Non-Dividend Paying Stocks and the Negative Value Premium

George W. Blazenko\textsuperscript{a,*} and Yufen Fu\textsuperscript{b}

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\textsuperscript{a}Faculty of Business Administration, Simon Fraser University, 8888 University Way, Burnaby, BC, Canada, V5A 1S6

\textsuperscript{b}The Segal Graduate School of Business, Simon Fraser University, 500 Granville Street, Vancouver, BC, Canada, V6C 1W6

Abstract

The profitability motivated risk/return dynamics of non-dividend paying firms is distinct from dividend paying firms. We find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability companies. Rather, in a dynamic equity valuation model, expected return for non-dividend paying firms is the forward rate of return on equity (ROE) plus a term that depends on earnings volatility. Because of constraints that restrict external financing, firms finance growth investments internally, but only when profitability permits. These investments increase risk. Consistent with this model, we find high returns for high profitability, high market/book, growth-stocks. High return combined with high market/book is a negative value premium for non-dividend paying companies. When we benchmark the returns of portfolios formed by ranking forward ROE and return volatility against a conditional asset-pricing model, we find negative abnormal returns for low risk value-stocks and positive abnormal returns for high risk growth-stocks. While rational financial-economic analysis guides our empirical investigation, we cannot rule out market-inefficiency as an explanation for abnormal returns. Either equity-markets over-price low-risk stocks and under-price high-risk stocks or current asset-pricing models do not fully capture the negative value-premium for non-dividend paying companies.

Keywords: Equity investing, portfolio management, analysts’ forecasts.

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\textsuperscript{*}Corresponding address. Tel.: +1 778 782 4959; fax: +1 778 782 4920

E-mail address: blazenko@sfu.ca, yfa5@sfu.ca
Non-Dividend Paying Stocks and the Negative Value Premium

Abstract

The profitability motivated risk/return dynamics of non-dividend paying firms is distinct from dividend paying firms. We find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability companies. Rather, in a dynamic equity valuation model, expected return for non-dividend paying firms is the forward rate of return on equity (ROE) plus a term that depends on earnings volatility. Because of constraints that restrict external financing, firms finance growth investments internally, but only when profitability permits. These investments increase risk. Consistent with this model, we find high returns for high profitability, high market/book, growth-stocks. High return combined with high market/book is a negative value premium for non-dividend paying companies. When we benchmark the returns of portfolios formed by ranking forward ROE and return volatility against a conditional asset-pricing model, we find negative abnormal returns for low risk value-stocks and positive abnormal returns for high risk growth-stocks. While rational financial-economic analysis guides our empirical investigation, we cannot rule out market-inefficiency as an explanation for abnormal returns. Either equity-markets over-price low-risk stocks and under-price high-risk stocks or current asset-pricing models do not fully capture the negative value-premium for non-dividend paying companies.

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1. Introduction

Arrow (1974) argues that corporations exist to organize the information gathering tasks of employees required for deployment of capital from investors when decision making is delegated to corporate managers who have developed this skill for the mutual benefit of all. Arrow attributes limited growth to the organizational costs of coordinating information processing and communication which exhibit dis-economies of scale. Tobin (1969) also presumes limits to corporate growth because $q$—market value of assets per dollar of replacement cost—exceeds unity, as it often does, only if these limits exist. Blazenko and Fu (2010) argue that the source of the value-premium—high returns for value compared to growth firms—is limits to growth. Limited growth opportunities restrict corporate managers from using high profitability to enhance growth which instead “covers” the ongoing costs of growth capital expenditures and reduces risk. Thus, high profitability growth firms, with great market/book, have lower risk and lower returns than value firms. Blazenko and Fu (2010) report supporting evidence for dividend paying companies.

In the pecking order hypothesis for corporate financing, companies pay dividends when they have no need to retain earnings to finance growth which suggests that they face limited growth prospects. The same argument cannot be made for non-dividend paying companies. Thus, Blazenko and Fu’s (2010) limits-to-growth hypothesis for the value premium does not apply to non-dividend paying companies. Because Blazenko and Fu do not consider non-dividend paying companies, we investigate the value premium for non-dividend paying companies in this paper.

The decision by corporate managers not to pay dividends is evidence of financing constraints (e.g., Froot, Scharfstein, and Stein 1993) that impede the development of unbounded (or at least less limited) growth opportunities. Profitability allows these firms to finance internally when they cannot finance externally, which increases growth, growth leverage, and return. Because high market/book companies have high profitability, the principal hypothesis that we test in this paper is that there is no value premium for non-dividend paying companies.

To structure this hypothesis, we investigate a dynamic equity valuation model for a non-dividend paying firm which predicts that expected return is the forward rate of return on equity ($ROE$) plus a term that depends on earnings volatility. We find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability companies. Rather, we find that high market/book growth stocks have high $ROEs$ (with consensus analysts’ earnings forecasts) and high returns which is consistent with unbounded growth opportunities constrained by financing and
undertaken only when profitability permits. High returns for growth stocks compared to value stocks is a negative value premium for non-dividend paying companies. Thus, we find that the profitability motivated risk/return dynamics of firms differs depending upon whether or not they pay dividends.

The literature on the relation between returns and profitability includes Haugen and Baker (1996) who use past equity returns as a proxy for corporate profitability to find that past ROE is an important determinant of expected return in a return characteristic model. Fama and French (2006) investigate profitability as a determinant of expected return. They use lagged accounting information and proxies of firm characteristics to predict profitability and then use this prediction in a cross-sectional return characteristic regression. They find that although lagged accounting information can predict future profitability, this prediction has little explanatory power for returns. Chen, Novy-Marx, and Zhang (2010) develop a three factor return model (a market factor, a factor for historical profitability, and an investment factor) as an alternative to Carhart’s (1997) four factor model that includes the three Fama and French (1996) factors plus a momentum factor. They find that in some circumstances, their three factor model with profitability explains equity returns better than Carhart’s (1997) four factor model. Rather than using historical earnings, we use analysts’ earnings forecasts for corporate profitability in forward ROE. We find that ROE relates positively with realized returns. Last, our development of the limits-to-growth hypothesis for returns predicts, and we present supporting evidence, that the relation between returns and profitability differs depending upon whether or not firms pay dividends.

The financial literature documents a number of ways in which firms that do and do not pay dividends differ. Pastor and Veronesi (2003) find that non-dividend paying firms have high market/book ratios, high return volatility, and high profit volatility. Fama and French (2001) find that non-dividend paying firms have low profitability, strong growth opportunities, and are smaller in size. Rubin and Smith (2009) find that non-dividend paying firms tend to be younger in age, smaller in size, more leveraged, and more volatile in daily returns than dividend paying firms. In addition to these differences, we find that non-dividend paying firms have a negative value premium.


There are several explanations for the value premium: financial distress, growth-option exercise, investment irreversibility, and limits to growth. First, Fama and French (1998, 2007) argue that the
value-premium reflects financial distress. Garcia-Feijoo and Jorgensen (2007) show that degree of operating leverage (which depends upon profitability) relates positively with book/market and is an important determinant of the value premium. Second, Anderson and Garcia-Feijoo (2006) find that the market/book ratio relates to the recent capital expenditures. High market/book growth firms have large past capital expenditures which they interpret as the exercise of growth options which reduces risk. Consistent with this interpretation, they find low average returns for these firms. Fama and French (2007) argue that market/book declines for growth firms because they have just exercised growth options. On the other hand, value firms restructure to improve their profitability which increases market/book. This market/book convergence increases return for value firms and decreases return for growth firms. Third, Zhang (2005) argues that the flexibility of growth options compared to irreversibility of in-place assets makes value-firms riskier than growth-firms. Fourth, Blazenko and Pavlov (2009) and Blazenko and Fu (2010) argue that the source of the value-premium is limits to growth. High profitability for growth firms covers the fixed costs of growth capital expenditures which reduces risk. In the current paper, we argue that growth opportunities are less limited for non-dividend paying firms than they are for dividend paying firms. Thus, we test for a negative value-premium for non-dividend paying stocks.

Recent literature documents a negative relation between past idiosyncratic return volatility and future returns (Ang et. al 2006, 2009). Barinov (2010) argues that high idiosyncratic volatility decreases the beta of growth options, which decreases expected return. Studies show that, analysts’ forecast dispersion as a volatility measure has a negative relation with future returns which Han and Manry (2000), Diether et. al (2002), Johnson (2004), Sadka and Scherbina (2007) and Avramov et. al (2009) attribute to information asymmetry, short-sale constraints, the option value of the equity, market liquidity, and financial distress, respectively. For non-dividend paying firms, we find no strong relations between the profitability motivated changes in the measures of volatility that we investigate and equity returns. This evidence suggests that any relation between returns and volatility is encompassed in the relation between returns and profitability that we investigate.

We find negative abnormal returns for low risk value-stocks and positive abnormal returns for high risk growth-stocks. Rational financial-economic analysis guides our empirical investigation, but we cannot dismiss market-inefficiency as an abnormal-return explanation. To do so would bias future scientific inquiry that our research might inspire. Either equity-markets over-price low-risk stocks and
under-price high-risk stocks or current asset-pricing models do not fully capture the negative value premium for non-dividend paying companies.

The rest of our paper is organized as follows. In section 2, we develop a dynamic equity valuation model for non-dividend paying firms which predicts that expected return is the forward rate of return on equity \((ROE)\) plus a term that depends on earnings volatility. In sections 3 and 4 we empirically investigate the relations between the value premium and corporate profitability predicted by our dynamic model. In section 5, we investigate whether or not investors anticipate the negative value premium for non-dividend paying stocks. Section 6 concludes, summarizes our findings, and suggests topics for future research.

2. Dynamic Financial Analysis

2.1. Preliminaries

When earnings growth requires capital growth, Blazenko and Pavlov (2009) value the equity of a company whose manager has a dynamic option to suspend and recommence growth indefinitely. If the return on equity \((ROE)\) falls below a hurdle rate, then the value maximizing manager suspends growth. If \(ROE\) rises above this hurdle rate, the manager recommences growth at a fixed rate \(g>0\). They use this model to show that the endogenously determined cost of capital uniformly exceeds the value maximizing hurdle rate for growth which means that the cost of capital is an unduly conservative benchmark for corporate growth. An important assumption that leads to this result is limited growth which, in their model, means that when a firm grows, it grows at a maximum rate \(g\). In their study of dividend paying firms, Blazenko and Fu (2010) find that high profitability growth firms have lower returns than low profitability value firms. They argue that high profitability growth firms do not need this profitability to fund growth, but instead high profitability “covers” the ongoing costs of limited growth capital expenditures which reduces both risk and return for growth firms compared to value firms.

2.2. Equity Valuation

We believe that there are two important differences between dividend paying firms and non-dividend paying firms. First, because they pay no dividends, non-dividend paying firms are more likely financially constrained. Second, the pecking order hypothesis for business financing suggests that because non-dividend paying firms use earnings to finance investment before they pay dividends, dividend paying firms face limits on their business growth opportunities. We incorporate these two presumptions about dividend paying versus non-dividend paying companies in a dynamic three state
growth model for equity valuation in an extension of the dynamic equity valuation model of Blazenko and Pavlov (2009). In the first state, when profitability (ROE) is modest, the corporate manager does not grow the business. In the second state, when ROE is greater, the corporate manager uses all of earnings for retention, reinvestment, and growth, and the corporate growth rate equals ROE. In the third state, when ROE is high, the business faces limited growth prospects and, thus, the manager pays dividends at the rate ROE-g>0 above that required to fund growth g. The corporate manager chooses value maximizing boundaries between these three states so that he/she can suspend growth, grow at the maximum rate that internal financing allows (ROE), or grow at the maximum rate that business opportunities allow (g>0), indefinitely. We report the technical development of this equity valuation model in appendix A.

2.3. Equity Return

When a constant returns to scale technology with stochastic return on equity, ROE, generates earnings Xt, that is, Xt = ROE·Bt (where B is equity capital), when neither capital, B, nor earnings, Xt, grows when the manager suspends growth, when equity capital, B, and earnings, Xt, grow when the manager decides to grow the business (at the rate ROE when the business is financially constrained and at the rate g when growth is constrained by limited expansion prospects), and when the return on equity (ROE) follows a non-growing geometric diffusion, dROE/ROE = σdz (where σ is earnings volatility), then the expected return on equity value, which we denote as ω, is the right-hand-side of equation (A5) in the appendix—without the risk adjustment term so that returns are not in a risk-neutral financial environment—divided by the market to book ratio π(ROE),

\[
\omega(ROE) = \begin{cases} 
ROE + (1-\pi)\frac{ROE-g}{\pi} + \frac{1}{2}\pi^*\sigma^2 \frac{ROE^2}{\pi} & \text{ROE}>\xi^*, \text{ growth=g,} \\
ROE + \frac{1}{2}\pi^*\sigma^2 \frac{ROE^2}{\pi} & \psi^* \leq ROE \leq \xi^*, \text{ growth=ROE, (1)} \\
\frac{ROE}{\pi} + \frac{1}{2}\pi^*\sigma^2 \frac{ROE^2}{\pi} & \text{ROE<\psi^*, growth=0}
\end{cases}
\]

Return matching between states (branches) in a real options model ensures no arbitrage opportunities at these junctures (Shackleton and Sødal, 2005). These conditions in equation (1) mean that at the lower threshold (ψ*), the market to book ratio is one (π = 1), and at the upper threshold ROE equals the maximum corporate growth rate (ROE=ξ*=g). Panels A and B of Figure 1 plot value (π) and
expected return \((\omega)\) versus \(ROE\), respectively, for a numerical example, as \(ROE\) increases from zero to 20%.

In the left-most section in Panel B of Figure 1, as \(ROE\) approaches its lower bound of zero, the likelihood of an increase back to the expansion boundary, \(\psi^*\), is remote. With no likelihood of incurring capital expenditures for growth, growth leverage disappears and expected return, \(\omega(ROE)\), approaches that of a hypothetical business that permanently commits to no-growth regardless of \(ROE\) (which is \(r^*=0.08\) in Panel B of Figure 1). If the manager has suspended growth, then expected return, \(\omega(ROE)\), increases with profitability, \(ROE\), because of recognition by investors of the increasing likelihood that at some future date the manager will grow the business which incurs growth leverage and greater risk. If the manager is financially constrained to growth at the maximum rate \(ROE\), then expected return, \(\omega(ROE)\), also increases with \(ROE\). Profitability reduces financing constraints which increases growth which increases growth leverage which increases expected return. Last, if the business has the financial capacity for growth (that is, \(ROE > g\) which is the right-most section in Panel B of Figure 1), but is constrained by business opportunities to grow at a maximum rate \(g\), then expected return, \(\omega(ROE)\), decreases with \(ROE\). Growth opportunities limited to an investment rate \(g\) restrict corporate managers from using high profitability to enhance growth which instead “covers” the ongoing costs of limited growth capital expenditures which reduces risk.

When the manager has suspended growth investments (the left-most section in Panel B of Figure 1), he/she pays dividends at the maximum rate allowed by profitability, \(ROE\). Even though corporate profitability \((ROE)\) is low and the manager does not need immediate cash to fund growth (which has been suspended), and, thus, he/she pays earnings as a dividend, recognizing financing constrains on future investment, he/she has an incentive to stock-pile cash from earnings \((ROE)\) to fund future growth once profitability stochastically improves. To model this “conservative of cash” requires different rates of return for different types of corporate assets: working capital versus depreciable asset investment. To keep our modeling as simple as possible, we do not do this. So, while our model presumes that because managers pay dividends (because cannot maintain a cash balance) when corporate profitability \((ROE)\) is low and they have suspended growth, more realistically, in this circumstance, managers likely stockpile cash to fund future growth when this growth becomes economically feasible once more. So, we refer to the firm on left in Panel B of Figure 1 (when \(ROE \leq g\)) as a non-dividend paying firm and the firm on the right (when \(ROE > g\)) as the dividend
paying firm. Fama and French (2001) report evidence that non-dividend paying companies have low profitability.

Panel C of Figure 1 plots the portion of expected return, $\omega(ROE)$, from equation (1) that is determined by earnings volatility which we denote as $VOL(ROE) = \pi^* \sigma^2 ROE^2 / (2\pi)$. $VOL(ROE)$ increases with $ROE$ when $ROE$ is low, but decreases with $ROE$ when $ROE$ is high. While the relation between $VOL(ROE)$ and $ROE$ is not monotonic, it is 0 as $ROE$ approaches 0 from the right and it is positive (approximately 6%) when $ROE$ is high (that is, $ROE=9%$ which is just before the firm starts to pay dividends). We interpret these observations to mean that for non-dividend paying firms, volatility is a more important determinant of expected return when $ROE$ is high.

Our model, represented by Figure 1, predicts that both returns ($\omega$) and the market-to-book ratio ($\pi$) for non-dividend paying companies increase with profitability ($ROE$). Combining these two predictions, it also predicts that high market-to-book growth firms have high returns and low market-to-book value firms have low returns. This is a negative value premium for non-dividend paying firms. This is the principal hypothesis that we test in the remainder of this paper.

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3. **Data, Portfolio Formation, and Portfolio Characteristics**

3.1. **Data**

We test the negative value-premium hypothesis on portfolios of non-dividend paying firms. We use firms that have data from COMPUSTAT, CRSP, and Thomson I/B/E/S. These are US, foreign interlisted companies, and American Depositary Receipts (ADRs) that trade on US exchanges. COMPUSTAT is our source for book equity ($BVE$), reported earnings ($EPS$), and other corporate financial data. We use CRSP for dividends (to verify that a firm has not paid dividends), split factors, shares outstanding, daily share price, and daily returns. We use Thomson I/B/E/S for reported $EPS$ and consensus analysts’ $EPS$ forecasts. Finally, we use Ken French’s website to retrieve daily portfolio and risk-less rate data for benchmarking $ROE$ based portfolios.

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1 If not in US dollars, we convert the accounting data (historical or forecast) of foreign interlisted companies and ADRs into US dollars.
2 Book equity ($BVE$) is Total Assets less Total Liabilities less Preferred Stock plus Deferred Taxes and Investment Tax Credits (from the COMPUSTAT quarterly file).
3 Because the COMPUSTAT Merged Primary, Supplementary, Tertiary & Full Coverage Research Quarterly and Annual files include both active and inactive companies, they do not suffer from survivor bias. CRSP stands for Center for
3.2. Portfolio Selection Criteria

Because ROE entails division by BVE, we require positive BVE from the latest reported quarterly or annual financial statements immediately prior to portfolio inclusion. To avoid bias in ROE arising from extremely small BPS, we require BPS greater than one dollar. In addition, because our dynamic model presumes that ROE follows a geometric Brownian motion and is, thus, always positive, we require positive trailing twelve month reported earnings. Last, we restrict our testing to firms that have paid no dividends in the trailing twelve months from the time of portfolio formation.

3.3. Portfolios and Forward ROE

The I/B/E/S database reports a snapshot of analysts’ earnings forecasts for the Thursday preceding the third Friday of the month which I/B/E/S refers to as a “Statistical Period” date. The first Statistical Period date is 1/15/1976. Common database coverage (that is, for I/B/E/S, COMPUSTAT, and CRSP) is up to October 2009 where the last Statistical Period date is 10/15/2009. Our testing uses portfolios that we rebalance at closing prices on Statistical Period dates. We define a “statistical period month” as the interval between adjacent statistical period dates.

We forecast ROE in three ways with three different consensus I/B/E/S analysts’ EPS forecasts at a Statistical Period date.\(^5\) These EPS forecasts are for the first,\(^6\) second, and third \((J=1,2,3)\) yet to be reported fiscal year-end in the future. We use annual EPS forecasts to avoid seasonality in quarterly earnings. Our ROE forecasts are \(\frac{EPS_j}{BPS}\) where \(EPS_j, J=1,2,3\), is the consensus earnings forecast for \(J\) as-yet-unreported fiscal years hence from a Statistical Period date, BVE is from the most recently reported quarterly or annual financial statements prior to the Statistical Period date, and BPS is BVE divided by shares outstanding at the Statistical Period date. We denote these ROE forecasts as \(ROE_j, J=1,2,3\), respectively. For each Statistical Period date from 1/15/1976 to 9/17/2009 we calculate forward ROE for firms with zero trailing twelve month dividends, positive trailing twelve month reported earnings, and positive BVE. At each Statistical Period date, we sort firms into twenty five ROE portfolios \((b=1,2,…,25)\) with an equal number of firms (approximately) in each portfolio.

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\(^4\) http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library

\(^5\) I/B/E/S also reports consensus and detailed analyst annual EPS forecasts beyond three fiscal years hence, but reporting of these forecasts is unduly sparse to be included in our study.

\(^6\) The calendar date of a fiscal year might precede a Statistical Period date because of normal reporting delays. The report date for actual EPS of a fiscal year is always after the statistical period date because when I/B/E/S reports an actual EPS, the \(EPS_2\) forecast becomes the \(EPS_1\) forecast and the former \(EPS_1\) forecast disappears.
This sorting leads to twenty-five portfolios that we rebalance at each Statistical Period date over the test period. In addition, because we sort firms in three ways, with \( \text{ROE}_j \) \( j=1,2,3 \), we investigate \( 3 \times 25 = 75 \) portfolios.

Our test period for \( \text{ROE}_1 \) and \( \text{ROE}_2 \) is 33 years and 8 months (1/15/1976 to 10/15/2009) which is 404 statistical period months. Our test period is shorter for \( \text{ROE}_3 \) because \( I/B/E/S \) only begins reporting \( \text{EPS}_3 \)– forecast earnings three unreported fiscal year-ends hence—at the 9/20/1984 Statistical Period date. Thus, our test period for \( \text{ROE}_3 \) is between 9/20/1984 and 10/15/2009 which is 25 years and 1 month (301 statistical period months). Over our test periods, the average numbers of stocks in the 25 \( \text{ROE}_j \) \( j=1,2,3 \) portfolios is 43.8, 39.5, and 17.1, respectively.\(^7\) The smaller number of stocks in \( \text{ROE}_3 \) portfolios is because analyst annual \( \text{EPS} \) forecasts are sparser for three unreported fiscal years hence compared to one and two unreported fiscal years hence.

More precisely, \( \text{EPS}_{j,i,t,b} \) is the median analysts’ \( \text{EPS} \) forecast and \( \text{ROE}_{j,i,t,b} = \frac{\text{EPS}_{j,i,t,b}}{\text{BPS}} \) is the median analysts’ \( \text{ROE} \) forecast for firm \( i \) at the beginning of statistical period month \( t \) which is one of the stocks in portfolio \( b=1,2,\ldots,25 \). The median forecast return on equity,\(^8\) \( \text{ROE}_{j,b} \), for portfolio \( b=1,2,\ldots,25 \) formed by ranking firms into 25 portfolios with \( \text{ROE}_{j,i,t,b}, j=1,2,3 \) is,

\[
\text{ROE}_{j,b} = \text{median} \left( \text{median} \left( \text{ROE}_{j,i,t,b} \right) \right) = \text{median} \left( \text{ROE}_{j,b} \right) \quad j=1,2,3 \text{ and } b=1,2,\ldots,25
\]

Column A of Table 1 reports \( \text{ROE}_{j,b} \), the median forecast \( \text{ROE} \) for portfolio \( b \) formed by ranking firms into 25 portfolios with \( \text{ROE}_j \), \( j=1,2,3 \). Since one of our screens on firms for study inclusion is that it has positive trailing twelve month earnings at a statistical period date, all of the average \( \text{ROE} \) forecasts are positive and increase monotonically from portfolio \( b=1 \) to \( b=25 \) for each of the sets of portfolios \( j=1,2,3 \).

3.4. Portfolio Returns
We measure portfolio returns from a Statistical Period date, where we form a portfolio, to the following Statistical Period date, which is approximately a month later. Because we use \( \text{ROE} \) to

\(^7\) Total number of observations in our sample for \( \text{ROE}_1, \text{ROE}_2, \text{ROE}_3 \) portfolio sets as 442,247, 398,949, and 128,898, respectively. Because there 404 and 301 Statistical Period months for \( \text{ROE}_1, \text{ROE}_2 \) and \( \text{ROE}_3 \) portfolios with 25 portfolios each, the average number of stocks in a portfolio is 442,247/(25×404)=43.8, 398,949/(25×404)=39.5, and 128,898/(25×301)=17.1, respectively.

\(^8\) Because \( \text{ROE} \) is forecast \( \text{EPS} \) divided by \( \text{BPS} \), which can approach zero, \( \text{ROE} \) can have extreme values. To limit the impact of these extreme values on our analysis, we use median rather than mean \( \text{ROE} \).
rebalance portfolios at each Statistical Period date and measure portfolio realized returns for the
following statistical period month, our empirical results are out-of-sample. Because Statistical Period
dates are mid-month rather than month-end, we cannot use CRSP monthly returns. Instead, for firm
\( i = 1, 2, \ldots, N \), sorted into portfolio \( b = 1, 2, \ldots, 25 \), with \( ROE_j \), \( J = 1, 2, 3 \), at the beginning of statistical period month \( t = 1, 2, \ldots, TP \), where \( TP \) is the number of months in our test period,\(^9\) monthly return between Statistical Period dates is,

\[
R_{j,t,b} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{j,t,b}
\]

where \( P_t \) and \( P_{t+1} \) are closing share prices\(^{10}\) on Statistical Period date \( t \) and \( t+1 \), and \( D_{t+1} \) is the dividend per share that has an ex-date between the Statistical Period Dates \( t \) and \( t+1 \). We adjust both the dividend \( D_{t+1} \) and the end of month share price \( P_{t+1} \) for stock splits and stock dividends.

The equally weighted portfolio return in statistical period month \( t = 1, 2, \ldots, TP \), for portfolio
\( b = 1, 2, \ldots, 25 \), is \( R_{j,t,b} = \frac{1}{N} \sum_{i=1}^{N} R_{j,t,b} \). Because \( ROE \) is an annual measure, for comparison purposes in
Table 1 and Figure 2, we annualize realized monthly portfolio returns. Annualized average portfolio
return over our test period is \( \bar{R}_{j,b} = 12 \cdot \sum_{t=1}^{TP} \left( \frac{R_{j,t,b}}{TP} \right) \), \( J = 1, 2, 3 \), \( b = 1, 2, \ldots, 25 \).

### 3.5. Market Value of Equity, MVE

Market value of equity (MVE) is the closing share price multiplied by shares outstanding (both on
a Statistical Period date). Let \( MVE_{j,t,b} \), be the market capitalization of firm \( i \) at the beginning of
statistical period month \( t \) which is one of the stocks in portfolio \( b = 1, 2, \ldots, 25 \) formed by ranking firms
by \( ROE_j \), \( J = 1, 2, 3 \), respectively into 25 portfolios. The average market capitalization, \( MVE_{j,b} \), for
portfolio \( b = 1, 2, \ldots, 25 \) formed by ranking firms into 25 portfolios with \( ROE_j \), \( J = 1, 2, 3 \) is,

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\(^9\) TP is 404 for portfolio sets \( ROE_1 \) and \( ROE_2 \) and 301 for portfolio set \( ROE_3 \).

\(^{10}\) If a stock is delisted during statistical period month \( t \) or closing share price is missing on the Statistical Period date \( t+1 \), we use the CRSP delisting price (if available) or the last traded price in the statistical period month as \( P_{t+1} \). If closing share price is missing on the Statistical Period date \( t \), we use the next opening price (if available from CRSP) or the first closing price in the statistical period month. Yan (2007) argues that equally weighting the monthly returns of individual stocks formed from compounding daily returns yields a portfolio return that is free of market microstructure biases. Therefore, in addition to returns calculated with equation (2), we also calculated returns for individual companies between Statistical Period dates by compounding CRSP daily returns. Results in this paper with this return methodology are qualitatively very similar (not reported).
\[
MVE_{J,b} = \frac{\sum_{i=1}^{TP} \left( \frac{\sum_{t=1}^{N} \left( \frac{MVE_{J,i,t,b}}{N} \right)}{TP} \right)}{TP} = \frac{\sum_{i=1}^{TP} \left( MVE_{J,i,t,b} \right)}{TP} \quad J=1,2,3 \text{ and } b=1,2,\ldots,25
\]

Column C of Table 1 reports \( MVE_{J,b} \), the average market value of equity for the twenty five portfolios \((b=1,2,\ldots,25)\), sorted by \( ROE_J, J=1,2,3 \), respectively. As one might expect, low profitability firms \((b=1)\) tend to have lesser market value than do high profitability firms \((b=25)\). In addition, market cap increases for \( ROE_{3,b} \) compared to \( ROE_{2,b} \) compared to \( ROE_{1,b} \) portfolios. This increase reflects the fact that analysts more likely forecast \( EPS \) further in the future for larger compared to smaller firms.

### 3.6 Market/Book

Market/book (M/B) is \( MVE \), divided by \( BVE \) from the most recently reported quarterly or annual financial statements prior to the Statistical Period date. Let \( M \_ B_{J,i,t,b} \) be the market to book ratio for firm \( i \) at the beginning of statistical period month \( t \) which is one of the stocks in portfolio \( b=1,2,\ldots,25 \) formed by ranking firms by \( ROE_J, J=1,2,3 \), respectively into 25 portfolios. The median market to book ratio,\(^{11}\) \( M \_ B_{J,b} \), for portfolio \( b=1,2,\ldots,25 \) formed by ranking firms into 25 portfolios with \( ROE_J, J=1,2,3 \) is,

\[
M \_ B_{J,b} = \text{median} \left( \text{median} \left( M \_ B_{J,i,t,b} \right) \right) = \text{median} \left( M \_ B_{J,b} \right) \quad J=1,2,3 \text{ and } b=1,2,\ldots,25
\]

Column D of Table 1 reports \( M \_ B_{J,b} \), the median market value of equity for the twenty five portfolios \((b=1,2,\ldots,25)\), sorted by \( ROE_J, J=1,2,3 \), respectively. As one might expect, low profitability firms \((b=1)\) tend to have lesser market to book ratios than do high profitability firms \((b=25)\). In addition, other than when profitability is very low, the market to book ratio increases for \( ROE_{3,b} \) compared to \( ROE_{2,b} \) compared to \( ROE_{1,b} \) portfolios. This increase reflects the fact that analysts more likely forecast \( EPS \) further in the future for growth compared to value firms and suggests that analysts have an inherent preference for growth stocks over value stocks as argued by Haugen (1999).

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\(^{11}\) The market/book ratio can have extreme values when \( BVE \) is close to zero. To reduce the impact of these extreme values on our analysis, we use the median rather than the mean market/book ratio.
3.7. Volatility Versus Returns

We investigate four volatility measures: analysts’ earnings forecast dispersion, past return volatility, volatility of the level of earnings, and volatility of the rate of earnings change. Since volatility of the rate earnings change is closest to the parameter $\sigma$ in the Brownian motion for the $ROE$ process in equation (A2), we refer to this volatility measure as “earnings volatility.”

Let $\sigma(FOREPS)_{J,i,t,b}$ be the standard deviation of the $EPS$ forecast (for annual $EPS$ $J$ fiscal years hence, $J=1,2,3$) across financial analysts scaled by book value of equity per share ($BPS$) for firm $i$, at the beginning of statistical month $t$, in portfolio $b$ which is formed by ranking $ROE$, $J=1,2,3$, respectively into 25 portfolios. We refer to $\sigma(FOREPS)_{J,i,t,b}$ as analysts’ earnings forecast dispersion. Then, the average analysts’ earnings forecast dispersion, $\sigma(FOREPS)_{J,b}$, for portfolio $b=1,2,\ldots,25$ formed by ranking firms into 25 portfolios with $ROE$, $J=1,2,3$, is,

$$\sigma(FOREPS)_{J,b} = \sum_{t=1}^{TP} \frac{\left[ \sum_{i=1}^{N} \left( \frac{\sigma(FOREPS)_{J,i,t,b}}{N} \right) \right]}{TP} \quad J=1,2,3 \text{ and } b=1,2,\ldots,25$$

Let $\sigma(EPS)_{J,i,t,b}$ be the standard deviation of annual $EPS$ reported during the sixty months\(^{12}\) prior to the beginning of statistical period month $t$, scaled by the most recently reported book value of equity per share for firm $i$, sorted into portfolio $b$, by ranking $ROE$, $J=1,2,3$, into 25 portfolios. We refer to $\sigma(EPS)_{J,i,t,b}$ as volatility of the earnings level. The average volatility of the earnings level, $\sigma(EPS)_{J,b}$, for portfolio $b=1,2,\ldots,25$ formed by ranking with $ROE$, $J=1,2,3$, is,

$$\sigma(EPS)_{J,b} = \sum_{t=1}^{TP} \frac{\left[ \sum_{i=1}^{N} \left( \frac{\sigma(EPS)_{J,i,t,b}}{N} \right) \right]}{TP} \quad J=1,2,3 \text{ and } b=1,2,\ldots,25$$

Let $\sigma(\Delta EPS)_{J,i,t,b}$ be the standard deviation of annual earnings changes reported during the sixty months prior to the beginning of statistical period month $t$, scaled by the most recently reported book value of equity per share for firm $i$, sorted into portfolio $b$, by ranking $ROE$, $J=1,2,3$ into 25 portfolios. We refer to $\sigma(\Delta EPS)_{J,i,t,b}$ as earnings volatility. Average earnings volatility for portfolio $b=1,2,\ldots,25$ formed by ranking with $ROE$, $J=1,2,3$, is,

\(^{12}\)In order to calculate the standard deviation of $EPS$, firms must have reported earnings at least twice in this sixty month window.
\[
\sigma(\Delta EPS)_{j,b} = \frac{\sum_{i=1}^{TP} \left[ \frac{\sigma(\Delta EPS)_{j,i,b}}{N} \right]}{TP} \quad J=1,2,3 \text{ and } b=1,2,\ldots,25
\]

Let \( \sigma(RET)_{j,i,b} \) be the standard deviation of monthly stock returns for up to sixty months prior to the I/B/E/S Statistical Period date that begins statistical period month \( t \), for firm \( i \), sorted into portfolio \( b \), by ranking \( ROE_j \), \( J=1,2,3 \) into 25 portfolios. We refer to \( \sigma(RET)_{j,i,b} \) as return volatility. The average return volatility, for portfolio \( b=1,2,\ldots,25 \) formed by ranking with \( ROE_j \), \( J=1,2,3 \), is,

\[
\sigma(RET)_{j,b} = \frac{\sum_{i=1}^{TP} \sum_{i=1}^{N} \left( \frac{\sigma(RET)_{j,i,b}}{N} \right)}{TP} \quad J=1,2,3 \text{ and } b=1,2,\ldots,25
\]

Table 1 reports our four mean volatility measures, analyst forecast earnings dispersion, \( \sigma(FOREPS)_{j,b} \), returns volatility, \( \sigma(RET)_{j,b} \), volatility of earnings level, \( \sigma(EPS)_{j,b} \), and earnings volatility, \( \sigma(\Delta EPS)_{j,b} \), for the twenty five portfolios \( (b=1,2,\ldots,25) \) formed by ranking with \( ROE_j \), \( J=1,2,3 \). For \( ROE_j \), \( J=1,2,3 \) portfolios, all four volatility measures are low for low \( ROE \) firms \( (b=1) \) and high for high \( ROE \) firms \( (b=25) \). All volatility measures increase almost monotonically from low \( ROE \) firms \( (b=1) \) to high \( ROE \) firms \( (b=25) \). Further, because portfolio returns in Table 1, \( \bar{R}_{j,b} \), also increase with \( ROE \), returns, \( \bar{R}_{j,b} \), and volatility also tend to be positively related for the twenty five portfolios \( (b=1,2,\ldots,25) \) formed by ranking with \( ROE_j \), \( J=1,2,3 \). Unlike the current literature (e.g., Ang et. al 2006, 2009; Barinov 2010; Han and Manry, 2000; Diether et. al, 2002; Johnson, 2004; Sadka and Scherbina, 2007; Avramov et. al, 2009) that reports a negative relationship between returns and volatility for firms in general, these preliminary summary measures (without statistical tests) suggest that for non-dividend paying firms, returns increase with profitability motivated changes in volatility.

In our dynamic equity valuation model, Panel C of Figure 1 suggests that the volatility component of expected return, \( VOL(ROE) \), is a larger portion of expected return for high \( ROE \) firms compared to low \( ROE \) firms. In section 5, we investigate whether the positive relation between returns and volatility motivated by increasing profitability suggested by Table 1 is extraordinary or, instead, is subsumed in existing risk factors commonly investigated in the financial literature.
4. The Negative Value-Premium for Non-Dividend Paying Stocks

4.1. Returns Versus Profitability, ROE

Column B of Table 1 reports average portfolio returns $\bar{R}_{j,b}$. These returns increase almost monotonically with $ROE_{j,b}$ for the 25 portfolios formed by sorting $ROE_j$, $J=1,2,3$. This preliminary evidence is consistent with our dynamic equity valuation model, represented by Panel B of Figure 1, which predicts that returns strictly increase with profitability ($ROE$). Panels A, B, and C of Figure 2 plot $\bar{R}_{j,b}$ versus $ROE_{j,b}$ for the 25 portfolios formed by sorting $ROE_j$, $J=1,2,3$, respectively. While our investigation at this stage is preliminary and exploratory, a positive relation between returns and profitability for non-dividend paying firms is clearly evident.

More formally, we estimate Fama-MacBeth (1973) regressions of monthly returns of 25 $ROE$ portfolios on portfolio profitability, $ROE$. In each statistical period month, $t$, we estimate a cross-sectional regression of monthly returns of 25 $ROE$ portfolios ($R_{j,t,b}$) on forward $ROE$ ($ROE_{j,t,b}$) (separately for $ROE_j$, $J=1,2,3$).

\[ R_{j,t,b} = \gamma_{0,j,t} + \gamma_{1,j,t} ROE_{j,t,b} + u_{j,t}, \]

where $R_{j,t,b}$ is the monthly portfolio return and $ROE_{j,t,b}$ is forward $ROE$, for portfolio $b=1,2,...,25$, in statistical period month $t=1,2,...,TP$, $u_{j,t}$ is an error term, $\gamma_{0,j,t}$ and $\gamma_{1,j,t}$ are intercept and slope coefficients.

Table 2 reports the average of cross-sectional estimated intercepts, $\bar{\gamma}_{0,j} = \frac{\sum_{t=1}^{TP} \gamma_{0,j,t}}{TP}$, and slope coefficients, $\bar{\gamma}_{1,j} = \frac{\sum_{t=1}^{TP} \gamma_{1,j,t}}{TP}$ in the Fama-MacBeth (1973) regression of return on $ROE$ over the 404 statistical period months for $ROE_1$ and $ROE_2$ portfolios and 301 statistical period months for $ROE_3$ portfolios. Each of these slopes, $\bar{\gamma}_{1,j}$, is positive for $ROE_j$, $J=1,2,3$ sorted portfolios and they are statistically significant for the $ROE_1$ and $ROE_2$ portfolios. This evidence is consistent with a positive relation between returns and profitability for non-dividend paying firms as predicted by our dynamic model as depicted in Panel B of Figure 1.
4.2. The Negative Value-Premium

Table 1 indicates that both portfolio returns and Market/Book ratios are high for high ROE firms. On the other hand, portfolio returns and Market/Book ratios are low for low ROE firms. Panels D, E, and F of Figure 2 plot average annual portfolio returns, $\bar{R}_{j,b}$, against portfolio market/book ratios, $M / B_{j,b}$, $b=1,2,\ldots,25$, for $J=1,2,3$, respectively. All three sets of these portfolios $J=1,2,3$ appear to have a positive relation between returns and Market/Book. This is preliminary evidence of a negative value premium for non-dividend paying stocks.

More formally, we estimate Fama-MacBeth (1973) regressions of monthly returns of 25 ROE portfolios on their Market/Book ratio. In each statistical period month, $t$, we estimate a cross sectional regression of monthly returns of 25 ROE portfolios ($R_{j,t,b}$) on Market/Book ratio ($M / B_{j,t,b}$) (separately for $ROE_j$, $J=1,2,3$).

$$R_{j,t,b} = \gamma_{0,j,t} + \gamma_{1,j,t} \frac{M}{B_{j,t,b}} + u_{j,t},$$

where $R_{j,t,b}$ is the monthly portfolio return and $M / B_{j,t,b}$ is Market/Book, for portfolio $b=1,2,\ldots,25$, in statistical period month $t=1,2,\ldots,TP$, $u_{j,t}$ is an error term, $\gamma_{0,j,t}$ and $\gamma_{1,j,t}$ are intercept and slope coefficients.

Panel B of Table 2 reports the average of cross-sectional estimated intercepts,

$$\bar{\gamma}_{0,j} = \frac{\sum_{t=1}^{TP} \left( \gamma_{0,j,t} / TP \right)}{TP},$$

and slope coefficients, $\bar{\gamma}_{1,j} = \frac{\sum_{t=1}^{TP} \left( \gamma_{1,j,t} / TP \right)}{TP}$, in the Fama-MacBeth (1973) regressions of return on Market/Book over the 404 statistical period months for $ROE_1$ and $ROE_2$ portfolios and 301 statistical period months for $ROE_3$ portfolios. Each of the slopes, $\bar{\gamma}_{1,j}$, $J=1,2,3$ is positive for $ROE_j$, $J=1,2,3$ portfolios. The slope, $\bar{\gamma}_{1,j=1}$, for $ROE_1$ portfolios is statistically significant at the 1% level and the slopes $\bar{\gamma}_{1,j=2}$ and $\bar{\gamma}_{1,j=3}$ for $ROE_2$ and $ROE_3$ portfolios, respectively, are very close to being statistically significant at the 10% level. These relations between return and Market/Book are evidence of a negative value-premium for non-dividend paying stocks.

5. Do Investors Recognize the Negative Value Premium for Non-Dividend Paying Stocks?

In this section, we investigate whether investors anticipate a negative value premium for non-dividend paying firms. If we can find evidence of non-zero abnormal returns in standard models of
asset pricing, then either investors or these models do not recognize the negative value premium for non-dividend paying stocks.

Non-dividend paying firms are generally more volatile than dividend paying firms (e.g., Pastor and Veronesi, 2003; Rubin and Smith 2009). In addition, recent literature (e.g., Ang et. al 2006, 2009; Barinov 2010; Han and Manry, 2000; Diether et. al, 2002; Johnson, 2004; Sadka and Scherbina, 2007; Avramov et. al, 2009) documents a negative relation between volatility and future returns. In section 2, our dynamic model predicts that expected return is the forward rate of return on equity (ROE) plus a term that depends on earnings volatility. Further, preliminary results in Table 1 suggest that both profitability and volatility are important determinants of returns. In this section, we investigate whether these relations are “abnormal” or subsumed in the factors used in standard asset pricing models by investigating portfolios that we form by a double sort of profitability (ROE) and volatility on Statistical Period dates. We use past return volatility as our volatility measure in this section, $\sigma(RET)$, but results are qualitatively similar for any of the volatility measures from Table 1.

We first sort firms into five ROE quintiles ($k=1,2,...,5$), and then for each ROE quintile into five volatility portfolios ($v=1,2,...,5$) at each statistical period date. This double sorting leads to twenty-five portfolios that we rebalance at each Statistical Period date over the 404 statistical period months for portfolios using $ROE_1$ and $ROE_2$ as the first sorting key, and 301 statistical period months for portfolios using $ROE_3$ as the first sorting key. In addition, because we sort firms by ROE in three ways, with $ROE_1$, $ROE_2$, and $ROE_3$, we investigate $3 \times 25 = 75$ portfolios.

For firm $i=1,2,...,N$, in portfolio $J=1,2,3$, $k=1,2,...,5$, $v=1,2,...,5$, for statistical period month $t=1,2,...,TP$, where $TP$ is the number of months in our test period, we calculate returns between Statistical Period dates using the change in closing share prices between current and next Statistical Period dates, plus dividend paid within the statistical period month (both share prices and dividend are adjusted for stock splits and stock dividends), divided by closing share price on the current Statistical Period date. Return for month $t=1,2,...,TP$, for firm $i=1,2,...,N$, in portfolio $J=1,2,3$, $k=1,2,...,5$, $v=1,2,...,5$, for statistical period month $t=1,2,...,TP$, is,

$$R_{J,i,t,k,v} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{J,i,t,k,v}$$

where $P_t$ and $P_{t+1}$ are closing share prices on Statistical Period date $t$ and $t+1$, and $D_{t+1}$ is the dividend per share that has an ex-date between the Statistical Period Dates $t$ and $t+1$.

$TP$ is 404 for portfolio sets $ROE_1$ and $ROE_2$ and 301 for portfolio set $ROE_3$. 

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13 $TP$ is 404 for portfolio sets $ROE_1$ and $ROE_2$ and 301 for portfolio set $ROE_3$. 

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The equally weighted portfolio return for ROE and earnings volatility sorted portfolios $J=1,2,3, k=1,2,...,5, \nu=1,2,...,5$, for statistical period month $t=1,2,...,TP$, is

$$\overline{R}_{J,t,k,\nu} = \frac{1}{N} \sum_{j=1}^{N} R_{j,t,k,\nu}$$

5.1 Normal Returns

The negative value premium reported in Table 2 may be risk compensation and does not assure abnormal returns for investment strategies based on ROE and volatility if investors recognize the negative value-premium for non-dividend paying stocks. We test for abnormal returns in this section.

We use a conditional four factor asset pricing model to represent normal returns.\(^{14}\) The four factor model explains expected returns with a Book/Market factor, a size factor, a momentum factor, and a market factor. Fama and French (1996) suggest a Book/Market factor, a size factor, and a market factor. The Book/Market factor is the return difference between portfolios of high Book/Market (value) and low Book/Market (growth) firms. The economic rationale for a Book/Market factor is that it represents distressed companies that have had poor operating performance in the recent past and that, therefore, have higher than normal leverage. Reinganum (1981, 1983) and Banz (1981) report evidence that small firms have great investment risk with higher returns than can be explained by financial models of the time. Fama and French’s (1996) size factor is the return difference between portfolios of small and large cap firms. The CAPM justifies a market factor, which we measure with an index that represents the market portfolio less a risk-free interest rate. Jegadeesh and Titman (1993) report evidence that momentum investment strategies that take long (short) positions in stocks that have had good (poor) share price performance in the recent past earn higher returns than can be explained by financial models of the time. Following, Carhart (1997), we include a momentum factor—the return difference between portfolios of “winners” and “losers.”

Unconditional asset pricing models, like, Fama and French (1996) and Carhart (1997), presume that expected returns and factor loadings are constant over time. However, Ferson and Harvey (1991) and Ferson and Warther (1996) present evidence that economic variables like the lagged aggregate

\(^{14}\) We also tested for abnormal returns with the three factor model of Chen, Novy-Marx, and Zhang (2010) that has a market factor, a factor for historical profitability and an investment factor (results not reported). Estimated alphas tend to be consistently positive which suggests a missing factor. Because non-dividend paying firms tend to be smaller than dividend paying firms (e.g., Fama and French, 2001, Rubin and Smith, 2009), because small firms tend to have greater returns than large firms, and because evidence in Chen, Novy-Marx, and Zhang (2010) suggests that their models does not explain the small firm effect, it appears that this missing factor is related to firm size. Because of this bias, we do not report results. Further, it is beyond the scope of our paper to search for new and better asset-pricing models.
dividend yield and the risk free rate capture variation in both risk and expected returns. Ferson and Harvey (1999) use these common lagged information variables in the Fama and French (1996) three factor model to capture these dynamic patterns in returns. Since our sample period is over 33 years for \( ROE_1 \) and \( ROE_2 \), and 25 years for \( ROE_3 \), we allow for time-variation in the factor loadings and specify the factor loadings as a linear function of information variables: lagged aggregate dividend yield and the risk-free rate.

From Ken French’s website, we download daily returns for the six Fama and French (1993) size and B/M portfolios used to calculate their \( SMB \) and \( HML \) portfolios (value-weighted portfolios formed on size and then book/market) and the six size and momentum portfolios (value-weighted portfolios formed on size and return from twelve months prior to one month prior). We compound daily returns for the riskless rates, for the \( CRSP \) value weighted portfolio, for the six size-B/M portfolios, and for the six size-momentum portfolios between \( I/B/E/S \) Statistical Period dates (the portfolio rebalance dates). Following the methodology on Ken French’s website, we create monthly \( SMB \), \( HML \), \( MOM \), and market risk factors (for statistical period months rather than calendar months) that we use to benchmark portfolios formed by a double sort of forward profitability (\( ROE \)) and volatility.

We risk-adjust the 25 \( ROE \) and volatility sorted portfolios with four risk factors in the regression model:

\[
R_{J,k,v} - R_{f,t} = \alpha_{J,k,v} + s_{J,k,v} SMB_t + h_{J,k,v} HML_t + m_{J,k,v} MOM_t + \beta_{J,k,v} (R_{M,t} - R_{f,t}) + \varepsilon_{J,k,v},
\]

(3)

\[
s_{J,k,v} = s_{0,J,k,v} + s_{1,J,k,v} DY_{t-1} + s_{2,J,k,v} R_{f,t},
\]

(4)

\[
h_{J,k,v} = h_{0,J,k,v} + h_{1,J,k,v} DY_{t-1} + h_{2,J,k,v} R_{f,t},
\]

\[
m_{J,k,v} = m_{0,J,k,v} + m_{1,J,k,v} DY_{t-1} + m_{2,J,k,v} R_{f,t},
\]

\[
\beta_{J,k,v} = \beta_{0,J,k,v} + \beta_{1,J,k,v} DY_{t-1} + \beta_{2,J,k,v} R_{f,t},
\]

where \( R_{J,k,v} \) denotes the return on portfolio \( J=1,2,3, k=1,2,....5, v=1,2,....5, \) in month \( t = 1,2,....TP \), \( R_{f,t} \) is the riskless rate, \( DY_{t-1} \) is the \( CRSP \) value-weighted index dividend yield lagged one period, \( R_{M,t} \), the return on the market portfolio, is the return on the \( CRSP \) value weighted index of common stocks in month \( t \), measured between Statistical Period dates by compounding daily \( CRSP \) value weighted returns, \( SMB_t \) and \( HML_t \) are the small-minus-big and high-minus-low Fama-French factors, and \( MOM_t \) is the momentum factor in month \( t \). The monthly riskless rate, \( R_{f,t} \) is the compounded simple
daily rate, downloaded from the website of Ken French, that, over the trading days between statistical period dates, compounds to a 1-month TBill rate.

Substituting (4) into (3) for $s_{J,k,v}$, $h_{J,k,v}$, $m_{J,k,v}$, and $\beta_{J,k,v}$, yields the conditional Fama-French-Carhart four-factor model. We test our 25 ROE and volatility sorted portfolios ($J=1,2,3$, $k=1,2,...,5$, $v=1,2,...,5$) on the conditional four-factor model. Table 3 reports abnormal returns, $\hat{\alpha}$ s, of regression (3) and (4) for portfolios formed with ROE and volatility.

5.2. Null Hypothesis

In this section, we discuss multivariate tests of abnormal returns, the $\hat{\alpha}$ s, of equation (3) and (4) and equation (5) and (6). The purpose of the Gibbons, Ross, and Shanken (1989) (GRS) test is to search for pricing errors in an asset pricing model. We use the GRS statistic to test the null hypothesis that the regression intercepts are jointly equal to zero, $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$. The alternative hypothesis is that there is a missing factor in the asset pricing model.

Hansen’s J statistic (Hansen 1982) tests the null hypothesis that abnormal returns, the $\hat{\alpha}$ s, are jointly equal to one another\(^{15}\), $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha$, but not necessarily equal to zero. The purpose of Hansen’s J test is to identify the differences in abnormal returns. A rejection of the null hypothesis suggests that investors can discriminate portfolio performance in such a way as to form profitable investment strategies. In our case, Hansen’s J statistic is $\chi^2$ distributed with degree of freedom equal to 4 (number of restrictions minus one) for ROE\(_1\), ROE\(_2\), and ROE\(_3\) portfolios.

5.3. Abnormal Returns

We now turn to abnormal return evidence–non-zero alphas–for the portfolios formed with ROE and volatility. Table 3 reports abnormal returns from the conditional Fama-French-Carhart four factor asset pricing model.

In Table 3, $\hat{\alpha}$ for lowest ROE quintile ($k=1$) is always negative, but sometimes statistically significant and sometimes not. On the other hand, $\hat{\alpha}$ for middle ROE portfolio ($k=3$) is sometimes positive and sometimes negative, but mostly statistically insignificant. Finally, $\hat{\alpha}$ for the highest ROE quintile ($k=5$) is always positive, but sometimes statistically significant and sometimes not.

\(^{15}\) Following the methodology in Cochrane (2001, pp. 201-264), the J statistic is $\chi^2$ distributed under the hypothesis that intercepts equal one another, $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha$, with degrees of freedom equal to the number of over-identifying restrictions minus one in the GMM (Generalized Method of Moments) estimation. See Hansen (1982) for the original development of the J statistic.
The positive and statistically significant abnormal returns for the highest ROE quintile \((k=5)\) and the negative and statistically significant abnormal returns for the lowest ROE quintile \((k=1)\) suggests that there is a missing factor in the conditional Fama-French-Carhart four factor model. The rejection of the hypothesis of jointly zero abnormal returns with the GRS statistic in the lowest ROE \((k=1)\) and the highest ROE \((k=5)\) quintiles is further evidence that there is a missing factor in the conditional Fama-French-Carhart four factor model for the two extreme ROE quintiles. The missing factor could be related to the other primary determinant of expected returns: earnings volatility. However, for \(ROE_1, ROE_2, \) and \(ROE_3\) portfolios, Hansen’s J-statistic fails to reject the null hypothesis of joint equality of abnormal returns for the five portfolios in almost all of the ROE quintiles.

6. Conclusion

We investigate a dynamic equity valuation model for non-dividend paying firms which predicts that expected return is the forward rate of return on equity \((ROE)\) plus a term that depends on earnings volatility. Our empirical evidence is consistent with the hypothesis that business investment opportunities are more limited for dividend paying companies (which is why they pay dividends rather than retain earnings) and that financing constraints are more likely binding for non-dividend paying firms. Consequently, dividend paying and non-dividend paying growth firms are very different in their risk/return profiles. High profitability reduces risk for dividend paying firms because, with limited investment opportunities, they cannot use this profitability to increase growth. Instead, profitability reduces risk and expected return which leads to the value-premium for dividend paying firms reported by Blazenko and Fu (2010). On the other hand, for non-dividend paying firms, profitability reduces financing constraints which increases growth, growth leverage, and expected return. Consistent with this prediction we report evidence of a negative value-premium for non-dividend paying firms.

Like any good empirical analysis, our study suggests avenues for future research. First, because our dynamic equity valuation model presumes a geometric Brownian motion for \(ROE\), and thus, because \(ROE\) is always positive, one of the screens we impose on firms for inclusion in our study is that they have positive trailing twelve month earnings at the time of portfolio formation. There are, of course, many firms that have negative earnings. These firms likely have greater bankruptcy risk and financial distress than the firms that we investigate in the current paper. An interesting study will be whether or not non-dividend paying firms with negative earnings have a negative value-premium or not. There are reasons to believe that they may or may not. If profitability reduces financing
constraints which increases growth which increases growth leverage which increases expected return, then these firms, like those in the current paper, will have a negative value premium. On the other hand, profitability may reduce bankruptcy risk and financial distress which decreases risk and expected return. Either of these two forces may dominate, and thus, non-dividend paying firms with negative earnings could have either a positive or a negative value premium.

Second, there is a literature (e.g., Easton et. al, 2002; Gebhardt et. al, 2001; and Gode and Mohanram, 2003) that calculates implicit expected equity return from share price and a static equity valuation model. The purpose of these implicit expected returns is for cost of capital determination and capital budgeting or value management with financial measures like residual income\(^{16}\) and \(EVA^{\circ}\)\(^{17}\). This literature generally compares these measures against realized equity returns. In a study of seven expected return proxies, Easton and Monahan (2005) find that these proxies are unreliable and none has a positive association with realized returns. We use expected return in our dynamic equity valuation model in equation (1) only for guidance for testing the negative value-premium hypothesis for non-dividend paying firms. However, with appropriate heuristics and approximations, we could develop this theoretical measure into one that could be useful in cost of capital calculations. If our purpose is to develop an unbiased measure of expected return, then the results we report in Table 1 suggest that the assumption of a random walk for \(ROE\) needs to be adjusted. For low \(ROE\) portfolios, average portfolio returns exceed \(ROE\). Since this difference is so great, this discrepancy is likely to remain for any adjustment we make to \(ROE\) to make it into an expected return. For high \(ROE\) portfolios, \(ROE\) exceeds average portfolio returns. Since this difference is so great, this discrepancy is likely to remain for any adjustment we make to \(ROE\) to make it into an expected return. This bias can be created by sorting \(ROE\) if \(ROE\) follows a mean reverting process rather than the random walk that we presume in the current paper. We suspect that we can reduce this bias by modeling \(ROE\) as a mean reverting process and by estimating its parameters with shrinkage type estimators to generate a return measure that is a better proxy for expected return than is currently available in the financial literature.

Appendix A

In this appendix, we develop a dynamic three state growth model for equity valuation. In the first state, when profitability (\(ROE\)) is modest, the corporate manager does not grow the business. In the

\(^{16}\) Residual income is accounting earnings less book equity times the required equity return.

\(^{17}\) \(EVA\) stands for Economic Value Added. The basic calculation for \(EVA\) is Net Operating Income less the dollar cost of capital (where the dollar cost of capital is book assets multiplied by the cost of capital).
second state, the earnings rate is greater, but growth is constrained by financing. The corporate manager uses all of earnings for retention, reinvestment, and growth, and, thus, the corporate growth rate equals ROE. In the third state, ROE is high, but the business faces limits on growth. The manager pays dividends at the rate ROE-g>0 above that required to fund maximum growth, g.

The manager controls the level of a firm’s equity capital, $B_t > 0$, by undertaking irreversible business investments at the instantaneous rate, 0, $ROE$ (for $ROE < g$), or $g>0$ (for $ROE \geq 0$). That is,

$$
\frac{dB_t}{B_t} = \begin{cases} 
g, & \text{growth constrained by business opportunities} 
ROE, & \text{growth constrained by financing} 
0, & \text{no growth}
\end{cases}
$$

(A1)

A constant returns to scale technology with stochastic return on equity, $ROE_t$, generates earnings $X_t$, that is, $X_t = ROE_t B_t$. When the manager suspends growth, then neither capital, $B$, nor cash flow, $X_t$, grows. On the other hand, the dollar amount of equity capital, $B$, and earnings, $X_t$, grows when the manager decides to grow the business (at the rate $ROE$ when the business is financially constrained and at the rate $g$ when business growth is constrained).

The return on equity ($ROE$) follows a non-growing geometric diffusion,

$$
\frac{dROE_t}{ROE_t} = \sigma dz,
$$

(A2)

where, $\sigma$ is volatility of both $ROE$ and earnings, $X_t$, and $dz$ is a Wiener process. There is no growth in capital efficiency. That is, $ROE$ does not grow, $E^{[\square]}[ROE_t] = ROE_0$.

The return to business investment for shareholders is $ROE$, earnings divided by equity capital, $ROE \equiv \frac{X}{B}$, rather than $ROE$ plus a growth factor (for example, $ROE+g$). $ROE$ plus a growth factor is business return for a hypothetical investment with spontaneous profit growth—like a stand of timber that does not require ongoing investment.\(^{18}\) However, this is not the nature of the investment we study. In our case, profit growth requires capital growth. Either in-place assets or expansion investments generate a non-growing perpetual stream of expected earnings, $X$, per dollar of equity capital, $B$. Regardless of the magnitude of the constraint on investment ($ROE$ or $g$), the return on

\(^{18}\) The static environment illustrates the point. If permanent profit growth at the rate $g$ requires growth of equity capital at the rate $g$, then, the IRR satisfies $(X-g*B)/(IRR-g)-B=0$, and, $IRR=ROE$ regardless of the growth factor, $g$. For comparison purposes, for spontaneous profit growth, the IRR satisfies $X/(IRR-g)-B=0$, and, $IRR = ROE+g$. 

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business investment for shareholders, the internal rate of return (IRR), satisfies \( ROE/IRR - 1 = 0 \) which means that \( IRR = ROE \).

Because earnings is \( ROE \) times equity capital \( B \), the process for earnings \( X \), is

\[
dX / X = \begin{cases} 
  gdt + \sigma dz, & \text{growth constrained by business opportunities} \\
  ROE dt + \sigma dz, & \text{growth constrained by financing} \\
  \sigma dz, & \text{no growth}
\end{cases} \tag{A3}
\]

The risk-adjusted process, \( X' \), for earnings is,

\[
dX / X = \begin{cases} 
  (g - \theta \sigma_{x,c})dt + \sigma dz, & \text{growth constrained by business opportunities} \\
  (ROE - \theta \sigma_{x,c})dt + \sigma dz, & \text{growth constrained by financing} \\
  -\theta \sigma_{x,c} dt + \sigma dz, & \text{no growth}
\end{cases} \tag{A4}
\]

where \( \theta \geq 0 \) is the coefficient of constant relative risk aversion for a representative investor, \( \sigma_{x,c} \) is the covariance of the log of operating profit, \( X \), with the log of aggregate consumption, \( c = \log(C) \), and aggregate consumption follows a geometric Brownian motion.

\( V(X) \) denotes the value of the operating business, which is equity capital, \( B \), times the market to book ratio, \( \pi(ROE) \). That is, \( V(X) = B \pi(ROE) \). Using the methodology in Blazenko and Pavlov (2009), which uses the financial market equilibrium modeling from Goldstein and Zapatero (1996), we combine the process for equity capital in equation (A1) with the risk-adjusted process for earnings in equation (A4), to develop an ordinary differential equation (with 3 branches) for the market to book ratio,

\[
r\pi = \begin{cases} 
  (ROE - g) - \theta \sigma_{x,c} ROE \pi' + \frac{\sigma^2}{2} ROE^2 \pi'' + g \pi, & \text{growth constrained by business opportunities} \\
  -\theta \sigma_{x,c} ROE \pi' + \frac{\sigma^2}{2} ROE^2 \pi'' + ROE \pi, & \text{growth constrained by financing} \\
  ROE - \theta \sigma_{x,c} ROE \pi' + \frac{\sigma^2}{2} ROE^2 \pi'', & \text{no growth}
\end{cases} \tag{A5}
\]

The left-hand side of equation (A5) is the return on the market value of equity at the riskless interest rate, \( r \). The upper branch of the right-hand-side of equation (A5) is the rate of dividend payment above that required to finance growth \( (ROE - g) \), less a loss due to risk aversion \( (\theta \sigma_{x,c} ROE \pi') \), plus an expected capital gain due the curvature of the value function \( (\sigma^2 ROE^2 \pi'' / 2) \), plus the contribution of
equity capital to value when capital is constrained to grow at the maximum rate \( g \) (\( g \pi \)). The middle branch on the right-hand-side of equation (A5) is the same as the upper branch, but with growth set equal to \( ROE \). In this case, dividend payment is zero, the retention ratio is one, and the firm grows at the maximum rate allowed by internal financing, \( ROE \). The lower branch on the right-hand-side of equation (A5) is the same as the upper branch, but with growth set equal to zero. In this case, corporate growth is zero and the rate of dividend payment is \( ROE \) because the manager cannot not retain for future growth in our modeling.

The value maximizing return threshold for expansion at the rate \( ROE \), \( \psi^* \), and the value maximizing return threshold for expansion at the rate \( g \), \( \xi^* \), separates the market to book ratio \( \pi(ROE) \), into 3 branches: one where the manager suspends growth, one where the manager is financially constrained to grow the business at a rate equal \( ROE \), and finally, a branch where limited business opportunities constrain the manager to grow the business at a maximum rate \( g>0 \). The manager expands profitability, \( X \), with incremental capital, \( B \), at the rate \( gd t \) when \( ROE \) exceeds the expansion boundary, \( ROE \geq \xi^* \). The manager expands profitability, \( X \), with incremental capital, \( B \), at the maximum rate allowed by financial constraints, \( ROEdt \) when \( ROE \) is between the expansion boundaries \( \psi^* \) and \( \xi^* \), that is, \( \psi^* \leq ROE \leq \xi^* \). Last, if \( ROE \) falls below the expansion boundary for financially constrained growth, \( ROE < \psi^* \), then manager suspends growth, \( g = 0 \), until profitability improves.

The solution to the differential equations in (A5), branch by branch, is,

\[
\pi = \begin{cases} 
\frac{ROE}{r^*-g} - \frac{g}{r-g} + c_1ROE^{\lambda_1}, & \text{ROE} \geq \xi^*, \text{growth}=g, \\
2c_2ROE^{\lambda_2}BesselI\left(\phi,\frac{2\sqrt{2} \sqrt{ROE}}{\sigma}\right) + c_3ROE^{\lambda_3}BesselY\left(\phi,\frac{2\sqrt{2} \sqrt{ROE}}{\sigma}\right), \quad & \psi^* \leq \text{ROE} \leq \xi^*, \text{growth}=ROE, \\
\frac{ROE}{r^*} + c_4ROE^{\lambda_4}, & \text{ROE} < \psi^*, \text{growth}=0
\end{cases}
\]

(A6)
\[
\phi = \sqrt{\frac{\sigma^4 + 4\sigma^2 \sigma_{x,c} + 4(\sigma_{x,c})^2}{\sigma^4} + 8\sigma^2 r}
\]

where,

\[
\lambda_2 = \frac{1}{2} + \frac{\sigma_{x,c}}{\sigma^2}
\]

\[
\lambda_1 = \lambda_2 - \sqrt{\lambda_2^2 + \frac{2(r - g)}{\sigma^2}}
\]

\[
\lambda_3 = \lambda_2 + \sqrt{\lambda_2^2 + \frac{2r}{\sigma^2}}
\]

\[
r^* = r + \sigma_{x,c}
\]

and, \(c_1, c_2, c_3, c_4\) are arbitrary constants.

On the “growth constrained by business opportunities” branch of equation (A6), the first term, \(ROE / (r^* - g)\), is the present value of earnings if the manger permanently expands (hypothetically) at the maximum rate \(g\) discounted at the risk-adjusted rate \(r^*\). The second term, \(g / (r - g)\), is the discounted cost of growth. The third term, \(c_1 ROE^{\lambda_1}\) is the combined value of the option to suspend growth (if \(ROE\) falls below \(\psi^*\)) and the cost of financing constraints (if \(ROE\) falls between \(\psi^*\) and \(\zeta^*\)) so that financing constrains growth. On the “no growth” branch of equation (A6), the first term, \(ROE / r^*\), is the present value of earnings if the manger permanently (hypothetically) does not grow discounted at the risk-adjusted rate \(r^*\). The second term, \(c_1 ROE^{\lambda_1}\) is the value of the option to begin growth at some time in the future (if \(ROE\) increases above \(\psi^*\)). The middle branch of equation (A6) is the value of the business when the rate of earnings is \(ROE\) and the manager retains 100% of earnings for growth. He/she also has a dynamic option to suspend growth (if \(ROE\) falls below \(\psi^*\)) and is constrained to grow at the maximum rate \(g\) if \(ROE\) increases above \(\zeta^*\).

Our valuation problem has six unknowns: the value maximizing return threshold for expansion at the rate \(g\), \(\xi\), the value maximizing return threshold for expansion at the rate \(ROE\), \(\psi\), and the four constants in equation (A6), \(c_1, c_2, c_3, c_4\). Smooth pasting and value matching conditions at \(\zeta\) and \(\psi\) give us four relations:
\[ \pi_g(x) = \pi_{ROE}(x) \]
\[ \pi'_g(x) = \pi'_{ROE}(x) \]
\[ \pi_g(y) = \pi_0(y) \]
\[ \pi'_g(y) = \pi'_0(y) \]

where \( \pi_g, \pi_{ROE}, \) and \( \pi_0 \) are the market to book ratios in the upper, middle, and lower branches of equation (A6), respectively. The value matching condition ensures that there are no discontinuities in the value function between various states, for example, “no-growth” state versus “growth constrained by financing” state. The smooth pasting condition ensures that there are no kinks in the value functions between these states.

Equation (A7) is a system of four linear equations in the four constants. Solve this system of equations for \( c_1, c_2, c_3, \) and \( c_4 \) in terms of the value maximizing return thresholds, \( \xi \) and \( \psi \). We denote these values as, \( c_1(\xi, \psi), c_2(\xi, \psi), c_3(\xi, \psi), \) and \( c_4(\xi, \psi) \). Substitute these expressions into equation (A7).

We need two more relations to ensure value maximization. We maximize the value function \( \pi \) on the “growth constrained by financing” branch of equation (A6) with respect to \( \xi \) and \( \psi \).

\[ \frac{\partial \pi_{ROE}(\xi)}{\partial \xi} = 0 \]
\[ \frac{\partial \pi_{ROE}(\psi)}{\partial \psi} = 0 \]  

Equation (A8) has an expression in terms of model parameters and \( \xi \) and \( \psi \). However, because this expression is long, we do not report it. Equations (A7) and (A8) are non-linear in \( \xi \) and \( \psi \), and therefore, there is no closed form solution for the value maximizing R&D return thresholds, \( \xi^* \) and \( \psi^* \). However, with numeric values for model parameters, the joint solution to equations (A7) and (A8) give a numeric solution for the value maximizing return thresholds for expansion at the rate \( g, \xi^* \), and the value maximizing expansion threshold for expansion at the rate \( ROE, \psi^* \). For a set of presumed parameters, Panel A of Figure 1 plots the value function \( \pi \) in its three regions as the \( ROE \) increases from 0 to 20%. 
Figure 1: Market/Book ($\pi$), Expected Return ($\omega$), and Volatility Versus ROE

Panel A

Panel B

Panel C

Notes: In Panel A, $\pi$ is the market/book ratio. In Panel B, $\omega$ is expected return. In Panel C, $VOL(ROE)$ is the volatility portion of expected return, $\pi \cdot \sigma^2 ROE^2 / (2\pi)$. Parameter values in these plots are: $g=0.09$ (maximum corporate growth, which is achievable only for $ROE \geq g$ because of financing constraints), $r^*=0.08$ (expected rate of return on a common share for a firm that hypothetically never grows), $\sigma=0.2$ (earnings volatility), $r=0.03$ (the riskless rate of interest).
Figure 2: Returns Versus ROE and Returns Versus Market/Book

Panel A

Returns versus ROE
25 ROE, Sorted Portfolios

Panel B

Returns versus ROE
25 ROE, Sorted Portfolios

Panel C

Returns versus ROE
25 ROE, Sorted Portfolios

Panel D

Returns versus Market/Book
25 ROE, Sorted Portfolios

Panel E

Returns versus Market/Book
25 ROE, Sorted Portfolios

Panel F

Returns versus Market/Book
25 ROE, Sorted Portfolios

Notes: Panels A, B, and C plot $\bar{R}_{j,b}$ versus $ROE_{j,b}$ for the 25 portfolios formed by sorting $ROE_j$, $J=1,2,3$, respectively. Panel D, E, and F plot average annual portfolio returns, $\bar{R}_{j,b}$, against the portfolio median of the market/book ratio, $M / B_{j,b}$, $b=1,2,\ldots,25$, for $J=1,2,3$, respectively.
Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>ROE Quintile</th>
<th>A: Median Forward ROE (J,b, t, b)</th>
<th>B: Average Portfolio Returns (J,b, t, b)</th>
<th>C: Mean MVE (Millions)</th>
<th>D: Median Market/Book (J,b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest ROE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b=1</td>
<td>0.000</td>
<td>0.002</td>
<td>404</td>
<td>0.373</td>
</tr>
<tr>
<td>b=2</td>
<td>0.023</td>
<td>0.049</td>
<td>488</td>
<td>0.589</td>
</tr>
<tr>
<td>b=3</td>
<td>0.040</td>
<td>0.068</td>
<td>518</td>
<td>0.806</td>
</tr>
<tr>
<td>b=4</td>
<td>0.053</td>
<td>0.082</td>
<td>686</td>
<td>0.984</td>
</tr>
<tr>
<td>b=5</td>
<td>0.065</td>
<td>0.095</td>
<td>583</td>
<td>1.037</td>
</tr>
<tr>
<td>b=6</td>
<td>0.074</td>
<td>0.104</td>
<td>579</td>
<td>1.104</td>
</tr>
<tr>
<td>b=7</td>
<td>0.083</td>
<td>0.113</td>
<td>507</td>
<td>1.195</td>
</tr>
<tr>
<td>b=8</td>
<td>0.091</td>
<td>0.122</td>
<td>716</td>
<td>1.240</td>
</tr>
<tr>
<td>b=9</td>
<td>0.099</td>
<td>0.131</td>
<td>702</td>
<td>1.240</td>
</tr>
<tr>
<td>b=10</td>
<td>0.107</td>
<td>0.140</td>
<td>734</td>
<td>1.240</td>
</tr>
<tr>
<td>b=11</td>
<td>0.115</td>
<td>0.148</td>
<td>748</td>
<td>1.240</td>
</tr>
<tr>
<td>b=12</td>
<td>0.123</td>
<td>0.157</td>
<td>901</td>
<td>1.240</td>
</tr>
<tr>
<td>b=13</td>
<td>0.130</td>
<td>0.166</td>
<td>837</td>
<td>1.240</td>
</tr>
<tr>
<td>b=14</td>
<td>0.137</td>
<td>0.176</td>
<td>859</td>
<td>1.240</td>
</tr>
<tr>
<td>b=15</td>
<td>0.145</td>
<td>0.185</td>
<td>915</td>
<td>1.240</td>
</tr>
<tr>
<td>b=16</td>
<td>0.153</td>
<td>0.196</td>
<td>809</td>
<td>1.240</td>
</tr>
<tr>
<td>b=17</td>
<td>0.162</td>
<td>0.207</td>
<td>962</td>
<td>1.240</td>
</tr>
<tr>
<td>b=18</td>
<td>0.172</td>
<td>0.220</td>
<td>1097</td>
<td>1.240</td>
</tr>
<tr>
<td>b=19</td>
<td>0.184</td>
<td>0.234</td>
<td>1178</td>
<td>1.240</td>
</tr>
<tr>
<td>b=20</td>
<td>0.197</td>
<td>0.253</td>
<td>1381</td>
<td>1.240</td>
</tr>
<tr>
<td>b=21</td>
<td>0.215</td>
<td>0.273</td>
<td>1629</td>
<td>1.240</td>
</tr>
<tr>
<td>b=22</td>
<td>0.233</td>
<td>0.301</td>
<td>1887</td>
<td>1.240</td>
</tr>
<tr>
<td>b=23</td>
<td>0.262</td>
<td>0.341</td>
<td>1863</td>
<td>1.240</td>
</tr>
<tr>
<td>b=24</td>
<td>0.310</td>
<td>0.405</td>
<td>2380</td>
<td>1.240</td>
</tr>
<tr>
<td>Highest ROE</td>
<td>0.446</td>
<td>0.572</td>
<td>2313</td>
<td>1.240</td>
</tr>
</tbody>
</table>

Notes: At each Statistical Period date (t=1,2,…,TP), we sort firms into twenty five portfolios (b=1,2,…,25) with an equal number of firms, approximately, in each portfolio by ROE_{i,b} = median_{t=1}^{TP} (EPS_{i,b}/BPS_{i,b}), where EPS_{i,b} is the consensus earnings forecast for J asset-unreported fiscal years, and BPS_{i,b} is the book equity per share for firm i=1,…,N, at a Statistical Period date t=1,2,…,TP, in portfolio b=1,2,…,25. ROE is the annualized portfolio returns, ROE_{i,b} = median_{t=1}^{TP} (ROE_{i,b}), is the median ROE, and MVE_{i,b} = sum_{t=1}^{TP} (MVE_{i,b})/TP is the average market value of equity, and M / B_{i,b} = median_{t=1}^{TP} (M / B_{i,b}) is the median Market to Book ratio for the five portfolios (b=1,2,…,25) over statistical period month t=1,2,…,TP, sorted by ROE_{J,b} at t=1,2,3. σ(FOREPS)_{i,b} is the standard deviation of reported annual EPS for the five fiscal years prior to the beginning of statistical period month t, scaled by the most recently reported book value of equity. σ(EPS)_{i,b} is the standard deviation of reported annual EPS for sixty months prior to the beginning of statistical period month t, scaled by the most recently reported book value of equity per share. σ(RET)_{i,b} is the standard deviation of monthly stock returns for up to sixty months prior to the I/B/E/S Statistical Period date that begins statistical period month t, for firm i, sorted into portfolio b, by ranking ROE_{J,b} =1,2,3 into 25 portfolios.
Table 2: Returns Versus ROE and Returns Versus Market/Book

Panel A: Fama-MacBeth Regression of Monthly Return on ROE

\[ R_{j,t,b} = \gamma_{0,j,t} + \gamma_{1,j,t} ROE_{j,t,b} + \varepsilon_{j,t} \]

<table>
<thead>
<tr>
<th>ROE Sorted by</th>
<th>( \gamma_{0,j,t} )</th>
<th>( t(\hat{\gamma}_{0,j}) )</th>
<th>( \gamma_{1,j,t} )</th>
<th>( t(\hat{\gamma}_{1,j}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE 1</td>
<td>0.0096</td>
<td>3.00</td>
<td>0.0231</td>
<td>4.37</td>
</tr>
<tr>
<td>ROE 2</td>
<td>0.0098</td>
<td>3.18</td>
<td>0.0140</td>
<td>2.68</td>
</tr>
<tr>
<td>ROE 3</td>
<td>0.0093</td>
<td>2.57</td>
<td>0.0063</td>
<td>1.26</td>
</tr>
</tbody>
</table>

Panel B: Fama-MacBeth Regression of Monthly Return on Market/Book

\[ R_{j,t,b} = \gamma_{0,j,t} + \gamma_{1,j,t} \frac{M}{B_{j,t,b}} + \varepsilon_{j,t} \]

<table>
<thead>
<tr>
<th>ROE Sorted by</th>
<th>( \gamma_{0,j,t} )</th>
<th>( t(\hat{\gamma}_{0,j}) )</th>
<th>( \gamma_{1,j,t} )</th>
<th>( t(\hat{\gamma}_{1,j}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE 1</td>
<td>0.0102</td>
<td>3.21</td>
<td>0.0014</td>
<td>3.39</td>
</tr>
<tr>
<td>ROE 2</td>
<td>0.0106</td>
<td>3.43</td>
<td>0.0008</td>
<td>1.76</td>
</tr>
<tr>
<td>ROE 3</td>
<td>0.0089</td>
<td>2.41</td>
<td>0.0007</td>
<td>1.68</td>
</tr>
</tbody>
</table>

Notes: In Panel A, for each statistical period month, \( t \), we estimate a cross sectional regression of monthly returns of 25 ROE portfolios (\( R_{j,t,b} \)) on forward ROE (\( ROE_{j,t,b} \)) (separately for ROE, \( J = 1,2,3 \)), where \( R_{j,t,b} \) is the monthly portfolio return and \( ROE_{j,t,b} \) is forward ROE, for portfolio \( b = 1,2,...,25 \), in statistical period month \( t = 1,2,...,TP \), \( \varepsilon_{j,t} \) is an error term, \( \gamma_{0,j,t} \) and \( \gamma_{1,j,t} \) are intercept and slope coefficients. Panel A reports the average of cross-sectional estimated intercepts, \( \bar{\gamma}_{0,j} = \frac{\sum_{t=1}^{TP} \gamma_{0,j,t}}{TP} \), and slope coefficients, \( \bar{\gamma}_{1,j} = \frac{\sum_{t=1}^{TP} \gamma_{1,j,t}}{TP} \) over the 404 statistical period months for ROE 1 and ROE 2 portfolios and 301 statistical period months for ROE 3 portfolios. In Panel B, for each statistical period month, \( t \), we estimate a cross sectional regression of monthly returns of 25 ROE portfolios (\( R_{j,t,b} \)) on Market/Book (\( \frac{M}{B_{j,t,b}} \)) (separately for ROE, \( J = 1,2,3 \)), where \( R_{j,t,b} \) is the monthly portfolio return and \( \frac{M}{B_{j,t,b}} \) is median Market/Book for portfolio \( b = 1,2,...,25 \), in statistical period month \( t = 1,2,...,TP \), \( \varepsilon_{j,t} \) is an error term, \( \gamma_{0,j,t} \) and \( \gamma_{1,j,t} \) are intercept and slope coefficients. Panel B reports the average of cross-sectional estimated intercepts, \( \bar{\gamma}_{0,j} = \frac{\sum_{t=1}^{TP} \gamma_{0,j,t}}{TP} \), and slope coefficients, \( \bar{\gamma}_{1,j} = \frac{\sum_{t=1}^{TP} \gamma_{1,j,t}}{TP} \) over the 404 statistical period months for ROE 1 and ROE 2 portfolios and 301 statistical period months for ROE 3 portfolios.
### Conditional Fama-French-Carhart Four-Factor Asset Pricing Model

\[
R_{j,k,v} - R_{f,t} = \alpha_{j,k,v} + \beta_{j,k,v} (R_{m,t} - R_{f,t}) + \varepsilon_{j,k,v},
\]

\[
s_{j,k,v} = s_{t,j,k,v} + s_{1,j,k,v} D_{Y,t-1} + s_{2,j,k,v} R_{f,t},
\]

\[
h_{j,k,v} = h_{t,j,k,v} + h_{2,j,k,v} D_{Y,t-1} + h_{3,j,k,v} R_{f,t}.
\]

\[
m_{j,k,v} = m_{t,j,k,v} + m_{2,j,k,v} D_{Y,t-1} + m_{3,j,k,v} R_{f,t},
\]

\[
\beta_{j,k,v} = \beta_{t,j,k,v} + \beta_{2,j,k,v} D_{Y,t-1} + \beta_{3,j,k,v} R_{f,t}.
\]

\[
k = 1,2,3,4,5, \quad v = 1,2,3,4,5, \quad t = 1,2,\ldots, TP, J = 1,2,3
\]

#### Table 3 Abnormal Returns

| ROE Quintile | Ret-VolQuintile | \( EPS_{j/P} \) | \( \alpha \) | \( t(\alpha) \) | \( p\text{-value} \) | \( Hansen's J \) | \( GRS \) | \( EPS_{j/P} \) | \( \alpha \) | \( t(\alpha) \) | \( p\text{-value} \) | \( Hansen's J \) | \( GRS \) |
|--------------|-----------------|-----------------|------------|-----------------|-----------------|----------------|--------|----------------|------------|-----------------|-----------------|-----------------|--------|----------------|
| Lowest ROE  | \( k = 1 \)     | Lowest Ret-Vol v=1 | -0.0024   | -1.55          | 3.22            | 2.78           | -0.0054 | -2.88          | 5.58       | 2.67            |
|              |                 | v=2             | -0.0029   | -1.74          | (0.5218)        | (0.0174)       | -0.0025 | -1.28          | (0.2327)  | (0.0216)       |
|              |                 | v=3             | -0.0045   | -2.71          |                 | -0.0048 | -2.51          |           |                 |
|              |                 | v=4             | -0.0012   | -0.55          |                 | -0.0007 | -0.32          |           |                 |
|              |                 | Highest Ret-Vol v=5 | -0.0051   | -2.18          |                 | -0.0019 | -0.87          |           |                 |
| Highest ROE | \( k = 5 \)     | Lowest Ret-Vol v=1 | -0.0024   | -1.56          | 4.99            | 0.77           | -0.0010 | -0.68          | 5.92       | 1.18            |
|              |                 | v=2             | 0.0000    | -0.03          | (0.3943)        | (0.5709)       | 0.0018  | 0.99           | (0.2051)  | (0.3196)       |
|              |                 | v=3             | 0.0019    | 1.10           |                 | 0.0024  | 1.26           |           |                 |
|              |                 | v=4             | 0.0001    | 0.06           |                 | -0.0016 | -0.85          |           |                 |
|              |                 | Highest Ret-Vol v=5 | -0.0003   | -0.15          |                 | -0.0029 | -0.88          |           |                 |

**Notes:** \( R_{j,k,v} \) denotes the return on portfolio \( k = 1,2,3,4,5 \), \( v = 1,2,3,4,5 \), in month \( t = 1,2,\ldots, TP \), for portfolio sets \( ROE_j, J = 1,2,3 \). \( R_{f,t} \) is the riskless rate, is the yield on a US Government 1-month Treasury bill. \( R_{m,t} \) is the return on the market portfolio, is the return on the CRSP value weighted index of common stocks in month \( t \), \( SMB \) and \( HML \) are the small-minus-big and high-minus-low Fama-French factors, \( MOM \) is the momentum factor in month \( t \), and \( D_{Y,t} \) is the CRSP value-weighted index dividend yield lagged one period. \( t \)-statistics are Newey-West (1987) adjusted with lag length two. \( p\)-values underlie Hansen’s J statistics and GRS statistics.
References


