓	↓	↓	↓	↓
	4	↓	↓	↓	↓	↓
	HIGH g	*High r*	*High r*	*High r*	*High r*	*High r*

The top row of the exhibit gives the mean E/P ratios for five portfolios formed by ranking firms on their E/P ratios. (These are actual mean trailing E/P ratios for U.S. traded stocks from rankings every year, 1963-2012). As E/P is determined partly by *r* (and strictly so in the no-growth case), these portfolios may indicate differential *r*, as the evidence indeed suggests.[9] However, expected earnings growth also affects the E/P ratio. So, a vector of accounting variables is identified that forecasts growth that connects to risk under accounting principles. Firms are then sorted within E/P portfolios on this vector into five portfolios (down columns). With $\frac{E_t(Earnings_{t+1})}{P_t} = r - g$ held constant in a given E/P portfolio, the information that sorts on *g* is necessarily also a sort of firms on *r* (from low to high, as indicated in the matrix) if the accounting captures priced risk.

2.2 Identifying Indicators of the Cost of Capital

The identification of the vector requires that relevant accounting observables are

(i) those that *a priori* indicate growth after t+1 that is at risk under accounting principles,

(ii) are then confirmed empirically to predict that growth and the risk surrounding it, and

(iii) are also confirmed to predict returns, and in the same direction as they predict growth.

The requirement that variables predict growth and returns in the same direction is a consistency condition: A variable that predicts higher (lower) returns must predict higher (lower) growth if it is to convey risk under accounting principles. For this study, we limit the predictions to growth in t+2, although growth over a longer period could be entertained. We stress that this was a preset program for addressing the data with the output then applied out of sample. This relieves concerns about data dredging. Some variables were prompted by reported anomalies in the

[9] Considerable research, beginning with Basu (1977) shows that E/P predicts subsequent stock returns.

literature (many of which come from data mining), but had to satisfy requirements (i) and (ii) before reaching stage (iii) testing.

To lead the selection of variables, we begin with book-to-price (B/P). This is a natural starting point, for two reasons. First, earnings in the E/P ratio is the bottom-line number in the income statement, and book value in B/P is the bottom-line (equity) number in the balance sheet. Thus the implication of using these two aggregates is considered before a more detailed analysis of their line-item components. Second (and more substantively), adding book value to earnings captures the accounting principle that connects growth to risk. $E/P \times P/B = E/B \equiv ROE$ (approximately).[10] Thus, with reference to Exhibit 1, a ranking (down columns) on B/P for a given E/P is an inverse ranking on ROE (return on equity), and ROE is affected by conservative accounting.[11] Under that accounting, an increase in risky investment deterministically reduces earnings and ROE (due to the immediate expensing) and increases expected earnings growth. Further, with the investment now omitted from the balance sheet, the accounting yields high ROE subsequently *if* earnings from the risky investment are realized (on a low book value base). The *if* implies that the expected earnings growth is at risk, and the removal of the *if* on realization implies the resolution of risk. In short, the accounting introduces a negative relation between ROE and growth, induced by the accountant's response to risk.

Accordingly, for a given E/P, a ranking on ROE down columns in Exhibit 1 (and a corresponding ranking on B/P) identifies E/P ratios associated with low ROE where the earnings in the E/P are reduced by deferrals and the expensing of investment, yielding higher *g* and

[10] The "approximate" qualification is because ROE is usually calculated on beginning (or average) book value for a period whereas B/P involves end-of-period book value.

[11] Feltham and Ohlson (1995) and Zhang (2000) model the effect of conservative accounting on ROE and growth, albeit with no implication for risk or the cost of capital.

corresponding higher r if the risk identified by the accounting is priced risk. These E/P ratios are distinguished from those associated with high ROE that result from the realization of earnings from risky investments, implying lower risk and lower r and g. Penman and Zhang (2015) elaborate and introduce measures of the effect of conservative accounting on ROE to show that, for a given E/P, ROE is negatively related, not only to subsequent earnings growth in satisfaction of requirement (ii), but also to the risk that the growth may not being realized. Further, ROE is also negatively related to average returns in satisfaction of requirement (iii). Penman, Reggani, Richardson, and Tuna (2015) report similar findings with B/P and thus explain, in part, the celebrated B/P effect in stock returns that is the basis for the Fama and French (1993) asset pricing model that has risen to prominence.

Further accounting variables, A_j, $j = 3,\ldots, K$, involving more refined accounting information are selected under requirement (i), and are then confirmed to predict growth and returns in the following regressions, in satisfaction of requirements (ii) and (iii):

$$\frac{\Delta Earnings^{a}_{t+2} \times 2}{\left|Earnings^{a}_{t+2}\right| + \left|Earnings_{t+1}\right|} = \alpha + \beta_1 \frac{E_t(Earnings_{t+1})}{P_t} + \beta_2 \frac{B_t}{P_t} + \sum_{j=3}^{K} \beta_j A_j + u_{t+2} \qquad (1)$$

$$R_{t+1} = a + b_1 \frac{E_t(Earnings_{t+1})}{P_t} + b_2 \frac{B_t}{P_t} + \sum_{j=3}^{K} b_j A_j + \varepsilon_{t+1} \qquad (2)$$

Earnings and prices are per share, and $Earnings^{a}_{t+2} = Earnings_{t+2} + (r_{ft+2} \times d_{t+1})$ where d_{t+1} is dividend per share in t+1 and r_{ft+2} is the yield on the one-year T bill for year t+2. The reinvestment of dividends recognizes that dividends reduce earnings growth (or, alternatively put, dividends can be reinvested to earn more earnings). The left-hand-side growth rate in equation (1) ranges from -2.0 to +2.0. This measure produces a growth rate that is quite close to the standard measure with positive base earnings in t+1 but accommodates the case where the base is negative, as well as compressing outliers when the growth rate is on a small base.[12]

The predictive regression (1) mirrors the portfolio scheme above. The regression holds E/P constant in the first term, now at a point rather than for a portfolio. With E/P held constant, variables selected under requirement (i) should jointly predict subsequent growth, and are retained only if they do so. Regression (2) serves to test whether the selected variables connect to the expected return: If those variables indicate priced risk, they should predict returns as well as growth. The identified set of accounting observables that satisfy these requirements are thus deemed to indicate the expected return one year ahead (for t+1). The approach can be adapted to forecasts of growth and returns for t+2 and subsequent periods (subject to dealing with survivorship issues).

To cast the analysis in terms of accounting observables, $\frac{E_t(Earnings_{t+1})}{P_t}$ is set equal to a forecast given by $\frac{Earnings_t}{P_t}$.[13] For added accounting observables beyond B_t/P_t, A_j, $j = 3,\ldots, K$, we identify variables that indicate growth and risk under accounting principles and which predict both future growth and returns in regressions (1) and (2) in Penman and Zhu (2014). These are

[12] In the expression, $\frac{E_t(Earnings_{t+1})}{P_t} = r - g$, g refers to growth in expected earnings rather than expected earnings growth. However, growth in expected earning is not observable. We assume that growth in expected earnings on average results in ex post by growth in earnings of the same order.

[13] Earnings is before extraordinary items (Compustat item IB) and special items (item SPI), minus preferred dividends (item DVP), with a tax allocation to special items at the prevailing Federal statutory corporate income tax rate for the year. $\frac{Earnings_t}{P_t}$, so calculated, is strongly correlated in the cross-section with realized forward earnings-to-price, $\frac{Earnings_{t+1}}{P_t}$, with an average Spearman correlation of 0.63.

also variables that market contemporaneously prices as bearing expected-return news in Penman and Yehuda (2015). This may not be the best or complete set, but our aim is to demonstrate an approach rather elicit the definitive information set. We provide justification in the appendix as to why identified variables are those that result from accounting principles that connect growth to risk, in satisfaction of requirement (i). The appendix also reports that these variables satisfy requirements (ii) and (iii).[14]

Significantly, some of these are characteristics that have been identified as return predictors, either analytically or via data dredging, to construct return factors in asset pricing models. Thus we are able to take our analysis to a comparison with models that incorporate similar information but with a different construction. Others have been identified as "anomalies" (unexplained by these pricing models), but the appendix explains how they connect to growth and risk, both under accounting principle and in empirical tests.

We produce cost of capital estimates for each year, 1981-2012, although the data period runs from 1971 to 2014 covering estimation periods and periods for out-of-sample tests.[15] For each year, 1971-2011, regression equation (2) is estimated from the cross section with a parsimonious set of accounting variables that satisfy requirement (i) and are validated to predict growth in regression (1) in satisfaction of requirement (ii). Then, for each year, 1981-2012, an expected return is estimated for each firm by applying the mean coefficients estimated over the

[14] Summary statistics for these variables and test statistics from in-sample estimation of regressions (1) and (2) are in Penman and Zhu (2014). Two of the variables in the appendix (EXTFIN and NSI) pertain to financing activities which, while correlated with the other variables, are not affected by the accounting we have in mind. However, they do introduce leverage effects on growth, risk, and the expected return. Penman and Yehuda (2015) obtain similar expected return predictions when these variables are excluded, as do we in this paper.

[15] The period was limited to post 1970 due to lack of data for some variables. However, data were available back to 1963 for calculating E/P, B/P, Accruals and Growth in Net Operating Assets. Estimates for 1973-1980 with just these variables produced similar findings to those reported in the paper.

prior 10 years with regression (2) to the relevant accounting variables for that firm. The estimates of the expected return are thus out of sample.

The analysis covers all U.S. firms which are available on Compustat files for any of the years, 1971-2012, and which have stock price and returns for the corresponding years on CRSP files. Financial firms (in SIC codes 6000-6999) are excluded because the accounting differs from that depicted as relevant here (for non-financial firms), and so are utility firms (in SIC codes 4900-4949) where the accounting numbers are partially a result of regulation. Firms were deleted for any year in which Compustat reports a missing number for book value of common equity, income before extraordinary items, common shares outstanding, or total assets. Firms with negative book value for common equity or a per-share value of less than 50 cents were also eliminated. Prices (P_t in the denominator of the regressions above) were observed on CRSP three months after each fiscal year, by which time the annual accounting numbers (for fiscal year t) should have been reported. Returns (R_{t+1}), also observed on CRSP, are annual buy-and-hold annual returns after this date, calculated as compounded monthly returns with an accommodation for non-survivors. Details of the calculation of accounting variables are in the appendix.

3. Estimated Expected Returns and their Properties

The empirical analysis begins with a documentation of how estimated expected returns (and the accounting numbers on which they are based) connect to risky growth expectations, and how that risk manifests itself in investment returns. At this point we refer to "expected returns" rather than the "cost of capital," for reasons that will become evident.

3.1 Expected Returns, Earnings Growth, and Accounting Characteristics

Each year, 1981-2012, firms are ranked on their out-of-sample estimated returns, ER_t, and formed into 10 portfolios. Panel A of Table 1 reports the mean (over years) of the mean ER_t for these portfolios.[16] The column next to the mean ER_t reports the mean (over years) of the forecast of earnings growth two years ahead from applying regression (1) out-of-sample each year. Portfolios 1 and 2 aside, the ER are increasing in the growth forecasts: The expected return connects to expected earnings growth. Means of yearly median forecasts (not reported), though slightly lower for each portfolio, exhibit the same pattern over portfolios.[17]

Most of the remainder of the table reports the accounting characteristics from which the ER_t are inferred (again, the mean over years of yearly portfolio means). The first characteristic, E/P, is the starting point for the analysis, as depicted in Exhibit 1. With the exception of the extreme ER portfolios that are associated with loss firms, E/P is similar across portfolios 4 – 9. As $E/P = r - g$ for positive earnings firms, the issue, then, is whether ER_t indicates whether these similar E/P ratios involve high r and g or low r and g. The ER_t for the portfolios and related growth expectations indicate an answer in the affirmative. Interestingly, negative E/P are associated with both extreme high and low ER_t portfolios so the ER_t estimation potentially distinguishes loss firms with high risk and expected return from those with low risk and expected return.

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[16] As firms have different fiscal-year ends, the portfolio features in this table and Table 2 do not necessarily align in calendar time, but represent all stocks. Results are similar with just December 31 fiscal-year firms where the features refer to the same calendar period.

[17] A similar pattern over portfolios was observed with the left-hand-side growth variable in regression (1) calculated as $\frac{\Delta Earnings^a_{t+2}}{|Earnings_{t+1}|}$ with the deletion of one percent outliers (presumably due to small denominators). The mean growth rates for portfolios 1 – 10, out of sample, were -0.074, -0.011, 0.016, 0.038, 0.050, 0.062, 0.072, 0.080, 0.090, and 0.102, respectively. This lessens a concern that, with growth calculated as $\frac{\Delta Earnings^a_{t+2} \times 2}{|Earnings^a_{t+2}| + |Earnings_{t+1}|}$, the estimation could be dominated by observations clustered at +2 or -2.

The association between the other characteristics and ER_t accord with the predictions in the appendix. This, of course, is partly by construction as the variables are identified as those that forecast growth in the estimation period; the numbers here just indicate that the relationships are stable out of sample. B/P is positively related to ER_t and the growth forecasts, in confirmation that ROE, with the effects of conservative accounting, predicts growth and risk (as explained above). Sales growth is considerably higher for the lower ER_t portfolios, indicating that the resolution of uncertainty with sales realizations projects lower expected returns, as accounting principles would suggest. Correspondingly, the realization of sales growth expectations is associated with lower two-year-ahead earnings growth forecasts (except for portfolio 1). The higher sales realizations in the low ER_t portfolios are translated into higher operating profit margins in the table; sales growth realizations flow through to higher realized earnings. In contrast, high ER_t portfolios are those where sales growth and margin growth are relatively not (yet) realized. Accruals, realized investments, and NOA growth exhibit the predicted patterns in the appendix with respect to both ER_t and forecasted growth. For example, the relatively high investment for the low ER portfolios indicate that uncertain investment opportunities have been realized—investment options have been exercised—and booked to the balance sheet rather than expensed under conservative accounting as particular risky; the booked investment indicates that expected earnings growth is more likely. Higher investment, along with higher sales growth and profit margins, is associated in the table with higher financing (EXTFIN and NSI) that also exhibit the predicted association with subsequent growth and expected returns in the appendix.[18]

[18] Leverage (net debt/market value of equity), not reported in the table, is decreasing in ER_t. A negative correlation is consistently observed between leverage and average returns when operating risk is not controlled for. See Penman, Richardson, and Tuna (2007).

The characteristics associated with loss firms (in portfolios 1, 2, 10, and, to a lesser degree, portfolio 9) highlight our organizing principles. Loss firms in portfolios 1 and 2, with substantial realized sales growth, increasing profit margins, and growing investment in anticipation of more realizable sales and earnings in the future, are (intuitively) less risky than those making losses in portfolio 10 with flat or declining sales and profit margins and no investment growth. The loss firms in the low ER_t portfolios are also growing their balance sheets (ΔNOA_t) and seeking external financing to finance new investment.

The final column in Panel A reports the mean expected return, ER_{t+1}, re-estimated at the end of year t+1 for the same firms that are in the relevant portfolio for ER_t. The expected returns are quite persistent, though exhibit some reversion to the mean in the extremes, particularly at the lower end. The mean reversion is expected as firms become similar to the average over time but may also be due to measurement error: Extreme ER_t may be due in part to over- or under-estimated expected returns—points that will be pertinent later in the paper. In unreported results, the accounting characteristics for ER_t portfolios in the table are also persistent; their t+1 values have a similar pattern over ER_t portfolios as their time-t values. For example, the negative relationship between sales growth and ER_t is also observed in their time-t+1 values, and so for the other characteristics. Thus the returns are not associated with reversals (of accruals, for example) that might be expected if the actual return difference over portfolios were due to market mispricing. That, along with the persistence of the relationships over the sample period, points to the accounting characteristics indicating return for risk rather than abnormal returns (though, of course, one cannot be definitive).

Panel B of Table 1 reports the accounting payoffs (after time-t when ER_t is estimated) for the respective ER_t portfolios. It begins with the forecast of two-year ahead earnings growth as in

Panel A, but now with that forecast compared to the actual (realized) earnings growth. With the exception of portfolio 1, actual growth rates align over ER_t portfolios, as they do with the forecasted growth rates.[19] Further, higher growth forecasts are associated with a higher standard deviation (STD) and interdecile range for the actual growth rates, as also reported in Penman and Zhu 2014: Portfolios with higher expected growth also have higher risk of actual growth deviating from expectation to a larger degree, with higher probability of realizations in the tails of the distribution—and these are firms with higher estimated ER_t[20]. The STD and IDR measures refer to the variation in means for portfolios over time so, to the extent risk is diversified in these portfolios, the differences across portfolios reflect common risk. The four-year aggregate actual earnings yields (four-years of earnings, t+1 to t+4, relative to price at t) are increasing in ER_t; A higher ER_t, denominated in price, is rewarded with higher earnings denominated in the same price, on average. But, again, that higher yield is at risk, as measured by the standard deviation and IDR of these outcomes.

Similar patterns for the standard deviation and IDR are observed for realized one-year ahead earnings, EPS_{t+1}/P_t.[21] These results are not reported, but the table does report portfolio earnings betas for t+1. The betas are estimated from regressions of the time-series of actual portfolio annual earnings-to-(beginning-of-period) price in the forward year, t+1 on total

[19] The comparison of expected and actual earnings growth for portfolio 1 suggests that the expected growth contains considerable measurement error, and so for portfolio 10.

[20] Realized growth two years ahead are affected by realized investment one year ahead. However, results are similar for growth in residual earnings, with book value at the beginning of the year charged at the prevailing risk-free rate for the year. This also deals with the issue that, for a given E/P in the Exhibit 1 construction, growth may differ over portfolios because of different payout (retention).

[21] The results in the table are subject to any survivor bias. The percentage of firms not surviving for two years (due to liquidation or takeover) is (in percent) 6.69, 5.27, 2.93, 2.31, 1.97, 1.74, 2.01, 1.91, 1.97, and 2.6 for portfolios 1 - 10 respectively. The similar pattern in the standard deviation and IDR for actual EPS_{t+1}/P_t (where the non-survivor issue is reduced) is thus reassuring.

(market-wide) earnings relative to price. Betas for the sensitivity of earnings changes in t+1 to changes in market-wide earnings are also given. These are betas actually experienced during the forward year that ER_t forecasts. Higher (lower) ER_t forecasts higher (lower) betas; ER_t predicts fundamental risk—the risk of earnings being affected by shocks to market-wide earnings.

In summary, while Panel A of Table 1 indicates that ER_t is related to earnings growth expectations, Panels B indicates that ER_t is also related to the risk around those expectations. There is some reservations about portfolio 1, though one must be skeptical about means taken over the extremes: Observations with high measurement error are in the extremes.

A question remains open: Does ER_t imbed a priced premium for the risk we have observed?

3.2 Risk to the Expected Return

In answer to this question, Table 2 reports the realized return outcomes for the ten ER_t portfolios and the risk incurred with those realizations. The various metrics are calculated from the time series of actual (realized) annual portfolio returns for each t+1 year over the sample period, the returns that ER_t forecasts. Mean and median actual returns are almost monotonically increasing in ER_t and indeed are quite similar to the ER_t estimates. The correspondence is quite impressive for out-of-sample estimates. It is similar for the last half of the sample period as the first half, indicating persistence in the relationship. The standard deviation of actual returns (again, calculated for portfolios over time) increases in the high ER portfolios, but otherwise the differences are small, and portfolio 1 (again) has a similar standard deviation to portfolio 9. A comparison of mean returns to the standard deviation reveals that Sharpe ratios are increasing across portfolios. However, this higher return per unit of standard deviation for higher ER_t is associated with an increase in the range of return outcomes. And the kurtosis measures indicate that there is increasingly more realizations in the tails as ER_t increases, while the relative skewness measures indicate that higher ER_t portfolios yield compensation for the risk on the upside. It appears that the accounting information indicates the likelihood of returns in the extremes, and it is the extremes with which investors are particularly concerned.

The predictable average realized returns in the table indicate return for risk if the risk is priced systematic risk. So, the table also reports beta sensitivities to common return factors appearing in asset pricing models. The forward market (CAPM) betas—estimated from the annual actual t+1 portfolio returns regressed on the return for the market portfolio over time—complement the earnings betas in Table1, Panel B. They are higher for high ER_t portfolios, though portfolio1 reports a high beta. Betas in up-markets (years when the value-weighted CRSP index return was greater than 10%) are also increasing in ER_t, as are down-market betas (years when the value-weighted CRSP index return was less than -10%). While the portfolio 1 up-market beta is 1.77, the down-market beta is only 0.48; it appears that this portfolio provides a hedge against bad times when wealth of investors is low, a property that implies lower risk and a lower expected return in the Merton (1973) intertemporal asset pricing model.[22] Note that these betas are those actually experienced during the t+1 year, not historical betas.[23]

Table 2 also reports the sensitivity of portfolio returns to the additional return factors (over the market factor) that appear in the Fama and French (2015) five-factor model, HML

[22] Ang, Chen, and Xing (2006) model a premium for downside beta relative to upside beta and show empirically that relative downside risk earns a return premium.

[23] We did find some evidence that contradicts the beta results. We calculated mean daily returns for portfolios during the forward year, separating days with pre-scheduled macro news announcements from non-announcement days. There were 1,302 news days in the sample period, covering announcements of CPI and PPI revisions, employment statistics, and interest rate decisions from the FOMC. Mean returns are increasing in ER_t for the non-announcement days. However, while the mean returns during announcement days were significantly higher than non-announcement days for all portfolios, they were similar across portfolios; the higher ER_t firms did not earn higher average returns to compensate for risk of macro news.

(book-to-price), SMB (size), RMW (profitability), and CMA (investment) factors. We also estimated the sensitivity of the returns to the factors in the Hou, Xue, and Zhang (2015a) (HXZ) so-called Investment CAPM. The results for the latter's size (ME) and ROE factors were similar to those for the corresponding to the FF SMB and RMW factors, so we only report the results for the investment factor, I/A. We present these findings more tentatively, for reasons that will become apparent when we evaluate ER_t against expected returns from these models later. The reported betas are estimated from time series regressions of actual excess monthly returns for the portfolios in year t+1 on these factor returns and the excess market return. So, like the CAPM betas, they are experiential betas.

As reported in Panel A of Table 1, ER_t is positively related to B/P and here the sensitivity of portfolios returns to the HML factor increases with ER_t. While each portfolio is quite sensitive to the SMB size factor—t-stats are all over 12.0—there is little difference in the SMB betas. Unreported results indicate that size varies little over portfolios; the sensitivity to risk associated with size (incremental to other factors) is within portfolios rather than across portfolios.[24] The betas on the profitability factor, RMW, are all negative and those on the CMA investment factor are not significantly different from zero (with the exception of portfolio 1). The betas on the investment factor, I/A, are positively related to ER_t. With investment negatively related to ER_t in Panel of Table 1 and also negatively related to investment in the Investment CAPM, the alignment is agreeable.

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[24] Size as measured by ln(market capitalization) is slightly lower for portfolio 10, 4.2 versus the typical size of about 5.4 for other portfolios. But ER is overall unrelated to size; accounting characteristic determine expected returns rather than size. Cochrane (2005) and Ang (2014) report that the size premium in returns is not evident after 1980. Repeating the analysis with value-weighted returns for ER_t portfolios, the SMB sensitivity coefficients were considerably lower, with an average of 0.18 across portfolios (but still varying little across portfolios). Thus the betas on SMB in Table 2 are due to variation in size in all portfolios. Similar findings on HML and SMB were observed with the original three-factor Fama and French model. Adding the UMD momentum factor to these three factors (as in some extensions of the model), betas on this factor are consistently negative over portfolios.

With respect to RMW and CMA (and the ROE in the HXZ model), the findings could be interpreted as ER_t not identifying the risk in these factors, but only if one accepts that these factors actually are risk factors. As the factors in FF are largely generated by data search one must remain skeptical, particularly as ER_t is based in part on ROE and investment. After all, ER_t is related to actual mean returns in the table, whereas these factor sensitivities are not. The question can be turned around: Why does sensitivity to these factors not indicate the expected returns, actual returns, and risk indicated by ER_t? We return to this issue later.

The cross-sectional variation in portfolio ER_t is evident from these tables. Within ER_t portfolios, the standard deviation of the yearly estimates over time is close to 0.04 for most portfolios, except for portfolio 1 where it is 0.056. We do not have a benchmark for how ER_t should vary over time (with changes in interest rates and risk premia), but this variation is not large enough to suggest that the estimates are wildly fluctuating. Nevertheless, some of the variation is presumably due to estimation error. Figure 1 plots the variation of the 10-year moving average of the estimates over time, for 1990-2012. The averaging washes out mean-zero estimation error if the "true" expected return is changing slowly. It is clear that the differences in ER_t between portfolios is maintained over time. Further, the estimates co-vary over time, suggesting that they contain a common varying systematic risk premium. For all portfolios, the estimates are lower in the mid-to-late 1990s, a period of quite high ex post returns.[25] But, relative to the variation across portfolios, the year-to-year estimates are quite stable, as are also consecutive 2-year and 3-year estimates (not reported).

3.3 ER_t and the Dimensionality of Return Predictors

[25] The seemingly low ER_t estimates for portfolio 1 in Table 1 are due mainly to this period (when they were negative). Some claim, without much justification, that the mid-to-late 1990s was a period when risk premiums declined.

Research has uncovered a large number of characteristics that predict returns, but far too many to suspect that they independently do so.[26] Most of these have been "discovered" by data dredging. There is a need to reduce the dimensionality, not only to exclude those that just load with a "significant t-statistic" by luck in the data dredging, but also to produce a parsimonious set of legitimate predictors from the many correlated variables. Lewellen (2015) does so, with out-of-sample validation, but as a statistical exercise that isolates predictors deemed "insignificant" given other included variables. Most of the relevant variables are accounting variables. In contrast to the statistical approach, this paper reduces the dimensionality by filtering variables into the analysis *a priori* on the basis of organizing principles that connect these accounting variables to risk.

In the Lewellen (2015) paper, book-to-market, size, and momentum explain a good deal of the cross-sectional variation in the out-of-sample expected returns estimated from the full set of predictors, as they do actual returns. Variables identified by our analysis, such as accruals, asset growth, and profitability, add significantly less explanation, while a number of other attributes not entertained by us (and largely not accounting variables) add very little.

Table 3 draws a contrast. It reports results of regressions of forward actual returns, R_{t+1}, on out-of-sample ER_t, with and without variables identified as relatively important in the Lewellen paper. The regressions are estimated in the cross section each year with mean coefficients over years and t-statistics on the means (Fama-Macbeth style) reported in the table. The regression at the portfolio level with ER_t alone produces a mean R^2 of 0.55, as might be expected from the alignment of ER_t with actual t+1 returns in Table 2. The R^2 is much reduced

[26] Harvey, Liu, and Zhu (2016) find 316 predictors, a number they say likely under-represents the total. Green, Hand, and Zhang (2013 and 2014) find that that, of 333 characteristics that have been reported as predictors of stock returns, many predict returns incrementally to each other.

when the regressions are run at the individual firm level, of course, but the t-statistic on ER_t is 6.12.[27] Remarkably, the mean coefficient estimate of 0.979 is very close to 1.0, with a standard error of 0.159 and a t-statistic for the mean relative to 1.0 of -0.17. The corresponding t-statistic on the mean slope coefficient of 1.065 for the portfolio regressions is 0.37. In both cases, the mean intercept (average bias) is not significantly different from zero. The slopes compare with a slope of 0.76 in the Lewellen paper that is significantly different from 1.0, with a standard error of 0.13.[28] The slope of 1.0 takes on further significance with the understanding that it is an estimate of the return on a minimum-variance long-short portfolio with unit net exposure to ER_t, as explained in Fama (1976): one-for-one.

Figure 2 plots ten-year rolling averages of the predictive slope from1990-2012, to be compared with a similar figure in Lewellen (2015). The slopes are higher in the early 1990s and early 2000s (periods of lower actual returns) and lower in the late 1990s (a period of high actual returns).

In Table 3, the coefficient on ER_t changes little with the addition of the variables in the Lewellen paper that are important to explaining returns, and none of these loads with a significant t-statistic.[29] Of course, they may be collinear so may add explanatory power jointly, and the R^2 is 0.050 compared with the 0.015 with ER_t alone. However, the added variables are

[27] It is difficult to benchmark the R^2. Most papers that predict returns report R^2 from in-sample estimation (typically about 0.015) whereas this is out of sample. The mean R^2 from estimating regression (2) in sample is 0.045.

[28] Lewellen (2015) also reports a mean slope of 0.74 with monthly return regressions, with a standard error of 0.07.

[29] We also added all the variables in Panel A of Table 1 to ER_t to assess whether the aggregate ER_t captured all the information in the variables underlying its construction. Only ΔNOA_t loaded with a significant mean coefficient (with a t-statistic of -2.14).

fitting in-sample (where the R^2 informs about the amount of contemporaneous volatility explained), not out-of-sample (where predictive ability is to be explained).[30]

4. Comparisons with Other Estimates of the Expected Return

4.1 Implied Cost of Capital Estimates

Many estimates of the ICC assume a constant growth rate across firms. We limit our comparison to two that allow for differing growth rates. The first is the ICC in Gephardt, Lee, and Swaminathan (2001) (GLS) where a growth rate is implied by assuming the reversion of ROE to an industry average. The second is that in Easton, Taylor, Shroff, and Sougiannis (2002) (ETSS) where growth rates are estimated jointly with the ICC.

Panel A of Table 4 reports the respective mean ICC for firms in ER_t portfolios. The GLS estimates vary little over the ER_t portfolios, though they increase slightly as ER_t increases. As in the original paper, the ETSS estimates are inferred from cross-sectional regressions of expected four-year ROE on P_t/B_t for the portfolios, with the four-years of expected earnings for the ROE calculation given by analysts' forecasts.[31] The mean estimated intercepts and slope coefficients from these annual regressions are reported in the table. The ICC inferred from these estimates (*r* in the table) are actually decreasing in ER_t, though they vary little. Further, the implied ETSS

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[30] One could argue that the explanatory power of ER_t is not quite out-of-sample given that the predicative ability of some of the variables that enter the calculation of ER_t have been observed in previous studies in some of the out-of-sample periods here. However, ER_t is not simply identified on the basis of in-sample correlations; rather, it is based on a filter that requires an *a priori* connection to risk and the requirement that variables also fit in the growth regression (1) before entering regression (2). Further, the t-statistics on ER_t in Table 3 are much higher than the 3.0 that adjusts for multiple comparisons in Harvey, Liu, and Zhu (2016). The correlations previously discovered were done so before 2000 (and many earlier) and Table 3 results hold after that date: The mean slope for the individual firm regression from 2000-2012 is 0.962.

[31] Our analysis is for 1981-2012. To ensure consistency with the ETSS findings, we first replicated their analysis for their sample period up to 1998. We maintained their criteria for dealing with data issues and reinvestment rates for the longer period. We also obtained similar results when we used analysts' forecasts and P/B ratios three months after fiscal-year end rather than at fiscal-year end, when we used IBES prices and shares outstanding rather than those from Compustat, when we made adjustments for differences in IBES and Compustat numbers for shares outstanding, and when we used different dividend reinvestment rates.

annualized growth rates (*g* in the table) are also decreasing over the ER_t portfolios, in contrast to Table 1 where both expected and actual earnings growth is increasing in ER_t. The positive relationship between *r* and *g* that our analysis posits and confirms is not at all evident in the ETSS estimates. While there is a positive relationship between the ICC and the ETSS implied growth rates, both are negatively related to ER_t and to the forecasted and actual earnings growth rates with which the ER_t are positively correlated.

Digging further to explain differences between estimates, we replicated Tables 1 and 2, but now with portfolios formed with the GLS estimate of the cost of capital. (This is not possible with the ETSS measure as it estimated from the cross-section). The GLS estimate is not related to most of the accounting characteristics in Table 1, Panel A that we identify are indicators of the expected return, though there is a slight positive correlation with B/P, and sales growth and change in profit margin are higher in GLS portfolios 1 and 2 (low cost of capital) than in other portfolios. In comparison to Table 1, Panel B, there is no correlation between expected and actual earnings growth rates, the four-year earnings realizations, nor the variation around them. There is a positive correlation with earnings change betas in t+1, however. In comparison to Table 2, there is a slight positive relation between GLS estimates and mean actual t+1 returns, and higher variation around the mean for the higher cost-of-capital portfolios.[32]

The reliance on analysts' forecasts is a recognized problem with the ICC, but we think the issues go deeper with the ETSS estimates.[33] First, the ETSS growth rate is the growth rate in residual earnings whereas we refer to growth in earnings. Residual earnings involves the cost of

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[32] The mean actual t+1 returns for GLS portfolios 1 to 10 were 0.105, 0.120, 0.141, 0.141, 0.143, 0.138, 0.156, 0.157, 0.157, and 0.170.

[33] One issue is the depth of analysts' coverage of firms. We repeated the ETSS estimation with the forecast of future ROE given by current ROE (before extraordinary and special items). Although this covers almost all firms, results were similar to those in Table 4.

capital, so the ETSS growth rate is itself a function of the cost of capital, a confusion of constructs. Second, ETSS infer a constant growth rate for the long term on a base of four years of earnings forecasts while ER_t is constructed on forecasts of two-year-ahead growth. For a closer correspondence, we estimated ETSS with just one year of analysts' forecasts (for positive earnings forecasts only as ETSS does not work for negative earnings), and obtained similar results to those in Table 4—both portfolio *r* and *g* are negatively related to ER_t.[34] Nevertheless, the estimated *g* is still a constant growth rate for all periods in the future, constraining the two-year ahead growth rate to be the same as that is all subsequent years. One might expect that, for a given P_t, a higher growth rate two years ahead would imply a lower growth rate in subsequent years (as the growth rate declines to a long-run average).

Nevertheless, there is a fundamental difference in the approaches. To get further insights into the conflicting estimates, we restate the ETSS formulation, starting from the version of the residual earnings model where the constant growth rate starts two-years ahead (just for simplicity):

$$P_t = B_t + \frac{E_t(Earnings_{t+1}) - r.B_t}{r-g}.$$

Inverting,

$$r = \left[\frac{B_t}{P_t} \times E_t(ROE_{t+1})\right] + \left[(1-\frac{B_t}{P_t}) \times g\right] \qquad (3)$$

(provided that $ROE_{t+1} > g$). That is, *r* is a weighted average of forward ROE and subsequent growth where the weight is given by observed B_t/P_t. Dividing through by P_t/B_t and rearranging,

$$E_t(ROE_{t+1}) = g + (r-g)\frac{P_t}{B_t} \qquad (4)$$

[34] Portfolio *r* decline from 10.3% for ER_t portfolio 1 to 7.9% for portfolio 10, and *g* declines from 9.2% for portfolio 1 to 3.3% for portfolio 10. Results are similar for growth after two years of analysts' forecasts.

$$\equiv \gamma_0 + \gamma_1 \frac{P_t}{B_t}$$

This is the equation that ETSS estimate in portfolios to extract $\gamma_0 = g$ and $\gamma_1 = r - g$, with an added error term because *r* and *g* are not likely to be the same for all stocks in a portfolio. An alternative expression can also be derived that delivers the same *r* and *g*. Restating equation (3),

$$r = \frac{E_t(Earnings_{t+1})}{P_t} + \left[(1 - \frac{B_t}{P_t}) \times g\right]$$

and, rearranging,

$$\frac{E_t(Earnings_{t+1})}{P_t} = (r - g) + g\frac{B_t}{P_t}. \qquad (5)$$

Thus, estimating *r* and *g* from the ETTS expression is equivalent to estimating them from a regression of the forward earnings yield on B/P.

Expression (5) connects E/P and B/P in a very different way to our setup. It depicts E/P and B/P as linearly related, varying by a constant, *g*. In contrast, our formulation, depicted in Exhibit 1, sees *r* and *g* both varying with B/P while holding E/P constant. That is so empirically: Penman, Reggiani, Richardson and Tuna (2015) show explicitly how B/P orders growth and average returns for a given E/P. Panel A of Table 1 shows that B/P varies over a wide range of ER_t portfolios where E/P is relatively constant, and that variation aligns with variation in the growth rate as well as ER_t. Also, negative E/P are associated with both high and low B/P, inconsistent with the linear relationship in equation (5), and B/P also sorts on growth and the expected return in this case. This contrasts with sorting on E/P and B/P pairs to infer *r* and *g* as in equation (5).

A similar critique applies to equation (4) which ETSS apply to estimate r and g. By dividing the simple model that is our starting point (in Exhibit 1), $\frac{E_t(Earnings_{t+1})}{P_t} = r - g$, through by $E_t(ROE_{t+1})$,

$$\frac{B_t}{P_t} = \frac{B_t}{E_t(Earnings_{t+1})} \times \frac{E_t(Earnings_{t+1})}{P_t} = \frac{r-g}{E_t(ROE_{t+1})} \tag{6}$$

and

$$E_t(ROE_{t+1}) = (r-g)\frac{P_t}{B_t} \tag{7}$$

This expression looks very much like the ETTS equation (4) except that g is now expected growth in earnings rather than growth in residual earnings. Equation (6) simply says that, for a given $\frac{E_t(Earnings_{t+1})}{P_t} = r - g$, a lower $E_t(ROE_{t+1})$ yields a higher B/P, as recognized earlier in connecting B/P to ROE. Introducing conservative accounting that reduces $E_t(ROE_{t+1})$ but also increases g, it must be that, holding $r - g$ and thus E/P constant, r also increases with the increase in g and B/P. That is, both r and g change as $E_t(ROE_{t+1})$ and $\frac{P_t}{B_t}$ in equation (7) change. We see in Table 1 that $\frac{P_t}{B_t}$ increases over ER_t portfolios, along with expected and actual earnings growth, and ER_t validates against actual realized returns. Equation (7) and equation (4) are a basis for estimation if higher g implies higher $\frac{P_t}{B_t}$, which is the case when growth adds to price but not to risk, but are not appropriate when growth adds to risk and the expected return such that $r - g$ is unaffected and (consequently) neither is price.

4.2 Estimates from Pricing Models

Panel B of Table 4 forms portfolios with cost-of-capital estimates from the Capital Asset Pricing Model (CAPM) and a three-factor Fama and French model (FF). All estimates are calculated with sensitivity (beta) coefficients estimated over prior 60-month periods, though results are not sensitive to the length of the estimation period. For the CAPM, the historical market beta is applied to a market risk premium of 5 percent for all stocks which, added to the prevailing risk-free rate, yields the cost of capital. For the FF estimates, beta coefficients estimated on monthly MKT, SMB, and HML factors over the prior 60 months are applied to mean factors returns over the full sample period which, together with the estimated intercept, yield a cost-of-capital estimate (annualized in the table). With the same factor risk premiums for each firm, differences in CAPM and FF cost of capital estimates across firms are determined by the firm-specific estimated sensitivity (beta) loadings.[35]

The mean CAPM betas for portfolios are a good indication of the experiential (forward) betas ($Beta_{t+1}$ in the table) experienced over the subsequent year when actual returns for the respective portfolios were realized. However, those actual returns for t+1are similar over all portfolios, despite this beta relationship. This contrasts with the relationship between ER_t and actual returns in Table 2. The table further reports that the CAPM cost-of-capital estimates are similar over ER_t portfolios, and the historical betas are actually decreasing in increasing ER_t.

The Fama and French (FF) cost-of-capital estimates for portfolios are not related to actual t+1 returns either, nor do the estimates vary much over ER_t portfolios at the far right of the table. The last two columns report intercepts and their t-statistics from time series regressions of ER_t portfolio excess monthly returns in actual return periods on the three factor returns. These

[35] For the FF estimates, we also set the intercept to zero, with similar results. A zero intercept is expected for a valid model; non-zero intercepts represent unidentified expected returns.

intercepts are returns unexplained by the FF model. They are increasing in ER_t, indicating that ER_t captures aspects of the expected return not recognized in these pricing models.

Results are similar with expected return estimates from the FF five-factor model (that includes the RMW and CMA factors investigated in Table 2), and those from the Hou, Xue, and Zhang (2015a) Investment CAPM (that includes the investment factor in Table 2); cost of capital estimates with these models vary little over ER_t portfolios and are not related to actual forward returns. Indeed, setting the expected return equal to the mean return over the past 60 months yields quite similar results.[36]

As with the GLS cost of capital, we replicated Tables 1 and 2 but now with portfolios formed (alternatively) on cost-of-capital estimates from the CAPM, the FF three-factor model, the FF five-factor model, and the HXZ model. There is little relation between these estimates and the characteristics in those tables that indicate ER_t. Further, while the estimates are not related to actual t+1 returns, they are also not related to the variation in returns around the mean returns. Nor are the related to expected and actual earnings growth or the variation in realized growth.[37]

The failure of these models to predict actual returns is well known.[38] The goal here is to see the extent to which they reflect the information in ER_t and vice versa. With respect to the CAPM estimates, Table 4 informs that the historical beta is a poor indicator of actual mean

[36] Modeling varying betas and factor premiums may improve the results, by applying shrinkage to beta coefficients estimated from past data for example, but the analysis in Fama and French (1997) does not hold out much hope. Rather than using historical factor sensitivities, we estimated them (for a three-factor model) from returns during all t+1 years in the sample period for those portfolios. We then applied those betas to the mean factor returns over the sample period. The resulting estimates for ER_t portfolios 1 – 10 (which are in sample) were 0.046, 0.104, 0.135, 0.157, 0.172, 0.167, 0.189, 0.176, 0.178, and 0.177, exhibiting some, but not a lot, of variation over portfolios. Note that cost-of-capital estimates actually become more extreme with the FF five-factor model, ranging from -0.123 for portfolio 1 to 0.523 for portfolio 10. These estimates apparently build in more measurement error than the simple CAPM or a three-factor model. The HZX estimates range from -0.189 to 0.528.

[37] An exception: The CAPM estimates are positively related to earnings betas and earnings change betas in t+1.

[38] See, for example, Fama and French (1997), Simin (2008), and Chattopadyhay, Lyle, and Wang (2015).

returns, whereas Table 2 indicates that ER_t forecasts actual returns and forward return betas and fundamental betas that align with those returns. Thus, it may not be that beta is a poor measure of the risk, but that it varies overtime, and the accounting information provides an update of the beta. Indeed, Penman and Yehuda (2015) show that changes in ER_t, calculated in a similar way as in this paper, coincide with changes in beta. Thus, the results here are not to be interpreted as saying that beta or the (conditional) CAPM is unimportant, but that accounting information can be elicited to indicate the expected forward beta that investors will experience (and to update the historical beta).[39]

Stationarity of factor betas (and possibly the risk premiums on the factors) is also an issue with FF models, as Fama and French (1997) recognize, and it may well be that accounting information also updates historical estimates of FF betas. That is, the models are appropriate, but the accounting characteristics provide a better estimate of sensitivities to factor returns than do historical estimates. However, the results in Table 2 indicate little relation between ER_t and beta sensitivities experienced with actual returns during investment periods.

That points to an issue that differentiates our estimates and the FF estimates: Some information is common to both approaches but the packaging of that information into an expected-return estimate differs. The organizing principle for the construction of the FF-type models involves searching for correlations in the data from cross-sectional (Fama and Macbeth) regressions of returns of characteristics, then constructing return factors from the discovered characteristics. B/P enters in this way as a basis for the HML factor. In contrast, B/P enters under

[39] Estimating the CAPM cost-of-capital with the forward beta estimates reported in Table 2 for ER_t portfolios yields higher estimates for ER_t portfolios 1, and 7 – 10, but little difference over portfolios 2 - 6. Applying the accounting information underlying ER_t to forecast beta changes is a potential alternative to the statistical approach to shrinking betas in Blume (1975) and Vasicek (1973).

our organizing principles as an indicator of the expected returns because, under accounting principles for a given E/P, it captures ROE and its connection, via conservative accounting, to growth and risk. Penman and Zhang (2015) elaborates. ROE underlies the RMW factor, with higher ROE indicating higher risk (it is said). But, under our organizing principles, ROE indicates growth, risk, and the expected return negatively conditional on E/P. E/P = ROE × B/P so, with B/P already a characteristic in the FF framework, ROE is capturing E/P, the starting point in our approach rather than an incremental factor (and a factor missing from the original three-factor FF model). Penman and Zhang (2015) show how the comparative statics that Fama and French (2015a) employ to introduce the ROE factor are at odds with how accounting works. And so with their identification of the investment factor. While investment enters in both our approach and in the construction of the CMA factor in FF, the returns for ER_t portfolios are not sensitive to the CMA factor in Table 2.

In short, construction of a cost-of-capital requires the identification of the relevant information *a priori* and the packaging of that information into a cost-of-capital estimate. The two approaches differ significantly in both aspects.[40] The packing aspect is pertinent in light of the observations that B/P, investment etc. predict returns but a FF cost of capital based on these inputs does not. Strikingly, our replication of Table 1, Panel A with FF cost-of-capital estimates revealed that the FF estimate, based on sensitivities to a B/P factor in sample, are unrelated to B/P—even though B/P is a characteristic that robustly predicts returns. Similarly, Investment is

[40] That is not to imply that we have identified all the relevant information or the appropriate way to combine the components. Our cross-sectional regression approach imposes a linear relation between returns and characteristics, and the estimation equally weights firms so that smaller firms have more representation than in the investment universe. Again, the purpose of the paper is to demonstrate an approach rather than perfect it. The construction of factors from portfolios in FF-type models relaxes the strict linearity, although there appears to be a continuing unresolved discussion about the appropriate split points for forming portfolios, with results sensitive to these split points. Daniel and Titman (1997) argue that characteristics rather than risk factor exposures are a better measure of cross-sectional dispersion of returns.

unrelated to the HXZ cost-of-capital estimate, even though this is from an "Investment CAPM" and investment predicts return. From this view, the sensitivities of ER_t returns to FF and HXZ factors in Table 2 are more a commentary on the those models than a demonstration of risk and return. The criterion we are invoking is out-of-sample fit against the actual returns to investors in the cross-section, in contrast to much of asset pricing research where the criterion is explaining variation in returns over time with constructed factors and the significance of in-sample intercepts. That said, we do not observe the "true" cost of capital for benchmarking, so all is relative.

The packaging is also pertinent to investigations of so-called anomalies. After constructing factors on the basis of selected characteristic return correlations, the resultant models are evaluated on how well they explain or "digest" other "anomalies," as in in Fama and French (2015b), Hou, Xue, and Zhang (2015a), and Zhang (2015). In our construction, so-called anomalies involving accounting variables are directly digested into the cost-of-capital estimate under *a priori* criteria that connects them to risk. (That said, we have not entertained all nominated anomalies.)[41]

The packing of information into an expected return estimate is also an issue with ICC estimates. For example, the ETSS estimates recognize the same ROE and P/B as the FF five-factor rendition as pertinent information, then tie them together in a linear relationship to extract a cost-of-capital estimate. As discussed above, with $E/P = E/B \times B/P$, that is a very different handling of this information than in our construction. Lyle and Wang (2015) also embrace these

[41] Stambaugh and Yuan (2015) add two factors to the market and size factors in the FF models based on 11 anomaly variables that include four of our variables in the appendix (and two others fairly close to them), and find that the resultant models accommodate a large set on anomalies relative to the Fama and French (2015b) and Hou, Xue, and Zhang (2015a). They choose to refer to the added factors as "mispricing factors."

two pieces of information (in log form), but connect them to expected returns (with assumed parametric assumptions) in a way that differs from ours.

5. Shrinking the Estimator to a Cost of Capital

The analysis to this point demonstrates that information elicited from financial statements informs about risk and the expected return for investing. However, there is a problem: The estimated expected returns for the portfolios in Table 1, 17.4 percent at the median and 26.4 percent for portfolio 10, seem too high relative to what one expects of a cost-of-capital measure. A comparison to the median CAPM cost-of-capital estimates in Table 4 makes the point (as does a comparison to the typical risk-free rate).

The issue is one of sample bias: the mean and median actual returns in Table 2 also seem out of line with perceived expected returns and the mean intercepts in Table 3 are close to zero. This was a period when stocks paid off very well, on average, resulting in high actual returns and high expected returns fitted to those actual returns. The range and kurtosis measures in Table 2 suggest that the accounting measures indicate susceptibility to both the extreme upside and extreme downside. But the upside has dominated in this period, yielding the positive skewness in payoffs for the high ER_t portfolios. From our perspective, this makes sense: The risk of investing is in buying growth, with down-side risk compensated with upside potential, and this was a period when a bet on growth paid of well in the U.S.[42] It was, after all, "the American Century." But that introduces the "Peso problem" that also confounds historical estimates of the equity risk premium.

Converting the ER_t estimates to an ex ante cost of capital requires adjustment for this ex post bias. As the mean slope coefficients for actual returns regressed on ER_t in Table 3 are almost

[42] The sample bias is in all papers that estimate expected returns using realized return over the last 50 years or so. See, for example, Lyle, Callen, and Elliott (2013). Lyle and Wang (2015), and Lewellen (2015).

exactly 1.0, the issue likely lies with the estimated intercept in estimating ER_t with regression model (2). We dealt with the issue in two ways.

First, regression (2) was re-estimated each year with the intercept constrained to be the annual yield on the 10-year bond, R_{ft}, for the relevant year. The explanatory variables now explain the variation of returns in excess of the risk-free rate. Then, in fitting the ER_t out-of-sample, the intercept was set as the corresponding R_f for that year (with the mean rolling estimated slope coefficients applied to the out-of-sample accounting numbers, as before).

While this procedure explains variation around the risk-free rate, any ex post bias must go into slope estimates under the OLS estimation. So, second, the out-of-sample estimate of ER_t for each firm was calculated with the intercept set as

$$Intercept_t = ERM_t - \sum_{k=1}^{K} \beta_k \overline{X}_{kt}$$

where $ERM_t = R_{ft} + 0.05$ is the estimated expected return for the market for the year and $\overline{X}_{kt}$ is the mean of explanatory variable in regression (2), X_{kt}, for all firms over the past ten years, the period over which the mean β_k are estimated. This calculation simply recognizes the property that the OLS intercept is always the mean of the dependent variable minus the mean of the explanatory variables multiplied by their estimated coefficients. But, rather than the mean X_{kt} variable being that for the cross-section for the relevant year (which may be influenced by ex post factors in that year), the mean, $\overline{X}_{kt}$, is now the mean over all firms for the preceding ten years. The procedure recognizes that the mean expected return must be equal to the expected return on the market. It does assume a risk premium of five percent, but the resultant cost-of-capital estimate can be adjusted by an investor with a different required risk premium (price of risk), and it can be adjusted for variation in that risk premium over time.[43] As the revised intercept just shifts ER_t by a constant in the cross-section, the properties of the resultant cost-of-capital portfolios are the same as those in Tables 1 – 4.

Table 5 reports the mean cost-of-capital estimates, C of C_t, under the two procedures. Under both procedures, cost-of-capital estimates around the median (portfolio 5) look close to the standard expectation of 10 percent to 12 percent for the average return and close to the average CAPM estimates in Table 4 (though benchmarking is difficult). They also align with actual returns in t+1. The expected returns over portfolios co-vary strongly, with the Pearson correlations ranging (for the mean $\overline{X}_{kt}$ adjusted intercept) from 0.93 between portfolios 1 and 9 to 0.99 for a number of portfolios. This indicates that the estimates co-vary strongly with common risk factors and their premiums.[44]

However, the estimates for the extreme portfolios are still extreme. These portfolios are likely to be those with high measurement error (that throws estimates to the extremes). The higher standard deviation of estimates for the extreme portfolios (not reported) suggest so. If an estimate in the extreme is influenced by measurement error, subsequent estimates will regress towards the error-corrected estimate provided that the measurement error is not strongly serially correlated. So the table reports the median cost of capital for firms in each portfolio estimated one year later, C of C_{t+1}. (Medians give lower weight to extreme observations in the extreme portfolios.) For both adjustments, extremes are pulled closer to central values (though less so for the risk-free rate intercept) and the estimates shrink over the whole range.

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[43] We applied an alternative procedure by predicting each X_{kt} from the following model estimated in time series over the sample period: $\text{Mean}X_{kt} = a + b_1.\text{Mean}X_{kt-1} + b_2.\text{Mean}X_{kt-2} + b_3.\text{Mean}X_{kt-3} + \text{error}_t$. Results were similar.

[44] Rolling ten-year estimates follow the same pattern over time as those in Figure 2 (but with a mean shift).

The cost-of-capital estimates are those for one year ahead. The approach is amenable to estimating regressions (1) and (2) with the target variables as growth and returns in subsequent years. However, that could only be for the short-term future because of data limitations and survivorship issues. Alternatively, one can envisage predictions from modeling the evolution of the determining accounting variables in the future as investments are made and earnings are deferred or realized. One can also envision a model that describes the evolution of the cost of capital estimates over time, a model that then can be estimated and applied out of sample to forecast the cost of capital recursively for a number of years ahead. Needless to say, forecasting for the very long term is problematic, but investors presumably are primarily concerned with shocks to their portfolios in the near-term, shocks that include revisions in expectations of the long term as financial reports evolve.

6. A Simple Estimate

A reasonable criticism might point to the complexity of the estimation procedure. So we report on a simpler, parsimonious estimate involving only E_t/P_t and B_t/P_t. These are the two variables that are identified in Penman, Reggiani, Richardson, and Tuna (2015) as jointly forecasting earnings growth, the risk around the expected growth, earnings betas, and stock returns. They are the variables which, when employed in the scheme in Exhibit 1, identify ROE and the effects of conservative accounting on growth and risk in the Penman and Zhang (2015).

E_t/P_t and B_t/P_t are the first two variables in regression equations (1) and (2). These equations were estimated with just these two variables, and SER_t (a simple expected return) was then estimated by applying estimated coefficients from regression (2) out of sample, as before.

Table 6 summarizes the output for 10 portfolios formed on the estimate. The mean intercept from estimating regression (2) over the years is 0.095 and the mean slope coefficients on E_t/P_t and B_t/P_t were 0.180 and 0.089, respectively.[45] These estimates, applied to the mean out-of-sample E_t/P_t and B_t/P_t in the table, yield the SER_t. The SER_t are positively correlated with actual t+1 returns. Cross-sectional regressions of actual returns for t+1 on SER_t (like those in Table 3) produced mean slope estimates of 1.135 for portfolios and 0.960 for individual firm regressions, not significantly different from 1.0, and mean intercepts (average errors) not significantly different from zero. The table also reports the shrinkage estimates for the cost of capital with the intercept adjusted for the mean X_{kt} = (E_t/P_t, B_t/P_t), as in Table 5.

This minimalist calculation uses just the bottom line numbers in the financial statements, earnings, and book values. It impressive how well it performs. It is then a question of how much improvement one gets by adding further information. The A_j variables in our analysis are such information, but the question is open to further exploration, provided included variables accord with our *a priori* criteria. Adding a specific measure of conservative accounting and its effect of ROE may be helpful. Both operating and financing leverage might be incorporated. Penman, Reggiani, Richardson, and Tuna (2015) show that the weights on E_t/P_t and B_t/P_t in predicting both earnings growth and returns changes with firm size, so the estimation might be done within size groups. In a strict application of the scheme in Exhibit 1, one might estimate within E_t/P_t portfolios (where E_t/P_t is roughly the same), effectively restricting the coefficient on E_t/P_t in regression (2) to be 1.0. As stated earlier, the point of this paper is to introduce an alternative approach rather than the definitive measure.

7. Conclusion

The "true" cost of capital is unobservable, so validation is an elusive endeavor. In a sense, acceptance of any measure must be on the basis of what "looks good" relative to alternatives.

[45] The mean estimates for 2001-2012 (which may be more relevant today) are 0.074 for the intercept and 0.112.and 0.104 for the coefficients on E_t/P_t and B_t/P_t.

However, "looking good" requires a set of aesthetic criteria. We embrace the following. First, a measure requires an *a prioi* rationale, and that rationale must involve a connection to risk. Second that measure must be supported by empirical evidence that the *a priori* conditions are satisfied. Third, in actual appearance, the measure must exhibit the features that one identifies with risk and the expected return for risk. The measure here satisfies all three criteria, both in absolute terms and on a relative basis to the alternatives examined. At worse, the analysis here is helpful in identifying deficiencies in the alternatives in satisfying these three requirements, though we view the paper in a much more positive and constructive light.

The cost of capital presumably changes over time as risk premiums (the price of risk) change. So the estimates offered here are not necessarily those for a particular year. That would depend on the price of risk at the time—indeed, each individual's price of risk which presumably varies over individuals. While Figure 1 indicates some common variation in expected return estimates over time, the estimates are based largely on cross-sectional differences in risk rather than the price of risk. An intriguing question is whether the latter can be extracted using accounting data: Variation over time in mean E_t/P_t and B_t/P_t or the other accounting characteristics? The work of Ellahie, Katz, and Richardson (2014) that explains cross-country average returns with aggregate E_t/P_t and B_t/P_t is promising in this regard.

Appendix

This appendix lists the accounting variables, $\frac{B_t}{P_t}$ and A_j, $j = 3,\ldots, K$, that enter as predictors of earnings growth and returns in regressions (1) and (2). The variables are accompanied by an explanation as to why they pertain to accounting principles that tie expected growth to risk and thus are selected under requirement (i) in the text to then be examined under requirements (ii) and (iii).

That explanation is accompanied by a report of whether requirements (ii) and (iii) are supported empirically. For B/P, the sign of the mean estimated coefficient is that in the validating regressions (1) and (2) with only E/P also in the regression. For the other variables, the sign is from the validating regressions (1) and (2) with both E/P and B/P in the regression. Thus, the sign of the mean coefficients for these variables are conditional upon the two bottom line numbers, earnings and book values (and implicitly ROE), in the regression. See Penman and Zhu (2014) for these estimates and associated test statistics.

A variable potentially indicates higher growth and risk if it indicates deferral of earnings recognition to the future (until realization) because of uncertainty. Correspondingly, a variable that results from the realization of expectations potentially indicates lower risk. While implied by accounting principle, the *a priori* reasoning does not formally connect the variables to priced risk and return. More modeling is required to make the explicit connection under a valid asset pricing model (if one were available). However, where support is provided by extant asset pricing theory, it is reported, for example with the connection of investment to expected returns in the Merton inter-temporal asset pricing model or the Liu, Whited, and Zhang (2009) "Investment-CAPM."

Variable	Calculation	Explanation for Selection	Predicted and Actual Sign of Coefficient in Regression (1)	Predicted and Actual Sign of Coefficient in Regression (2)
Book-to-price (B_t/P_t)	Common equity at the end of fiscal-year t, divided by price at t. Book value is Compustat's common equity (item CEQ) plus any preferred treasury stock (item TSTKP) less any preferred dividends in arrears (item DVPA). Book value and prices are on a per-share basis, with prices at three months after fiscal-year end adjusted for stock splits and stock dividends during the three months after fiscal-year end.	Earnings and book value are the primary summary accounting numbers. For a given E/P, B/P recovers earnings-to-book (ROE) that captures the effect of earnings deferral and conservative accounting on these summary numbers. See text and Penman and Zhang (2015) for further explanation and for documentation that ties ROE to risky growth expectations and to returns. Penman, Reggiani, Richardson, and Tuna (2015) document that, given E/P, B/P forecasts earnings growth, and also the risk surrounding the expected growth.	Positive	Positive
Sales growth rate$_t$	$\frac{\Delta Sales_t}{Sales_{t-1}}$	Sales (revenues) are a realization of growth expectations, resolving uncertainty (and reducing risk) under accounting principles. The realization of growth expectations reduces future expectations, *ceteris paribus*. Correspondingly, unrealized (expected) sales indicate higher risk (that the expectation will not be realized).	Negative	Negative
Accruals$_t$	Sum of change in accounts receivable (Compustat item RECT), change in inventory (item INVT), and change in other current assets (item ACO), minus the sum of change in accounts payable (item AP) and change in other current liabilities (item LCO), minus depreciation and amortization expense (item DP), all divided by average assets	Accruals are driven primarily by sales recognition (receivables net of revenue deferrals) from realization. But they also include associated expense accruals that allocate costs to the current period versus deferral to the future (with the latter decreasing expected earnings growth). Netting change in operating working capital against depreciation and amortization	Negative	Negative

		recognizes conservative accounting for accelerated depreciation and amortization.		
$Investment_t$	Change in gross property, plant, and equipment (item PPEGT) + change in inventory (item INVT), all divided by lagged assets	Investment booked to the balance sheet is the realization of (uncertain) investment opportunities and thus resolution of the risk that those opportunities will be realized. In making investments, the firm signals that earnings can be realized, and realized earnings imply lower risk under accounting principles. This is a restatement in accounting terms of the connection between the exercise of real options and expected returns in Berk, Green, and Naik (1999). It is also an elaboration on Cochrane (1991) *q*-theory under which firms make investments when the hurdle rate for investment is lower: The prospect of realizable earnings lowers that rate. Further, under conservative accounting, investment booked to the balances sheet is deemed lower risk for earnings outcomes than investment that is expensed immediately (as risky). The Merton (1973) intertemporal CAPM and the Liu, Whited, and Zhang (2009) Investment-CAPM provide formal links to expected returns.	Negative	Negative
Growth in net operating assets (ΔNOA_t)	Change in net operating assets divided by average assets. Net operating assets is the sum of accounts receivable (item RECT), inventory (item INVT), other current assets (item ACO), property, plant, and equipment (item PPENB), intangible assets (item INTAN) and other long term assets (item AP), minus the sum of accounts payables (item AP), other current liabilities (item LCO) and other long term liabilities (item LO)	This is the total of all changes in the operating section of the balance sheet due to realized income from operations and realized investments. It also includes recognized earnings not captured by the accruals measure, for example, income in subsidiaries, realized gains and losses on assets sales, changes in deferred taxes, impairments and restructurings, and write-downs. For a given earnings (in E/P), ΔNOA is lower if (relatively risky) investments are expensed with conservative accounting. Write-downs and impairments are due to revisions of expected cash flows, and	Negative	Negative

		expected cash flows are negatively related to the cost of capital *ceteris paribus* in asset pricing theory (see Johnstone 2015).		
External financing ($EXTFIN_t$)	Change in debt plus the change in equity from net equity transactions, scaled by average assets. Change in debt is the cash proceeds from the issuance of long term debt (item DLTIS) less cash payments for long term debt reductions (item DLTR) plus the net changes in current debt (item DLCCH). Change in equity is measured as the proceeds from the sale of common and preferred stock (item SSTK) less cash payments for the purchase of common and preferred stock (item PRSKC) less cash payments for dividends (item CDVC).	External financing is positively correlated with current investment, and also indicates plans for further investment. Lamont (2000) shows that investment plans are negatively correlated with future returns. These investments and investment plans are realizations (or anticipated realizations) of uncertain investment opportunities which, in turn, signal that expected sales and earnings can be realized in the future (as above).	Negative	Negative
Net share issue (NSI_t)	The natural log of the ratio of split-adjusted shares outstanding at the end of the fiscal year to shares outstanding at the end of the previous fiscal year.	For given total financing (EXTFIN), net share issues reduce future earnings per share (growth) and reduce leverage.	Negative	Negative

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Figure 1. Ten-year Rolling Averages of Estimated Expected Returns, ER_t, for Ten ER_t Portfolios

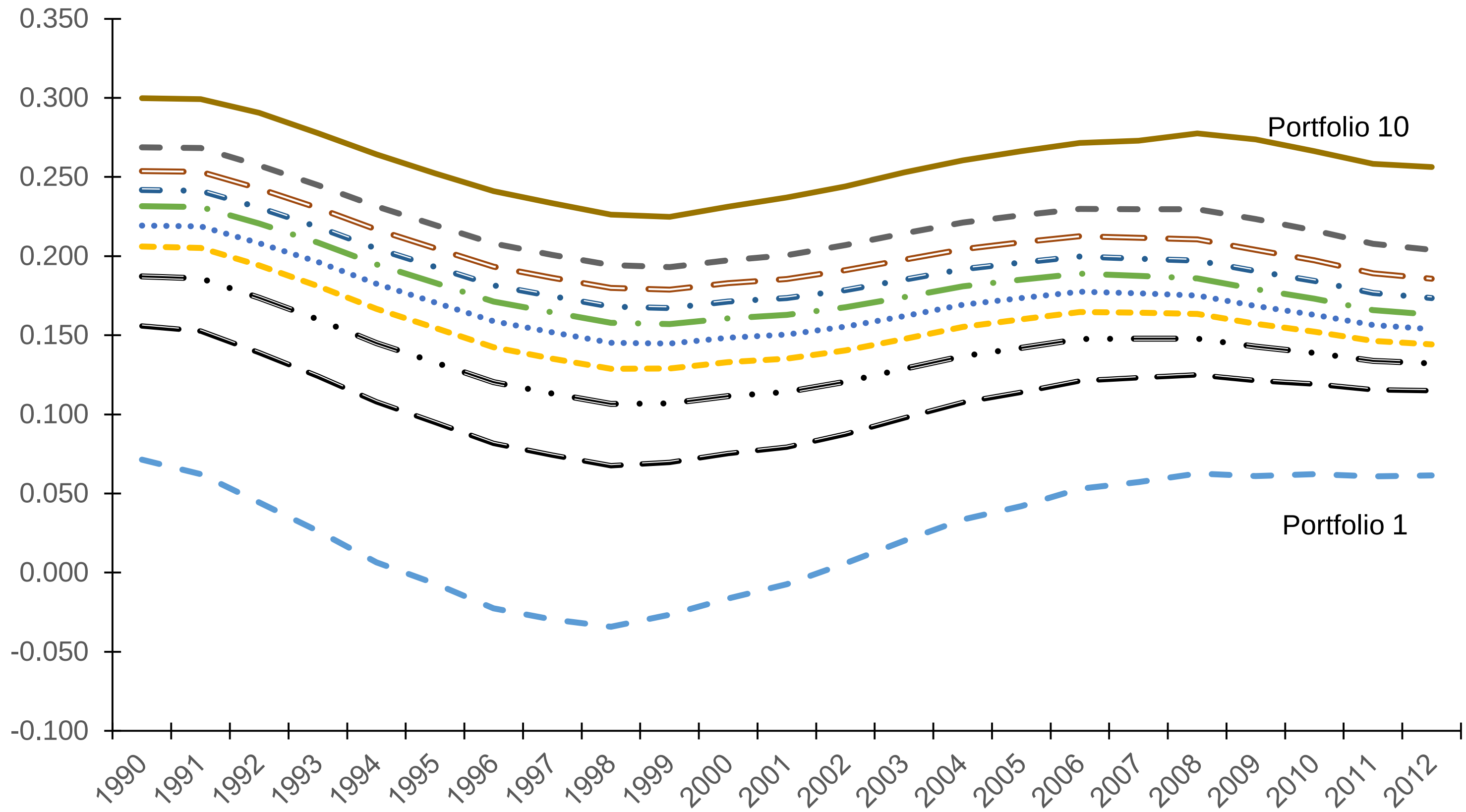

Figure 2. Ten-year Rolling Averages of Predictive Slopes for Out-of-Sample ER_t Forecasts of Actual Annual Returns

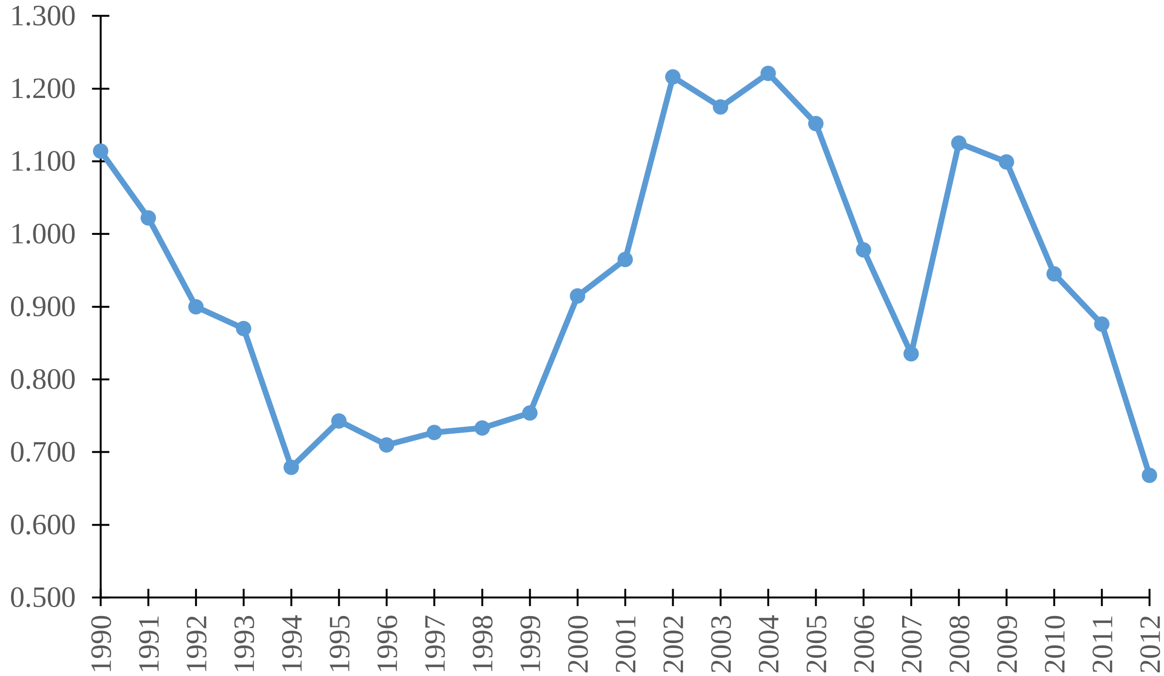

Table 1

Accounting Characteristics for Expected Return Portfolios

The table reports mean expected returns, ER_t, and accounting characteristics for portfolios formed on the estimated expected returns. Reported numbers are means over years of means for the ten portfolios formed each year, 1981-2012. Panel A characteristics are those at the time that ER_t is estimated, and Panel B characteristics are those observed subsequently. ER_t is estimated by first estimating regression (2) in the cross-section with variables in the appendix, and then applying mean coefficients estimates over the prior 10 years to accounting characteristics in each year on a rolling basis. Forecasts of EPS growth rates two years ahead are estimated by applying mean coefficients from estimating regression equation (1) over the prior 10 years to accounting characteristics in each year.

Panel A: Time-t Accounting Characteristics for Expected Return Portfolios

Expected Return Portfolio	Expected Return (ER_t)	Forecast of EPS Growth Rate Two Years Ahead	E_t/P_t	B_t/P_t	Sales $Growth_t$	Change in Operating Profit $Margin_t$	$Accruals_t$	Invest$ment_t$	ΔNOA_t	$EXTFIN_t$	NSI_t	ER_{t+1}
1 (Low)	0.043	0.119	-0.103	0.437	0.374	0.037	0.005	0.187	0.190	0.276	0.151	0.117
2	0.117	0.043	-0.015	0.471	0.255	0.024	-0.001	0.141	0.154	0.104	0.080	0.145
3	0.145	0.030	0.009	0.486	0.195	0.009	-0.011	0.112	0.124	0.055	0.047	0.159
4	0.162	0.028	0.020	0.515	0.145	0.007	-0.020	0.088	0.098	0.028	0.028	0.168
5	0.174	0.031	0.030	0.542	0.121	0.005	-0.030	0.074	0.076	0.011	0.018	0.175
6	0.186	0.041	0.029	0.610	0.097	0.003	-0.040	0.059	0.057	-0.001	0.013	0.182
7	0.197	0.053	0.030	0.667	0.078	0.001	-0.049	0.051	0.042	-0.011	0.007	0.187
8	0.209	0.070	0.029	0.775	0.055	0.001	-0.056	0.037	0.022	-0.019	0.004	0.196
9	0.225	0.104	0.018	0.944	0.035	0.005	-0.066	0.022	0.004	-0.026	0.000	0.205
10 (High)	0.264	0.215	-0.044	1.354	-0.001	0.011	-0.093	-0.012	-0.043	-0.044	-0.004	0.222

Panel B: Accounting Characteristics Subsequent to Time-t for Expected Return Portfolios

Expected Return Portfolio	EPS Growth Rate Two Years Ahead				EPS Over Next Four Years/P_t				
	Forecast	Actual	STD Actual	IDR Actual	Actual	STD Actual	IDR Actual	Earnings $Beta_{t+1}$	Earnings Change $Beta_{t+1}$
1 (Low)	0.119	0.023	0.154	0.361	0.013	0.072	0.192	0.45	0.84
2	0.043	0.008	0.157	0.459	0.091	0.048	0.112	0.71	0.81
3	0.030	0.012	0.163	0.425	0.134	0.050	0.098	0.72	0.94
4	0.028	0.019	0.147	0.382	0.154	0.049	0.115	0.85	0.69
5	0.031	0.044	0.147	0.430	0.184	0.052	0.109	0.85	0.47
6	0.041	0031	0.176	0.462	0.188	0.052	0.066	0.90	0.72
7	0.053	0.053	0.168	0.450	0.206	0.054	0.091	1.16	1.27
8	0.070	0.051	0.174	0.376	0.203	0.060	0.138	1.30	1.82
9	0.104	0.082	0.206	0.502	0.200	0.081	0.218	2.10	2.24
10 (High)	0.215	0.123	0.263	0.672	0.162	0.124	0.308	4.42	2.46

E_t/P_t is earnings for fiscal-year t divided by stock price. Earnings are before extraordinary items (Compustat item IB) and special items (item SPI), minus preferred dividends (item DVP), with a tax allocation to special items at the prevailing Federal statutory corporate income tax rate for the year. Earnings and prices are on a per-share basis, with prices observed three months after fiscal-year end adjusted for stock splits and stock dividends during the three months after fiscal year end. Operating profit margin is earnings before net interest expense divided by sales. All other accounting characteristics in Panel A are defined in the appendix.

In Panel B, STD is standard deviation and IDR is the interdecile range of annual portfolio means over years. EPS Over Next Four Years/P_t is the sum of split-adjusted EPS for years t+1 to t+4 with dividends for year t+1 to t+3 reinvested as the prevailing risk-free rate for the year, all divided by price per share at t. Earnings beta is the slope coefficient from estimating the following time-series regression of portfolio annual earnings yield on the market-wide earnings yield, for December 31 fiscal-year firms only (to align in calendar time):

Portfolio $\frac{Earnings_{t+1}}{P_t} = \alpha + \beta \cdot \text{Market} \frac{Earnings_{t+1}}{P_t} + \varepsilon_t$. The portfolio earnings yield is aggregate earnings for the portfolio relative to aggregate price and the market earnings yield is aggregate earnings for all stocks in the sample for the relevant year relative to aggregate price. Earnings change betas are similarly estimated. ER_{t+1} is the mean expected return at the end of year t+1 estimated for firms in the respective ER_t portfolios at time t.

Table 2

Expected Returns, Actual Returns, and Forward Betas

The table summarizes the distribution of actual (realized) annual returns for ER_t portfolios over the following year. It also reports betas for these actual returns with respect to the market return (the return for the value-weighted CRSP index) and their sensitivities to factors in the Fama and French (FF) five-factor model and I/A factor in the Hou, Xue, and Zhang (2015a) (HXZ) Investment CAPM.

Expected Return Portfolio	**Expected Return (ER_t)**	**Actual Annual Return t+1**						**Market Beta t+1 (Annual Returns)**			**FF Betas t+1 (Monthly Returns)**				**HXZ Beta t+1**
		Mean	**Median**	**STD**	**Range**	**Skewness**	**Kurtosis**	**All Years**	**Up Beta**	**Down Beta**	**HML**	**SMB**	**RMW**	**CMA**	**I/A**
1 (Low)	0.043	0.049	0.028	0.258	0.977	0.495	2.364	1.31	1.77	0.48	0.07	0.84	-0.31	-0.34	-0.46
2	0.117	0.094	0.042	0.211	0.847	0.074	2.344	1.13	1.35	0.81	0.10	0.78	-0.15	-0.15	-0.29
3	0.145	0.129	0.117	0.216	0.967	0.097	2.886	1.15	1.44	0.87	0.09	0.78	-0.13	-0.08	-0.15
4	0.162	0.144	0.139	0.214	1.037	0.557	3.562	1.12	1.38	0.85	0.06	0.70	-0.11	0.01	-0.04
5	0.174	0.155	0.113	0.215	1.041	0.497	3.330	1.20	1.58	0.96	0.07	0.75	-0.03	0.06	0.02
6	0.186	0.160	0.151	0.197	0.941	0.485	3.784	1.18	1.62	0.99	0.19	0.73	-0.05	0.02	0.10
7	0.197	0.179	0.174	0.201	0.990	0.337	3.569	1.20	1.65	1.12	0.17	0.70	-0.09	0.06	0.13
8	0.209	0.191	0.174	0.235	1.074	0.717	4.316	1.30	1.77	1.27	0.19	0.72	-0.14	0.04	0.22
9	0.225	0.212	0.219	0.258	1.413	1.142	6.050	1.41	2.02	1.44	0.27	0.73	-0.32	0.01	0.26
10 (High)	0.264	0.282	0.241	0.360	1.826	1.265	5.782	1.82	2.89	1.45	0.14	0.80	-0.62	0.13	0.28

Actual return metrics summarize the times series of portfolio actual returns for ER_t portfolios in year t+1, 1981-2012. Betas and other factor betas are estimated from the time series of portfolios returns, the market return betas with annual returns and the Fama and French (FF) betas with monthly returns. Returns are equally weighted in ER_t portfolios. Market return betas are estimated with December 31 fiscal-year firms only. Up markets are those where the CRSP value-weighted index was greater than 10% for the year, and down markets are those where it was less than -10%. FF and HXZ betas are estimated with all factors in the model (not one at a time). HML, SMB, RMW, and CMA monthly returns are those for the Fama and French book-to-price, size, profitability, and investment factors, respectively, and are from the Kenneth French website library. Monthly returns on Investment CAPM factors were supplied by Lu Zhang. With the exception of portfolio1, none of the estimated betas on the CMA factor are significantly different from zero, nor are those for HML in portfolios 1-5 and RMW in portfolios 5 and 6. The t-statistics on the I/A factor are significantly different from zero, with the exception of portfolios 4 and 5. Betas on other Investment CAPM factors (size and ROE) were similar across portfolios to the corresponding factors in the FF model.

Table 3

Coefficient Estimates from Annual Cross-sectional Regressions of Forward Actual Returns (R_{t+1}) on ER_t and Other Variables

The table reports mean coefficients from estimating cross-sectional regressions each year, 1981-2012. The t-statistics (in parenthesis) are estimated from the time-series of estimated coefficients with a Newey-West correction for the serial correlation in the coefficient estimates. Size is log market capitalization of equity. Beta is the return beta on the value-weighted CRSP index return. Leverage is net debt/market value of equity. Momentum is the buy-and-hold return over the twelve months prior to one month before the time t when ER_t is estimated.

		Individual Firm ER_t	
	Portfolio ER_t	**ER_t Alone**	**Adding Factors from Pricing Models**
Intercept	-0.034	-0.012	0.057
	(-0.80)	(-0.31)	(1.02)
ER_t	1.065	0.979	0.911
	(6.06)	(6.12)	(9.24)
E_t/P_t			-0.017
			(-0.25)
B_t/P_t	T+		-0.012
			(-0.53)
$Beta_t$			0.002
			(0.27)
$Size_t$			-0.010
			(-1.86)
$Leverage_t$			-0.004
			(-0.66)
$Momentum_t$			-0.008
			(-0.33)
Adj. R^2	0.550	0.015	0.050

Table 4
Implied Cost-of-Capital Estimates (ICC) for Expected Return Portfolios and Cost-of-Capital Estimates from the Capital Asset Pricing Model (CAPM) and Fama and French Three-Factor Model (FF)

For each ER_t portfolio, Panel A of the table reports mean ICC estimates calculated as in Gebhardt, Lee, and Swaminathan (2001) (GLS) and Easton, Taylor, Shroff, and Sougiannis (2002) (ETSS), with mean intercept and slope coefficients and implied cost of capital, *r*, and implied growth, *g*, from applying procedures in ETSS. Panel B reports the mean cost of capital, C of C_t, and actual returns for portfolios formed from CAPM estimates and Fama and French (FF) model estimates with three factors (MKT, SMB, and HML), along with related measures. It also reports the mean CAPM and FF cost-of-capital estimates for ER_t portfolios and, for the latter, the intercepts and associated t-statistics from time-series regressions of excess monthly returns for the ER_t portfolios.

Panel A: Implied Cost of Capital (ICC) for ER_t Portfolios

		ETSS Implied Cost of Capital			
ER_t Portfolio	**GLS ICC_t**	**Intercept γ_0**	**Slope γ_1**	**Implied r (%)**	**Implied g (%)**
1	0.076	0.523	0.101	12.8	10.8
2	0.074	0.382	0.181	11.8	8.3
3	0.076	0.383	0.194	12.0	8.3
4	0.079	0.406	0.170	11.9	8.5
5	0.082	0.226	0.315	11.4	7.0
6	0.081	0.267	0.259	11.0	7.0
7	0.086	0.283	0.218	10.6	6.3
8	0.088	0.213	0.285	10.6	4.7
9	0.095	0.237	0.231	10.0	5.1
10	0.104	0.149	0.347	10.5	4.7
All Firms		0.325	0.205	11.2	7.3

Panel B: Cost of Capital Estimates from Asset Pricing Models

CAPM Cost of Capital Portfolios					CAPM Cof C_t for ER_t Portfolios		FF Cost of Capital Portfolios		FF Cost of Capital for ER_t Portfolios		
Portfolio	Cof C_t	Mean $Beta_t$	$Beta_{t+1}$	Actual $Return_{t+1}$	Cof C_t	$Beta_t$	FF Cof C_t	Actual $Return_{t+1}$	FF Cof C_t	FF Intercept	t-stat FF Intercept
1	0.069	0.06	0.75	0.142	0.133	1.36	0.006	0.128	0.161	-0.0065	-3.92
2	0.091	0.50	0.80	0.159	0.129	1.27	0.071	0.148	0.155	-0.0026	-2.23
3	0.101	0.71	0.90	0.170	0.127	1.22	0.096	0.157	0.151	-0.0003	-0.28
4	0.109	0.88	0.97	0.170	0.124	1.17	0.116	0.167	0.149	0.0002	0.24
5	0.117	1.03	1.06	0.170	0.123	1.15	0.135	0.160	0.147	0.0019	2.27
6	0.125	1.19	1.15	0.168	0.122	1.14	0.153	0.159	0.149	0.0017	2.11
7	0.134	1.38	1.21	0.161	0.121	1.12	0.174	0.159	0.149	0.0034	4.00
8	0.146	1.61	1.31	0.161	0.121	1.11	0.200	0.168	0.149	0.0038	4.17
9	0.163	1.94	1.46	0.135	0.121	1.11	0.238	0.161	0.152	0.0049	4.32
10	0.202	2.73	1.67	0.130	0.120	1.09	0.358	0.158	0.154	0.0081	4.99

Historical CAPM $Beta_t$ is estimated for each firm from monthly returns over 60 months prior to the point when the Cof C_t is estimated (or a lesser period if returns are not available for the full period). $Beta_{t+1}$ is estimated from monthly portfolio returns during actual return periods over the complete sample period. Fama and French cost-of-capital estimates are calculated by applying factor sensitivity coefficients estimated over the prior 60 months to mean factor returns over the whole sample period and adding the estimated intercept, with these estimates then annualized. The FF intercepts are estimated from FF model time-series regressions with monthly excess returns for ER_t portfolios during actual returns periods.

Table 5

Cost-of-Capital Estimates with Intercept Adjustments

The table reports cost-of-capital estimates, C of C_t, for portfolios, calculated after shrinking the expected returns in Tables 1 and 2 with an intercept adjustment when applying regression (2). The first adjustment sets the intercept at the prevailing risk-free rate for the year. The second adjusts the intercept for the mean of the explanatory variables over the past ten years. The table also reports mean actual returns in the subsequent year and the mean estimated cost of capital at the end of that year, C of C_{t+1}, for firms in the respective C of C_t portfolios.

	Intercept is R_{ft}				Mean-adjusted Intercept			
C of C_t Portfolio	Mean C of C_t	Median C of C_t	Actual $Return_{t+1}$	Median C of C_{t+1}	Mean C of C_t	Median C of C_t	Actual $Return_{t+1}$	Median C of C_{t+1}
1	-0.018	0.003	0.061	0.063	-0.021	-0.034	0.049	0.044
2	0.066	0.063	0.107	0.086	0.055	0.049	0.094	0.083
3	0.095	0.085	0.139	0.099	0.083	0.080	0.129	0.091
4	0.114	0.101	0.135	0.106	0.100	0.097	0.144	0.097
5	0.129	0.115	0.161	0.118	0.113	0.109	0.155	0.098
6	0.142	0.128	0.167	0.127	0.124	0.120	0.160	0.104
7	0.156	0.142	0.179	0.136	0.135	0.130	0.179	0.113
8	0.173	0.159	0.204	0.150	0.147	0.141	0.1921	0.122
9	0.197	0.183	0.236	0.165	0.163	0.155	0.212	0.140
10	0.261	0.241	0.272	0.197	0.203	0.198	0.282	0.158

Table 6

Simple Expected Returns and Cost-of-Capital Estimates

The table reports means (over years) of Simple Expected Returns, SER_t, actual returns, and shrinkage cost-of-capital estimates for portfolios formed on SER_t each year, 1981-2012. SER_t is estimated out-of-sample by applying mean regression coefficients over the past ten years from estimating regression (2) with only E_t/P_t and B_t/P_t as explanatory variables. The table also reports mean regression coefficients from estimating regression (2) in all years, 1981-2012. The shrinkage estimates are mean-adjusted estimates, as in the second adjustment in Table 5.

Simple Exp. Ret. Portfolio	Mean SER_t	Actual $Return_{t+1}$	Mean E_t/P_t	Mean B_t/P_t	Median Shrinkage C of C_t	Median Shrinkage C of C_{t+1}
1	0.062	0.042	-0.351	0.350	0.035	0.052
2	0.109	0.081	-0.051	0.263	0.066	0.070
3	0.121	0.116	-0.004	0.302	0.079	0.081
4	0.131	0.130	0.012	0.377	0.088	0.089
5	0.140	0.143	0.022	0.456	0.097	0.097
6	0.149	0.151	0.026	0.550	0.107	0.105
7	0.160	0.160	0.033	0.662	0.118	0.114
8	0.173	0.183	0.037	0.802	0.131	0.125
9	0.193	0.198	0.036	1.023	0.150	0.138
10	0.244	0.227	0.021	1.613	0.191	0.164