

**EQUITY RETURNS, CORPORATE PROFITABILITY,  
THE VALUE PREMIUM AND DYNAMIC MODELS OF  
EQUITY VALUATION**

by

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# ABSTRACT

This dissertation investigates the relation between equity returns and profitability. I develop several dynamic equity valuation models that have the common characteristic that a value maximizing manager suspends corporate growth upon low profitability. Profitability increases the likelihood of future growth which engenders risk and increases return. Thus, over some range of profitability, returns and profitability relate positively. I use these dynamic equity valuation models to investigate a number of hitherto unexplained phenomena in equity markets. These phenomena are all related to the “value-premium” which is the empirical observation that low market/book “value” stocks have higher returns than high market/book “growth” stocks.

First, I propose a new explanation for the value-premium: the “limits-to-growth hypothesis.” With organizational limits on growth expenditure, profitability decreases risk for high profitability “growth” firms but increases risk for low profitability “value” firms in anticipation of future growth-leverage. Consistent with a modified version of the limits-to-growth hypothesis, I find that profitability increases returns to a greater extent for value compared to growth firms.

Second, I find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability non-dividend paying companies. Non-dividend paying firms do not face the same growth limits as dividend paying firms. They finance growth investments internally only as profitability permits. These investments increase risk and return. Consistent with this prediction, I find high returns for high profitability,

high market/book, growth stocks, which is a negative value-premium for non-dividend paying stocks.

Third, I show that distress-risk is part of the reason for the value-premium despite the commonly reported anomalous observation that high distress-risk firms have low returns. Profitability impacts two risks in opposite ways. Profitability decreases distress-risk but increases growth-leverage. Thus, high profitability firms with low distress-risk and high growth-leverage can have higher returns than low profitability firms with high distress-risk and low growth-leverage. The value-premium for firms in financial distress arises from a U-shaped relation between returns and profitability and a hill-shaped relation between market/book and profitability. When market/book is low (high or low profitability), returns are high.

*To Ben, Ethan, and Matthew*

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# TABLE OF CONTENTS

Approval.....	ii
Abstract .....	iii
Dedication .....	v
Acknowledgements .....	vi
Table of Contents .....	viii
List of Figures .....	xi
List of Tables.....	xii
<b>CHAPTER 1: Introduction .....</b>	<b>1</b>
1.1 Introduction.....	1
1.2 What is the Relation Between Equity Returns and Profitability? .....	6
1.3 Which Firms do and Which Firms do not Have a Value-Premium?.....	8
1.4 Description of Primary Dissertation Chapters.....	10
Appendix 1A .....	13
<b>CHAPTER 2: Value Versus Growth in Dynamic Equity Investing .....</b>	<b>17</b>
2.1 Introduction.....	17
2.2 Dynamic Financial Analysis .....	23
2.2.1 Expected Return .....	23
2.2.2 Static Growth Expected Return.....	27
2.2.3 <i>SGER</i> as a Component of Expected Return .....	28
2.3 Data, Portfolio Formation, and Portfolio Characteristics.....	30
2.3.1 Data and Portfolio Selection Criteria .....	31
2.3.2 Corporate Performance Forecasting and Financial Measures .....	31
2.3.3 Descriptive Statistics and Portfolio Characteristics .....	34
2.3.4 Realized Versus Expected Returns.....	40
2.4 Profitability, Growth, and the Value Premium.....	46
2.4.1 The Value Premium .....	46
2.4.2 Profitability, Growth, and the Value Premium.....	47
2.4.3 Returns Versus Profitability In-The-Small.....	52
2.5 Do Investors Recognize the Relation Between Returns and Profitability in-the-Small .....	53
2.5.1 Normal Returns .....	54
2.5.2 Null Hypothesis.....	58
2.5.3 Abnormal Returns .....	59
2.5.4 Asset Pricing Errors .....	64
2.6 Expected Return versus Volatility.....	65
2.6.1 Preliminaries .....	65
2.6.2 Returns Versus Earnings Volatility.....	67
2.6.3 Volatility Measures .....	69
2.6.4 Portfolio Returns Versus Volatility.....	71
2.7 Conclusion for Chapter 2 .....	72
Appendix 2A .....	75

Appendix 2B.....	77
Appendix 2C.....	79
<b>CHAPTER 3: Non-Dividend Paying Stocks and the Negative Value Premium.....</b>	<b>81</b>
3.1 Introduction.....	81
3.2 Dynamic Financial Analysis.....	87
3.2.1 Preliminaries.....	87
3.2.2 Equity Valuation.....	88
3.2.3 Equity Return.....	89
3.3 Data, Portfolio Formation, and Portfolio Characteristics.....	94
3.3.1 Data.....	94
3.3.2 Portfolio Selection Criteria.....	94
3.3.3 Portfolios and Forward <i>ROE</i> .....	95
3.3.4 Portfolio Returns.....	99
3.3.5 Market Value of Equity, <i>MVE</i> .....	100
3.3.6 Market/Book.....	101
3.3.7 Volatility Versus Returns.....	102
3.4 The Negative Value-Premium for Non-Dividend Paying Stocks.....	104
3.4.1 Returns Versus Profitability, <i>ROE</i> .....	104
3.4.2 Testing the Relation Between Returns and Profitability, <i>ROE</i> .....	105
3.4.3 The Negative Value-Premium.....	108
3.4.4 Testing the Relation Between Returns and Market/Book.....	108
3.5 Do Investors Recognize the Negative Value Premium for Non-Dividend Paying Stocks?.....	109
3.5.1 Normal Returns.....	111
3.5.2 Null Hypothesis.....	114
3.5.3 Abnormal Returns.....	116
3.6 Conclusion for Chapter 3.....	117
Appendix 3A.....	120
<b>CHAPTER 4: Financial Distress and the Value Premium.....</b>	<b>127</b>
4.1 Introduction.....	127
4.2 Dynamic Financial Analysis.....	133
4.2.1 Preliminaries.....	133
4.2.2 Equity Valuation.....	133
4.2.3 Equity Return.....	139
4.3 Data, Portfolio Formation, and Portfolio Characteristics.....	142
4.3.1 Data.....	142
4.3.2 Sample Selection and the Empirical Definition of Financial Distress.....	142
4.3.3 Portfolios and Forward Earnings Yield.....	144
4.3.4 Forward Return on Equity, <i>ROE</i> .....	149
4.3.5 Portfolio Returns.....	150
4.3.6 Market Value of Equity, <i>MVE</i> .....	152
4.3.7 Market/Book.....	153
4.4 The Value-Premium for Firms in Financially Distress.....	155
4.4.1 A U-Shaped Relation Between Returns and Profitability, <i>ROE</i> .....	155
4.4.2 A Hill-Shaped Relation Between Market/Book and Profitability, <i>ROE</i> .....	156
4.4.3 The Value-Premium.....	159

4.4.4	Volatility Versus Profitability, <i>ROE</i> .....	162
4.4.5	The Financial-Distress/Growth Hypothesis of the Value Premium .....	166
4.5	Do Investors Recognize the U-Shaped Relation between Returns and Profitability?.....	166
4.5.1	Normal Returns .....	167
4.5.2	Null Hypothesis.....	173
4.5.3	Abnormal Returns .....	173
4.6	Conclusion for Chapter 4 .....	175
	Appendix 4A .....	178
	<b>CHAPTER 5: Dynamic Growth Expected Return.....</b>	<b>182</b>
5.1	Introduction .....	182
5.2	Static Growth Expected Return, <i>SGER</i> .....	186
5.2.1	Preliminaries .....	186
5.2.2	Data, Portfolio Formation, and Portfolio Characteristics .....	187
5.2.3	Fama-French Earnings-Reversion.....	189
5.2.4	Marginal <i>ROE</i> .....	197
5.2.5	Realized Returns Versus <i>SGER</i> With Different <i>ROE</i> Forecasts .....	202
5.2.6	Long Run <i>ROE</i> Forecasts.....	204
5.2.7	Realized Returns Versus <i>SGER</i> With Long-Run <i>ROE</i> Forecasts .....	207
5.3	A Dynamic Model of Equity Valuation .....	211
5.3.1	Preliminaries .....	211
5.3.2	Dynamic Growth Expected Returns, <i>DGER</i> .....	216
5.3.3	Mean Squared Errors.....	220
5.4	Conclusion for Chapter 5 .....	222
	Appendix 5A .....	223
	Appendix 5B.....	231
	<b>CHAPTER 6: Conclusion.....</b>	<b>232</b>
	<b>References .....</b>	<b>239</b>

## LIST OF FIGURES

FIGURE 1.1	STATIC EQUITY VALUATION MODEL .....	3
FIGURE 1.2	DYNAMIC EQUITY VALUATION MODEL.....	7
FIGURE 2.1	EXPECTED RETURN, $\omega(ROE)$ , VERSUS PROFITABILITY, $ROE$ .....	26
FIGURE 2.2	PANEL A: VOLATILITY'S CONTRIBUTION TO EXPECTED RETURN, $\omega(ROE)$ .....	30
FIGURE 2.3	PROFITABILITY, GROWTH, AND THE VALUE PREMIUM .....	48
FIGURE 2.4	EXPECTED RETURN AND VOLATILITY .....	68
FIGURE 3.1	MARKET/BOOK (II), EXPECTED RETURN ( $\omega$ ), AND VOLATILITY VERSUS $ROE$ .....	93
FIGURE 3.2	RETURNS VERSUS $ROE$ AND RETURNS VERSUS MARKET/BOOK .....	107
FIGURE 4.1	MARKET/BOOK , AND EXPECTED RETURN ( $\Omega$ ) VERSUS $ROE$ .....	138
FIGURE 4.2	RETURNS VERSUS $ROE$ , MARKET/BOOK VERSUS $ROE$ , AND RETURNS VERSUS MARKET/BOOK .....	151
FIGURE 4.3	VOLATILITY VERSUS $ROE$ .....	160
FIGURE 5.1	EXPECTED RETURN, $\omega(ROE)$ , VERSUS PROFITABILITY, $ROE$ .....	212
FIGURE 5.2	PROFITABILITY, GROWTH, AND THE VALUE PREMIUM .....	213

## LIST OF TABLES

TABLE 2.1	DESCRIPTIVE STATISTICS .....	36
TABLE 2.2	PORTFOLIO CHARACTERISTICS .....	39
TABLE 2.3	REALIZED PORTFOLIO RETURNS, EXPECTED PORTFOLIO RETURNS, AND REALIZED MINUS EXPECTED PORTFOLIO RETURNS.....	42
TABLE 2.4	FAMA-MACBETH REGRESSIONS OF RETURN ON PROFITABILITY, <i>ROE</i> .....	51
TABLE 2.5	ABNORMAL RETURNS .....	61
TABLE 2.6	RETURN AND VOLATILITY .....	70
TABLE 3.1	DESCRIPTIVE STATISTICS .....	98
TABLE 3.2	RETURNS VERSUS <i>ROE</i> AND RETURNS VERSUS MARKET/BOOK .....	106
TABLE 3.3	ABNORMAL RETURNS .....	115
TABLE 4.1	DESCRIPTIVE STATISTICS .....	148
TABLE 4.2	RETURNS VERSUS <i>ROE</i> AND RETURNS VERSUS MARKET/BOOK .....	158
TABLE 4.3	MARKET/BOOK VERSUS <i>ROE</i> AND EBITDA VOLATILITY VERSUS <i>ROE</i> .....	161
TABLE 4.4	ABNORMAL RETURNS .....	171
TABLE 5.1	REGRESSION TO EXPLAIN THE LEVEL AND CHANGES IN <i>ROE</i> .....	195
TABLE 5.2	<i>ROE</i> FORECASTS, <i>SGER</i> , MSE AND <i>QMSE</i> .....	200
TABLE 5.3	<i>ROE</i> MEAN-REVERSION RATE .....	201
TABLE 5.4	LONG TERM <i>ROE</i> , <i>SGER</i> ,MSE, AND <i>QMSE</i> .....	210
TABLE 5.5	<i>DGER</i> , MSE, AND <i>QMSE</i> .....	218

# CHAPTER 1:INTRODUCTION

## 1.1 Introduction

This dissertation investigates the relation between equity returns and profitability. Traditional static equity valuation models predict a negative relation between returns and profitability. In a static model, common-place managerial decisions, like whether to grow a business or not are both “now-or-never” and unalterable. The manager cannot time the growth decision but instead must commit immediately to permanent growth or no-growth. Further, the manager cannot reverse, suspend, or amend a growth decision once made. In Appendix 1A, I develop an expression for expected equity return ( $\omega$ ) as a function of profitability (the rate of return on equity, *ROE*) from an equity valuation model for a business for which the manager has permanently committed to growth at a constant rate. Panel A of Figure 1.1 illustrates that this relation is negative for a numerical example. Profitability decreases both risk and return for two related reasons. First, at the left most sections of Panel A and B, the firm is in financial distress. In Panel B, market/book, which I denote as  $\pi(ROE)$ , approaches zero as *ROE* decreases from the right. However, the reason for this financial distress is rather artificial. Because the valuation model is static, the manager commits to permanent growth at a constant rate even as profitability falls. This modeling arbitrarily restricts the manager from suspending growth investment upon poor profitability. As profitability falls, the manager nonetheless continues to make growth capital expenditures.<sup>1</sup> Profitability, *ROE*, relieves the financial distress that this commitment creates, and thus, profitability decreases

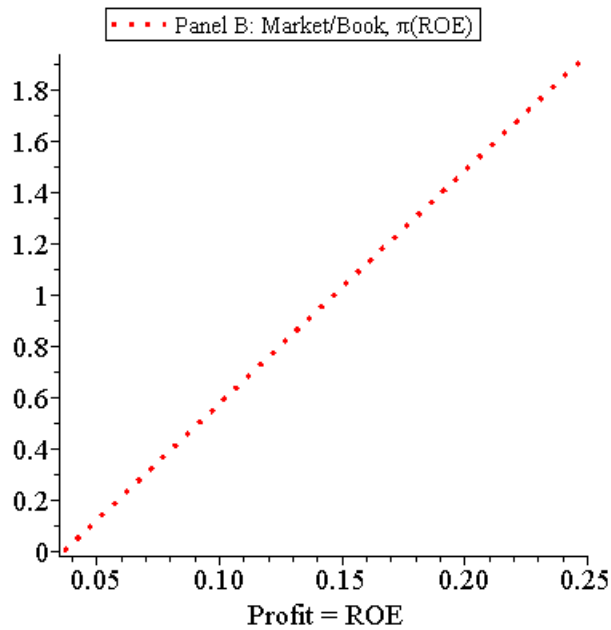
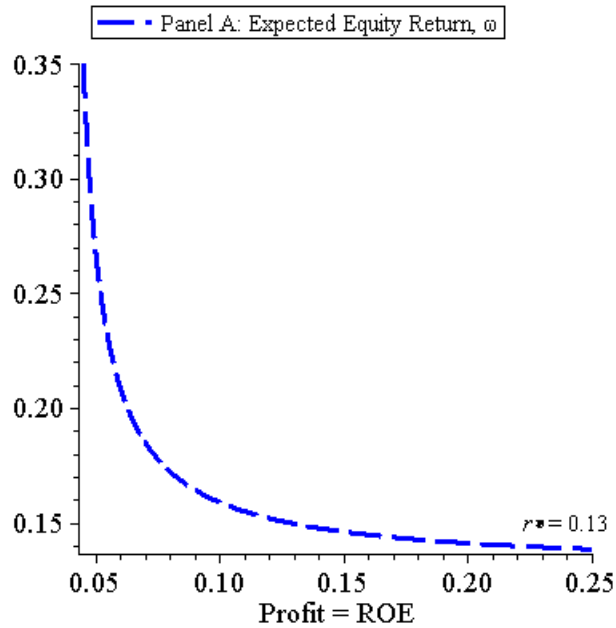
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<sup>1</sup> More realistically, in actual firms, as profitability falls, managers suspend growth but, nonetheless they fall into financial distress because of their commitment to make interest payments on debt regardless of profitability. I develop a dynamic equity valuation model of this type in Chapter 4.

return,  $\omega$ . Second, at the right hand side of both Panel A and B of Figure 1.1, the firm is no longer in financial distress. Here, profitability increases the ability of the firm to “cover” growth capital expenditures which decreases risk and return.

The “real” options literature (for example, Dixit and Pindyck, 1994) recognizes that managers have greater latitude in the management of business investments than the restrictive environment presumed in a static equity valuation model. Typical real options include the timing decision for the start of a new venture, the business suspension decision, the business expansion decision, and the business abandonment decision. A principal determinant of these managerial decisions is profitability. A manager will suspend or abandon a business upon poor profitability. A manager will start a new business or expand an existing business when expectations for future profitability are good. Because these profitability dependent and dynamic managerial decisions change the risk of a business, they make the relation between equity return and profitability more complex than is predicted by a static equity valuation model like the one depicted in Figure 1.1. While there have been great advances in the study of real options for corporate investment decisions, with only a few exceptions (eg., Garlappi and Yan 2010), often empirical analysis in financial economics uses static equity valuation models, at least implicitly, for theoretic underpinning. The perspective on risk imposed by these static models determines and limits the issues that this literature investigates. The purpose of my dissertation is to remove some of these limits.

**Figure 1.1 Static Equity Valuation Model**



*Notes:* In Panel A,  $\omega$  is expected equity return which depends on profitability,  $ROE$ . In Panel B,  $\pi(ROE)$  is the market/book ratio. Parameter values in these plots are:  $g=0.02$  (maximum corporate growth),  $r^*=0.13$  (equity discount rate for a firm that hypothetically never grows),  $r=0.08$  (the riskless rate of interest). The parameter values are not meant to be representative of any particular economy. Any change in the parameters leaves relations represented in the panels of this figure essentially unaltered.



In the entire cross-section of firms, there is a great body of evidence for a value-premium which is high returns for low profitability, low market/book, “value” firms and low returns for high profitability, high market/book “growth” firms. For example, Fama and French (1992) find that a value-premium exists for post-1963 U.S. stock returns. Chan, Hamao, and Lakonishok (1991) find a value-premium for Japanese firms. Fama and French (1998) find that value stocks outperform growth stocks in twelve of thirteen international markets in the period 1975-1995. Because high profitability firms have high market/book, this evidence is consistent with a negative relation between returns and profitability as predicted, for example, by Figure 1.1. However, this prediction does not accord well with other equity market phenomena.

I contend in this dissertation that dynamic models of equity valuation, where value maximizing managerial decisions depend upon profitability, can explain these empirical phenomena and, in addition, provide guidance to researchers for future investigation of equity returns. I develop several dynamic equity valuation models to focus on different types of firms. These models have the common characteristic that a value maximizing manager suspends corporate growth upon low profitability. Profitability increases the likelihood of future growth which engenders risk and increases return. Thus, over some range of profitability, returns and profitability relate positively which is a key feature of the explanations that I develop in this dissertation for the below equity market puzzles.

First, Haugen and Baker (1996), Piotroski (2000), Mohanram (2005), and Fama and French (2006) find that, for value and growth stocks separately (that is, investigating either value or growth stocks separately), the relation between returns and profitability is

positive rather than negative. These results indicate that in some instances, profitability increases risk, but these empirical papers do not identify why. In Chapter 2, I explain why returns increase with profitability for both value and growth stocks separately (that is, “in-the-small”) and in addition, why in the entire cross-section of firms, high profitability growth firms have lower returns than low profitability value firms (that is, “in-the-large”).

Second, the business represented by Figure 1.1 pays dividends. However, I could develop a slightly more complicated static model where the firm does not currently pay dividends but instead pays dividends when profitability reaches a certain level. Then, for non-dividend paying firms, nonetheless, the relation between returns and profitability is negative. But, in Chapter 3 of this dissertation, I show that the relation between returns and profitability for non-dividend paying firms is positive rather than negative. A positive relation between returns and profitability is inconsistent with a static model of equity valuation represented, for example, by Figure 1.1. Only a dynamic model can explain a positive relation between returns and profitability.

Third, if profitability is exceptionally low, that is, for firms is in financial distress (the left-most section of Figure 1.1), then the static equity valuation model represented by Figure 1.1, predicts that returns should be exceptionally high. However, Katz, Lilien, and Nelson (1985), Griffin and Lemmon (2002), and Campbell, Hilscher, and Szilagyi (2008) find that returns are low rather than high for firms in financial distress. Based on this evidence, Griffen and Lemmon (2002) conclude that the value-premium does not arise from distress-risk. In Chapter 4, I show that distress-risk is part of the reason for the value-premium despite the fact that returns are low for firms in financial distress.

Fourth, there is a literature that either calculates or estimates expected return from share prices and an equity valuation model.<sup>2</sup> Easton and Monahan (2005) find that in the entire cross-section of firms these implicit returns are unreliable and none has a positive association with realized returns. In Chapter 2 of this dissertation I argue that this literature runs afoul of the value-premium. The implicit return measure that I develop relates positively with realized returns within book/market quintiles. However, I also find that my implicit return measure overstates realized returns for growth stocks and understates realized returns for value stocks. In Chapter 5, I find that reversion in profitability cannot reconcile this value-versus-growth bias. On the other hand, regressions of realized returns on profitability, *ROE*, for value versus growth stocks are a conditional reduced-form version of the dynamic equity valuation model that I develop in Chapter 2. Return forecasts from these regressions in large part eliminate the value-versus-growth bias.

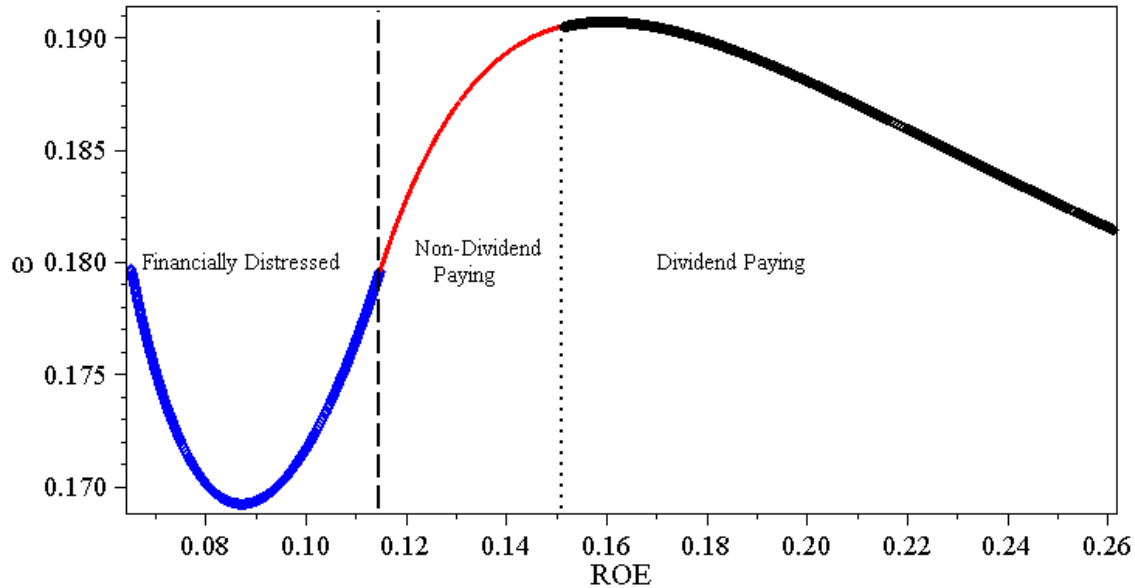
## **1.2 What is the Relation Between Equity Returns and Profitability?**

Possibly the reason that I find empirical results in this dissertation that are, by and large, remarkably close to my theoretic modeling is that I do not test hypotheses from this modeling on the entire cross-section of firms. I find that the relation between returns and profitability differs across the three different classes of firms that I investigate: dividend paying firms, non-dividend paying firms, and firms in financial distress. Because the relation between returns and profitability differs for different classes of firms, testing on the entire cross-section of firms would obscure these relations.

---

<sup>2</sup> See, for example, Easton (2004, 2006), Easton, Taylor, Shroff, and Sougannis (2002), Gebhardt, Lee, Swaminathan (2001), and Gode and Mohanram (2003).

**Figure 1.2 Dynamic Equity Valuation Model**



Notes:  $\omega$  is expected equity return which depends on profitability,  $ROE$ . Parameter values in these plots are:  $g=0.12$  (maximum corporate growth),  $r^*=0.11$  (cost of capital for a firm that hypothetically never grows),  $\sigma=0.2$  (earnings volatility),  $r=0.04$  (the riskless rate of interest),  $\gamma=0.25$  (debt to asset ratio).

Figure 1.2 depicts a plot of return,  $\omega$ , versus profitability  $ROE$  for a numerical example of a model that I develop more fully in Chapter 4 of this dissertation. Loosely speaking,<sup>3</sup> the left, middle, and right-most sections of this plot represent the three classes of firms that I investigate in this dissertation, respectively: firms in financial distress<sup>4</sup> (Chapter 4), non-dividend paying firms (Chapter 3), and dividend paying firms (Chapter 2).

<sup>3</sup> I say loosely speaking, because in this model the firm is never strictly speaking “non-dividend paying.” If  $ROE$  is less than the corporate growth rate,  $g$ , then the firm finances this free cash flow deficit with the sale of new common shares. On the other hand, if  $ROE$  is greater than  $g$ , then the firm pays dividends at a rate equal to the difference. In Chapter 3, I presume financing constraints so that a firm cannot finance this free cash flow deficit with the sale of new shares or other financial assets. In this case, for relatively high profitability, the firm pays a dividend, and otherwise is a non-dividend paying firm. I do not, however, model financial distress in Chapter 3.

<sup>4</sup> In Chapter 4, the manager suspends growth upon poor profitability. Financial distress arises from a commitment to make interest payments regardless of poor profitability. In Chapter 4, I define firms in financial distress as those having negative trailing-twelve-month reported earnings.

First, for dividend paying firms that are not in financial distress, the relation between returns and profitability “in-the-large,” that is across market/book groupings of firms, is negative. Second, for non-dividend paying firms that are not in financial distress, the relation between returns and profitability is positive. Finally, for firms in financial distress, the relation between returns and profitability is U-shaped.

### **1.3 Which Firms do and Which Firms do not Have a Value-Premium?**

I report evidence in this dissertation that some classes of firms have and other classes do not have a value-premium. First, dividend paying firms not in financial distress have a value-premium. Because these firms are not in financial distress, financial distress is clearly not the reason for this value-premium. Rather, a value premium for these firms is consistent with the limits-to-growth hypothesis that I propose in Chapter 2.

Profitability increases the ability of the firm to “cover” growth capital expenditures which decreases risk and return. So, high profitability, high market/book, growth firms have lower return than do low profitability, low market/book, value firms.

Second, non-dividend paying firms not in financial distress do not have a value premium. I find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability non-dividend paying companies. Earnings that are retained for growth rather than paid as dividends suggests that non-dividend paying firms do not have the same growth limits as dividend paying firms. Rather, constraints on external financing mean that non-dividend paying firms finance growth investments internally as profitability permits. These investments increase risk and return. Consistent with this prediction, I find high returns for high profitability, high market/book, growth stocks, which is a negative value-premium for non-dividend paying stocks.

Last, firms in financial distress have a value premium. However, the reason for this value-premium is quite distinct from the reason that dividend paying firms not in financial distress have a value-premium. For firms in financial distress, I contend that profitability impacts two risks in opposite ways. At low profitability, *ROE* decreases distress-risk which decreases return. In particular, at exceptionally low profitability, returns are high and market/book is low. On the other hand, at high profitability, *ROE* increases the likelihood of growth which increases risk and increases return. Consistent with these predictions, I find strong evidence of both of relations. However, on the face of it, one would not expect a value premium—high returns for low market/book stocks—from a U-shaped relation between returns and profitability. Depending upon where firms in a particular sample fall along this U-shaped curve, returns and market/book might relate positively or negatively but this relation is unlikely to be strong or persistent. However, I find that *ROE* decreases not only volatility of earnings but also volatility of operating earnings for firms in financial distress. A decrease in volatility for operating earnings does not arise from a fall in financial leverage because operating earnings is before interest. Rather, consistent with Jensen and Meckling (1976), I argue that managers “risk-shift” into higher risk business investments with financial distress because they put creditors’ (rather than shareholders’) capital at risk with impunity. This behavior is consistent with the view that distress risk accentuates the call option features of common equity. Because the common equity of a firm in financial distress has characteristics of a call option, as *ROE* decreases volatility, value falls: a decrease in volatility decreases the value of a call option. Thus, for firms in financial distress, but with relatively great *ROE*, earnings-volatility is low, value is low, and market/book is

low. Putting these results together, there is a hill-shaped relation between market/book and profitability. Along with a U-shaped relation between returns and profitability, there is a value premium for firms in financial distress. When market/book is low (high or low profitability), returns are high.

#### **1.4 Description of Primary Dissertation Chapters**

In this subsection, I describe the principal chapters of my dissertation. First, in Chapter 2, I propose a new explanation for the value-premium: the “limits-to-growth hypothesis.” With organizational limits on growth expenditure, profitability decreases risk and return for high profitability companies. On the other hand, in anticipation of future growth, profitability increases risk and return for low profitability firms that have suspended growth. I test this hypothesis on dividend paying firms. I interpret dividend payment as evidence of limited growth prospects. I find that high profitability growth-firms, with high market/book, have low returns. This result is consistent with the existing literature for the entire cross-section of firms. However, profitability can either increase or decrease risk. Across market/book groupings of firms, profitability decreases risk and return (the value-premium), but within market/book groupings, profitability increases risk and return. Because the impact of profitability on risk and return is more pronounced for value firms compared to growth firms, consistent with a slightly modified version of the limits-to-growth hypothesis, I find that profitability increases returns to a greater extent for value compared to growth firms.

Second, in Chapter 3, I show that the profitability motivated risk/return dynamics of non-dividend paying firms is distinct from dividend paying firms. I find no evidence of limited growth opportunities that would otherwise induce low returns for high

profitability non-dividend paying companies. Earnings that are retained for growth rather than paid as dividends suggests that non-dividend paying firms do not have the same growth limits as dividend paying firms. Rather, constraints on external financing mean that non-dividend paying firms finance growth investments internally as profitability permits. These investments increase risk and return. Consistent with this prediction, I find high returns for high profitability, high market/book, growth stocks, which is a negative value-premium for non-dividend paying stocks.

Third, in Chapter 4, I show that distress-risk is part of the reason for the value-premium despite the commonly reported anomalous observation that high distress-risk firms have low returns. Profitability impacts two risks in opposite ways. Profitability decreases distress-risk but increases growth-leverage (risk created from capital expenditures for growth). Thus, high profitability firms with low distress-risk and high growth-leverage can have higher returns than low profitability firms with high distress-risk and low growth-leverage. The value-premium arises from a U-shaped relation between returns and profitability and a hill-shaped relation between market/book and profitability. When market/book is low (high or low profitability), returns are high. I develop these relations and report confirming evidence.

Last, the expected return measure I develop in Chapter 2, *SGER* (static growth expected return) overstates realized returns for high- profitability growth firms and understates realized returns for low-profitability value firms. A possible reason for this bias is that the implicit return measure, *SGER*, does not recognize the mean reversion in profitability that Fama and French (2000) empirically document. I investigate whether I can reduce or eliminate this value-versus-growth bias in *SGER* as a conditional expected



return measure by recognizing mean-reversion prior to inputting *ROE* into *SGER*. In other words, high profitability for growth firms is unsustainably high and is not a good forecast for expected return determination (and vice versa for value firms). I compare several *ROE* forecasts using both historical earnings and analysts' earnings forecasts. Nonetheless, *SGER* continues to overstate realized returns for growth firms and understate realized returns for value firms.

The fact that earnings reversion does not eliminate the value-versus-growth bias for *SGER* as a conditional expected return measure suggests that this bias will never be removed with implicit-returns from static models of equity valuation. Rather, only expected returns from a dynamic model of equity valuation that recognize the value-premium will eliminate this bias. In Chapter 2, I propose a new explanation for the value-premium: the "limits-to-growth hypothesis." With organizational limits on growth expenditure, profitability decreases risk for high profitability growth firms but increases risk for low profitability value firms in anticipation of future growth-leverage. Consistent with a modified version of the limits-to-growth hypothesis, I find that returns and profitability relate positively for both value and growth stocks but that the relation is stronger for value stocks than it is for growth stocks. The estimated regressions of realized returns on profitability, *ROE*, that lead to these results are effectively a conditional reduced-form version of the dynamic equity valuation model that recognizes the value-premium. I investigate *ROE* with historical earnings and consensus analysts' earnings forecasts as input in these regressions to produce an expected return. I call return forecasts from these regressions "dynamic growth expected returns," *DGER*. I find that *DGERs* effectively eliminate the value-versus-growth bias.

## Appendix 1A

### *An Example of Static Equity Valuation*

A constant returns to scale technology generates corporate earnings,  $X_t$ , as the product of stochastic return on equity ( $ROE$ ) and business investment for shareholders,  $B_t$ . That is,  $X_t = ROE_t B_t$ . One might measure business investment for shareholders empirically, for example, with accounting book equity. The return on equity follows a non-growing geometric Brownian motion  $dROE_t/ROE_t = \sigma dz$ , where  $dz$  is a standard Gauss-Weiner process. I use a non-growing geometric Brownian motion rather than a growing Brownian motion. Any business investment generates a non-growing stream of expected earnings per dollar of business investment equal to  $ROE$ . Corporate growth does not arise because individual business investments spontaneously grow earnings (like a stand of timber). Rather, businesses grow because of incremental business investment.

The manager grows the business with incremental business investments at the rate  $g \times 100\%$  per annum  $dB_t/B_t = g dt$ . In this static equity valuation model, the manager permanently commits to this growth regardless of profitability. Because earnings,  $X_t$ , is  $ROE$  times business investment for shareholders,  $X_t = ROE_t \cdot B_t$ , the process for earnings is:

$$dX_t/X_t = g dt + \sigma dz \quad (A1.1)$$

The presumption of a geometric Brownian motion imposes a number of requirements on the business that I model in this chapter. First, the manager maintains a target financial structure by growing both book equity and debt at the rate  $g \times 100\%$  per annum. Second,  $ROE$  (and earnings,  $X$ ) can never be negative. Because  $ROE$  is always

positive, this modeling eliminates financial distress (distress-risk) for businesses and their shareholders. This is an unrealistic representation of actual businesses. Businesses do occasionally face bankruptcy and liquidation as the result of poor profitability. I model financial distress more realistically in Chapter 4 of this dissertation.

I use the valuation methodology of Goldstein et al. (2001) as applied by Blazenko and Pavlov (2009) to find equity value of a business,  $V(X,B)$ , that grows at the rate  $g$ .

The risk-adjusted process,  $X'$ , for earnings is:

$$dX'/X' = (g - \theta\sigma_{x,c})dt + \sigma dz \quad (A1.2)$$

where  $\theta \geq 0$  is the coefficient of constant relative risk aversion for a representative investor,  $\sigma_{xc}$  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. I presume positive covariance risk,  $\sigma_{xc} \geq 0$ .

With a constant riskless interest rate,  $r$ , the equity value for the business,  $V(X,B)$ , satisfies the differential equation:

$$rVdt = (X - gB)dt + E(dV)$$

Since  $dB_t/B_t = gdt$ , with Ito's Lemma applied to  $dV$ , and with the risk adjusted process for profit in Equation (A1.2),

$$rV = X - gB + (g - \theta\sigma_{xc})XV_x + \frac{\sigma^2}{2}X^2V_{xx} + gBV_B \quad (A1.3)$$

The value function  $V(X,B)$  is of the form:

$$V(X,B) = B\pi(ROE) \quad (A1.4)$$

where  $ROE = X/B$  and  $\pi(ROE)$  is the market/book ratio for equity. Note that:

$$\begin{aligned}
\frac{\partial V}{\partial X} &= B\pi' \frac{1}{B} = \pi' \\
\frac{\partial^2 V}{\partial X^2} &= \frac{\partial \pi'}{\partial X} = \pi'' \frac{1}{B} \\
\frac{\partial V}{\partial B} &= \pi - B\pi' \frac{X}{B^2} = \pi - \frac{X}{B} \pi'
\end{aligned}
\tag{A1.5}$$

Substitute Equation (A1.5) into Equation (A1.3) and after dividing both sides by  $B$ ,

$$r\pi = (ROE - g) - \theta\sigma_{xc} \cdot ROE \cdot \pi' + \frac{\sigma^2}{2} ROE^2 \cdot \pi'' + g\pi \tag{A1.6}$$

Imposing the requirement that  $r > g$ , and after eliminating arbitrary constants, the solution of Equation (A1.6) is,

$$\pi(ROE) = \frac{ROE}{r^* - g} - \frac{g}{r - g} \tag{A1.7}$$

where  $r^* \equiv r + \theta\sigma_{xc}$ . To verify this expression, substitute Equation (A1.7) into Equation (A1.6) and simplify.

The first term in Equation (A1.7) is the discounted value of predicted future growing earnings (per one dollar of equity capital). The second term is the discounted value of growing capital expenditures for growth. The discount rate in the first term is greater than the discount rate in the second term because earnings are risky, whereas, capital expenditures for growth are not.

As an illustration that static equity valuation pushes valuation results beyond what is economically reasonable, note that as profitability,  $ROE$ , in Equation (A1.7) approaches zero from the right, value becomes negative. With low profitability, the commitment of permanent growth becomes such a burden on shareholders that they are willing to pay avoid the obligation. As such, in Figure 1.1, I plot return versus profitability only over the range of profitability,  $ROE$ , where equity value is positive. Of

course the presumption of permanent growth is unreasonable and, therefore, I relax this presumption in remaining chapters of this dissertation.

Determine expected return, which I denote as  $\omega$ , by replacing  $r$  with  $\omega$  on the left hand side of Equation (A1.6), remove the term  $\theta \cdot \sigma_{xc} \cdot ROE \cdot \pi'$  from the right hand side of Equation (A1.6) (so that  $\omega$  is the risk-adjusted return), eliminate the term

$\frac{\sigma^2}{2} ROE^2 \cdot \pi''$  (because  $\pi'' = 0$ ), and rearrange,

$$\omega = \frac{ROE - g}{\left[ \frac{ROE}{r^* - g} - \frac{g}{r - g} \right]} + g \quad (A1.8)$$

Notice that  $\lim_{ROE \rightarrow \frac{g(r^* - g)}{r - g}} [\omega] = \infty$  which means that as the value of equity approaches zero then

expected return becomes infinitely great. In addition,  $\lim_{ROE \rightarrow \infty} [\omega] = r^*$  which means that as

profitability increases without bound expected return approaches that of a firm that permanently does not grow (that is,  $g=0$ ). Finally, it is easy to show that expected return strictly decreases with profitability,  $\omega' < 0$ . Figure 1.1 plots this relation between expected equity return ( $\omega$ ) and  $ROE$  for a numerical example.

# CHAPTER 2: VALUE VERSUS GROWTH IN DYNAMIC EQUITY INVESTING

## Abstract

I propose a new explanation for the value premium that I call the “limits-to-growth hypothesis.” With organizational limits on growth expenditures, profitability decreases risk. Thus, high profitability growth-firms, with high market/book, have low returns. I use this hypothesis to explain a puzzle in the financial literature: profitability can either increase or decrease risk. Across market/book groupings of firms, profitability decreases risk and return (the value premium), but within market/book groupings, profitability increases risk and return. Consistent the limits-to-growth hypothesis, I find that profitability increases returns to a greater extent for value compared to growth firms.

## 2.1 Introduction

I investigate an explanation for the value premium that I call the “limits-to-growth hypothesis.” Arrow (1974) argues that constraints on organization restrict managers from all possible wealth creating business investments that they uncover. Tobin (1969) also presumes these limits because, otherwise, firms invest (or divest) until diminishing returns force Tobin’s “ $q$ ” permanently to one. Growth relative to profitability determines risk and return. If firms face financing constraints (e.g., Froot, Scharfstein, and Stein, 1993), they alternatively finance growth internally only when profitability permits. Limits to growth mean that managers often do not need all corporate profitability for internal financing of the investments that they pursue. High profitability “covers” growth expenditures which decreases risk. Thus, high profitability growth-firms, with high market/book, have lower risk and lower return than value-firms.

The limits-to-growth hypothesis can explain the value premium in the entire cross-section of firms. However, as I outline later, there are many explanations of the value-premium. To distinguish the limits-to-growth hypothesis I use it to explain a puzzle in the financial literature for which these other explanations are ineffective. I use the limits-to-growth hypothesis to explain why profitability can either increase or decrease risk. The relation between profitability and returns “in the large,” the value premium, means that high profitability growth-firms have lower returns than low profitability value-firms. Fama and French (1992, 1998) document evidence of the value premium for both domestic and international firms. On the other hand, the relation between profitability and returns “in the small” (for either growth or value stocks separately) is positive. Haugen and Baker (1996), Piotroski (2000), Mohanram (2005), and Fama and French (2006) document this empirical regularity without economic explanation. A complete theory of the value premium requires an explanation of the relation between returns and profitability in-the-small as well as in-the-large. I develop this explanation in the current chapter.

When earnings growth requires capital growth, Blazenko and Pavlov (2009) value the equity of a business whose manager has a dynamic option to suspend and restart growth indefinitely. If the return on capital falls below a value-maximizing hurdle rate, then the manager suspends growth. If the return on capital rises above the hurdle rate, the manager recommences growth at a fixed rate. They show that the cost of capital uniformly exceeds this hurdle-rate, which means that the cost of capital is an unduly conservative benchmark for business expansion. A critical assumption for this result is limited growth, which means that when a firm grows, it grows at a maximum rate

regardless of how high profitability might be. The relation between profitability and returns is hill-shaped. Firm with low profitability suspend growth. Increasing profitability increases the likelihood of recommencing growth, which creates growth-leverage and increases return. On the other hand, high profitability covers growth costs, which decreases leverage and return. Blazenko and Pavlov's dynamic equity valuation model is consistent with but does not guarantee a value premium.

In a partial-equilibrium model of equity valuation, for example, the static constant growth discounted dividend model (the Gordon growth model) that discounts forecast dividends at a constant rate, there is no relation between expected return and corporate profitability. On the other hand, in an equilibrium model of static equity valuation where a manager permanently commits to growth, the relation between returns and profitability is negative (see, Figure 1.1 and Appendix 1A of Chapter 1 of this dissertation).

Profitability increases the ability of a firm to “cover” growth capital expenditures, which decreases risk and return. Thus, a static model of equity valuation can explain the negative relation between returns and profitability in-the-large but not the positive relation between returns and profitability in-the-small. The importance of Blazenko and Pavlov's dynamic model for my purposes is that it suggests the circumstances under which returns can increase with profitability. For firms that have suspended growth, increasing profitability increases the likelihood of future growth, which increases growth-leverage and return. This economic explanation arises only from a dynamic model and not from a static model of equity valuation. Only a dynamic model can explain the differing relations between returns and profitability in-the-large and in-the-small.



Blazenko and Pavlov's (2009) hill-shaped relation between returns and profitability predicts that returns should increase with profitability for value stocks and decrease with profitability for growth stocks. However, like others cited above, I find empirically that returns increase with profitability for both value and growth stocks. Thus, I use a modified version of the limits-to-growth hypothesis to explain the relation between returns and profitability in-the-small. For value firms, increasing profitability increases the likelihood of growth which increases growth-leverage which increases return. At the same time, increasing profitability increases the ability of the firm to finance growth internally when they cannot finance externally (e.g., Froot, Scharfstein, and Stein, 1993). This increase in the corporate growth-rate increases risk, which increases return. These two forces work together so that the relation between returns and profitability is quite strong for value firms. On the other hand, for growth firms, increasing profitability covers growth costs, which decreases leverage and decreases return. At the same time, increasing profitability increases the ability of the firm to finance growth internally when they cannot finance externally. This increase in the corporate growth-rate increases risk, which increases return. These two forces work in opposite directions. So, the relation between returns and profitability can be either positive or negative for growth firms (depending upon which force dominates), but it is weaker for growth firms than it is for value firms.

In this Chapter, I investigate dividend paying companies. I interpret dividends as a corporate response to growth limits and, thus, an indication of these limits.<sup>5</sup> Firms pay dividends when they do not need these funds for growth financing in a financially constrained environment. Consistent with the modified limits-to-growth hypothesis, I report evidence that the relation between returns and profitability is positive for both value and growth stocks but it is stronger for value stocks.

There are three common explanations for the value premium: financial distress, growth-option exercise, and investment irreversibility. First, Fama and French (1995, 1998) argue that the value premium arises from financial distress arising from the poor profitability of value firms. Carlson, Fisher, and Giammarino (2004) and Garcia-Feijoo and Jorgensen (2007) show that operating leverage (which depends on profitability) relates positively with book/market and the value premium. Second, Anderson and Garcia-Feijoo (2006) argue that growth firms have large past capital expenditures, which they interpret as growth-option exercise that reduces risk and return. Similarly, Fama and French (2007) argue that growth-option exercise reduces market/book for growth firms, while restructuring improves market/book for value firms. This market/book reversion creates high expected returns for value firms and low expected returns for growth firms. Third, Zhang (2005) argues that irreversibility of assets-in-place makes value firms riskier than growth firms. Each of these explanations for the value premium is consistent

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<sup>5</sup> There are other financial measures that one might use as an indication of growth limits, like for example, the rate of investment. Managerial dividend choice has the advantage that it is immediate and recurring for each dividend declaration and is therefore an indication of growth limits at the current instant. Because business investments are often difficult to start, stop, or slow down, they are a reflection of growth limits in the past. Further, the evidence in this Chapter and the next suggests that the profitability induced relation between risk and return is distinct for dividend paying and non-dividend paying firms. Thus, dividend paying and non-dividend paying firms are indeed distinct.

with a negative relation between returns and profitability in-the-large, but they do not explain the positive relation between returns and profitability in-the-small.

To investigate whether current asset-pricing models recognize the relation between profitability and returns in-the-small for dividend paying firms, I benchmark the returns of portfolios formed by ranking both market/book and a return proxy against two conditional asset-pricing models. Within each market/book grouping, I find negative abnormal returns for low risk stocks and positive abnormal returns for high risk stocks. While rational analysis guides my empirical investigation, I cannot dismiss market-inefficiency as an explanation for abnormal returns. Either equity-markets over-price low-risk stocks (and vice-versa), or current asset-pricing models do not capture the relation between returns and profitability in-the-small for either value or growth stocks. While it is not the focus of the current Chapter of this dissertation, evidence of statistically significant abnormal returns suggests that dynamic and non-linear asset pricing models, like Blazenko and Pavlov (2009) that I use for guidance in this chapter, may be a better representations of returns than linear asset pricing models that are commonly used currently.

In the following section, I use Blazenko and Pavlov's (2009) dynamic equity valuation model to show that expected return is the sum of two terms: expected return from the static constant growth discounted dividend model (Williams, 1938), which I call static growth expected return (*SGER*), plus a term that arises from the business expansion option and depends on earnings volatility. *SGER* does not require estimation and is easy to calculate with an earnings forecast and readily available financial market measures. Further, *SGER* is a large portion of expected return from the dynamic model. In sections

2.3 and 2.4, I empirically investigate the relations between returns and profitability in-the-large and in-the-small. In section 2.5, I report evidence that portfolios formed with *SGER* (in-the-small) earn abnormal returns. In section 2.6, I find no evidence that the contribution of volatility to returns beyond market/book and *SGER* is either economically or statistically significant. Section 2.7 concludes and offers suggestions for future research.

## 2.2 Dynamic Financial Analysis

### 2.2.1 Expected Return

I use Blazenko and Pavlov's (2009) model of a dynamically expanding business where profit growth requires capital growth. They develop an expected return expression, for common equity,

$$\omega(ROE) = \begin{cases} \frac{ROE - g + g\pi + \frac{1}{2}\pi''\sigma^2 ROE^2}{\pi}, & \text{growth, } ROE \geq \xi^* \\ \frac{ROE + \frac{1}{2}\pi''\sigma^2 ROE^2}{\pi}, & \text{suspend growth, } ROE < \xi^* \end{cases} \quad (2.1)$$

where the growth rate for earnings and capital is  $g$ ,  $ROE$  is the return on equity that follows a non-growing geometric Brownian motion with earnings volatility  $\sigma$ ,  $\xi^*$  is the value maximizing expansion boundary in Equation (A2.3) of Appendix 2A, and  $\pi$  is the market/book ratio in Equation (A2.1).

Blazenko and Pavlov (2009) model the return on capital as a geometric Brownian motion because they investigate the relation between the cost of capital and the value maximizing hurdle rate for business expansion. To simplify my analysis, I model the return on equity ( $ROE$ ) as a geometric Brownian motion. This presumption implies that

the manager maintains a target financial structure by increasing both debt and equity at the rate  $g$  to finance growth investment. A geometric Brownian motion implies that  $ROE$  can never be negative. This  $ROE$  property restricts my analysis from firms in financial distress. Thus, one of the sample selection criteria that I use later in this Chapter is that firms have positive trailing-twelve-month earnings. Alternatively, Chapter 4 investigates the value premium for firms in financial distress.

The manager's expansion decision depends on profitability,  $ROE$ . When  $ROE$  exceeds the expansion boundary,  $\xi^*$ , the manager expands earnings at the rate  $g$  with capital growth at the rate  $g$ . When  $ROE$  is less than the expansion boundary,  $\xi^*$ , the manager suspends growth until profitability improves. To prevent arbitrage (Shackleton and Sødal, 2005), the two branches of Equation (2.1) for expected return equal one another and, thus, both equal one at the expansion boundary. Since the manager grows the business when market/book exceeds one, this representation of corporate investment is the dynamic equivalent of Tobin's (1969)  $q$ -theory.

The upper branch of Equation (2.1) represents expected return for firms in the growth state. In the numerator, the first term,  $ROE-g$ , is dividend per dollar of equity investment (that is, book equity). The second term,  $g\pi$ , is the contribution of capital to value. The third term,  $\frac{1}{2}\pi''\sigma^2 ROE^2$ , is value protection from the option to suspend growth. Expected return,  $\omega(ROE)$ , in the growth state, is the sum of these three terms scaled by market/book  $\pi(ROE)$ .

The lower branch is expected return for a firm that suspends growth,  $ROE < \xi^*$ , which is a special case of the upper branch with a zero growth rate,  $g=0$ . The firm pays

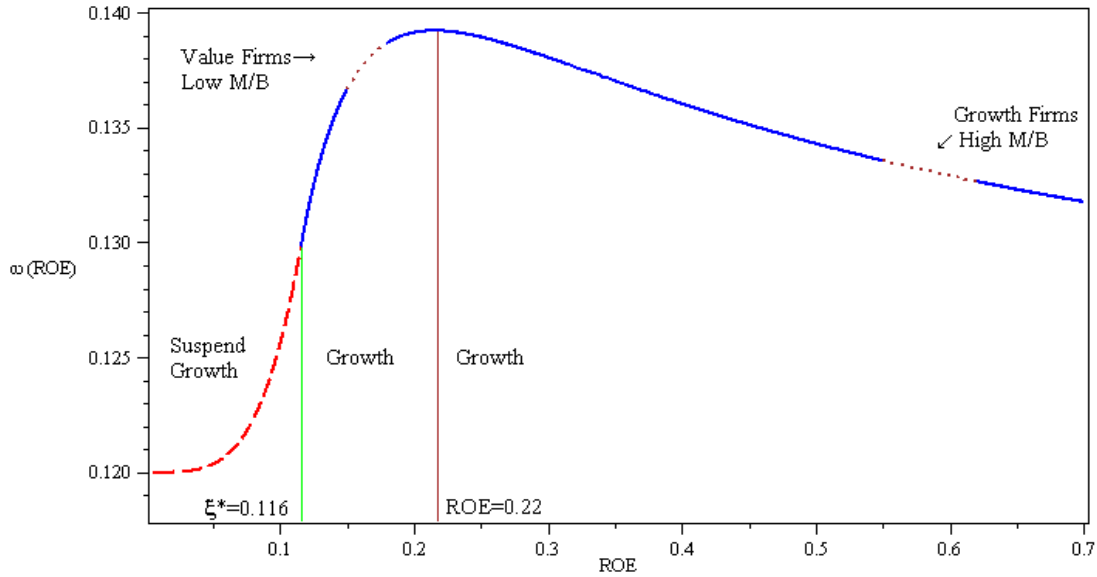
all earnings as dividends when growth is suspended.<sup>6</sup> A payout ratio of one means that the first term,  $ROE$ , is dividend per dollar of equity investment. The second term,  $\frac{1}{2}\pi\sigma^2ROE^2$ , is expected capital gain from the growth option. Expected return,  $\omega(ROE)$ , in the suspended growth state, is the sum of these two terms scaled by market/book,  $\pi(ROE)$ .

Figure 2.1 plots expected return from Equation (2.1) versus profitability,  $ROE$ , for a numerical example. The difference between expected return for a hypothetical business that permanently does not grow,  $r^*=0.12$ , and the riskless rate,  $r=0.05$ , represents the primary source of business risk with a risk premium of  $0.12-0.05=0.07$ . As the manager grows the business, growth capital expenditures (which themselves grow) “lever” this business risk above 0.12 in Figure 2.1. In addition, investor expectations of this risk, even when the firm suspends growth, influence expected return. I refer to this enhanced business risk as “growth-leverage.” Because the manager’s decision to grow depends upon profitability, which alters growth-leverage, profitability,  $ROE$ , is an important determinant of expected return in Equation (2.1).

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<sup>6</sup> Firms that suspend growth might accumulate cash to finance expected future growth. Because my simple modeling does not accommodate different classes of assets with different rates of return, I presume that the manager adopts a payout ratio of one when the firm does not grow.

**Figure 2.1 Expected Return,  $\omega(ROE)$  , versus Profitability,  $ROE$**



*Notes:* Figure 2.1 plots expected return,  $\omega(ROE)$  , versus profitability,  $ROE$  (with earnings volatility  $\sigma=0.2$ , earnings growth  $g=0.06$ , and a risk adjusted expected return for a hypothetical business that permanently does not grow  $r^*=0.12$ ). The value maximizing return threshold for business expansion is  $\xi^*=0.116$  in this numerical example.

When the firm suspends growth (the left-most section of Figure 2.1), as profitability,  $ROE$ , approaches zero from the right, growth-leverage disappears because the likelihood of returning to the growth state diminishes. In this case, expected return falls. When  $ROE=0$ , the likelihood of returning to the growth state is zero. With no possibility of growth-leverage there is no risk induced by growth and return equals that of the business that permanently does not grow. That is,  $\omega(ROE) = r^* = 0.12$ . In the left-most section of Figure 2.1, when  $ROE$  increases, risk increases because of increasing likelihood that at some future time  $ROE$  will cross the expansion boundary,  $\xi^* = 0.116$ , where the firm begins growth and incurs growth-leverage. Expected return  $\omega(ROE)$  increases in anticipation of this risk.

Once profitability,  $ROE$ , crosses the expansion boundary,  $ROE \geq \xi^* = 11.6\%$ , the manager begins to grow the business with growth investments. As  $ROE$  increases, expected return increases until  $ROE=0.22$  in Figure 2.1. For  $0.116 \leq ROE \leq 0.22$ , profitability increases the likelihood of remaining in the growth state and continuing to incur growth-leverage rather than fall back into the state with suspended growth and without growth-leverage. This increasing likelihood of growth-leverage increases risk, which increases expected return,  $\omega(ROE)$ . For  $0 \leq ROE \leq 0.22$  in Figure 2.1, profitability,  $ROE$ , increases risk and expected return,  $\omega(ROE)$ .

When profitability is high in Figure 2.1 ( $ROE \geq 0.22$ ), the likelihood suspending growth becomes remote and, therefore, this likelihood has little impact on risk. Rather, with increasing profitability the firm is better able to “cover” growth expenditures,  $g$ , which decreases risk. Thus, for  $ROE > 0.22$  in Figure 2.1, profitability decreases risk and expected return.

## 2.2.2 Static Growth Expected Return

The first portion of the upper branch of Equation (2.1) is,

$$\frac{ROE - g + g\pi}{\pi}. \quad (2.2)$$

The term  $ROE-g$  is dividend per dollar of equity investment. Dividend yield,  $dy$ , is  $ROE-g$  divided by market/book,  $dy \equiv (ROE - g) / \pi$ . Blazenko and Pavlov (2009) do not recognize, but, with a little algebra, I can rewrite Equation (2.2) as,

$$SGER \equiv ROE + (1 - \pi)dy \quad (2.3)$$

I refer to Equation (2.3) as *static growth expected return* ( $SGER$ ) because it arises not only as a component of expected return,  $\omega(ROE)$ , in the dynamic model, but also as



expected return itself from the static growth discounted dividend model (Williams, 1938). See Appendix 2B for a proof of this claim. While the form of these expressions is the same, it is important to recognize that they are different because share price in the first is from a dynamic model, whereas share price in the second is from a static model. Note that the component terms of *SGER* are either readily available (that is,  $\pi$  and  $dy$ ) or relatively easy to forecast, *ROE*. Note, in particular, that growth “g” does not appear directly in Equation (2.3) other than through its impact on price which determines market/book,  $\pi$ , and dividend yield,  $dy$ .

### 2.2.3 *SGER* as a Component of Expected Return

In this section, I show that *SGER* is a large portion of expected return from the dynamic model (Equation 2.1). Panel A of Figure 2.2 plots volatility’s contribution to expected return which I measure as the last term on either branch of Equation (2.1)

divided by expected return:  $\left(\frac{1}{2}\pi''\sigma^2 ROE^2 / \pi\right) / \omega(ROE)$ . Volatility’s contribution to

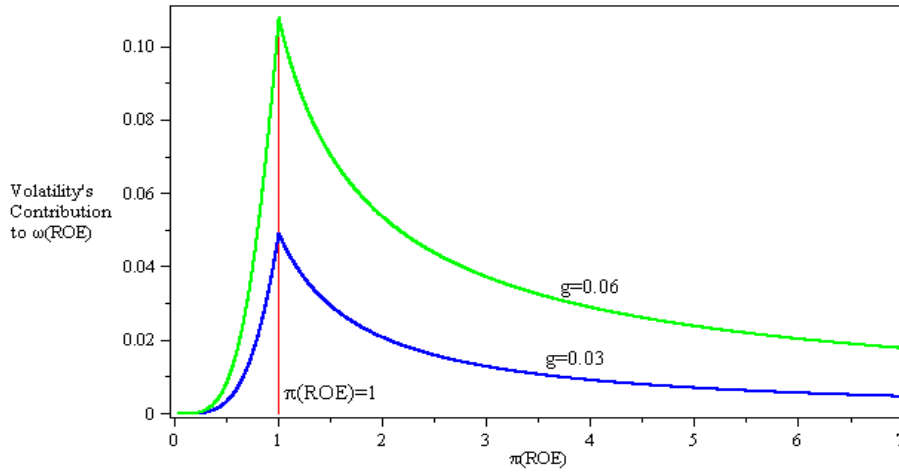
expected return is highest where market/book equals one,  $\pi(ROE) = 1$ . As profitability *ROE* increases or decreases and market/book changes from one, volatility’s contribution to expected return decreases. Volatility’s contribution to expected return is no more than 11% in Figure 2.2 when real growth is high,  $g=0.06$ . When real growth is more realistic,  $g=0.03$ , then, volatility’s contribution to expected return is less than 5%. When market/book differs from one, volatility’s contribution to expected return is even less.

Panel B of Figure 2.2 plots *SGER* and expected return,  $\omega(ROE)$ , versus market/book,  $\pi$ . *SGER* is the portion of expected return from Equation (2.1) that does not have earnings volatility,  $\sigma$ , as a direct input. In the growth state, *SGER* behaves in a

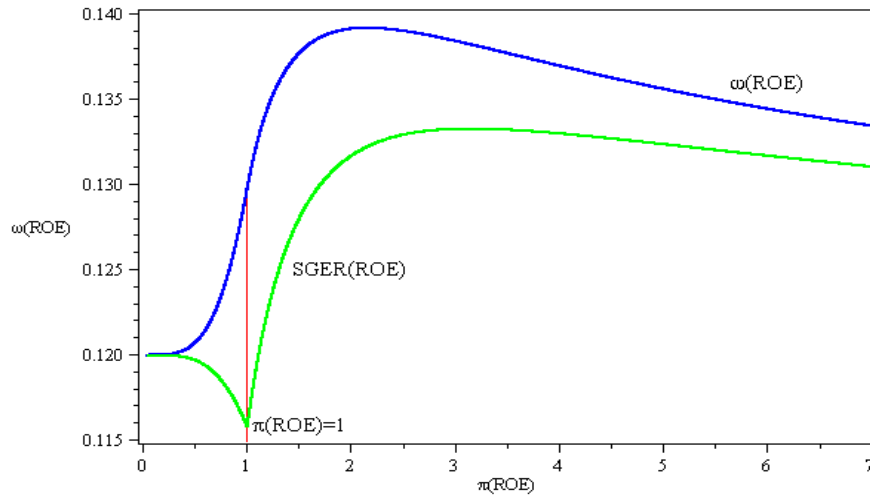
similar way as expected return,  $\omega(ROE)$ . *SGER* increases initially with market/book,  $\pi$ , because of increasing likelihood of incurring growth-leverage. *SGER* eventually decreases with market/book,  $\pi$ , as firms cover the capital expenditure costs of growth with profitability, *ROE*, and growth-leverage decreases.

This analysis indicates that, in the growth state where market/book,  $\pi$ , is greater than one, *SGER* is a large portion of expected return,  $\omega(ROE)$ , and changes in *SGER* are similar to changes in expected return,  $\omega(ROE)$ , with respect to profitability, *ROE*. For empirical testing later in this Chapter, *SGER* has the attraction that it is easy to calculate with readily available financial market measures and does not require statistical estimation. Further, in section 2.6, I find little statistical or economic significance for earnings volatility beyond *SGER* for returns. This observation is consistent with *SGER* as a large portion of expected return from the dynamic model. Consequently, I investigate *SGER* on its own in my empirical analysis as a return proxy rather than in conjunction with earnings volatility.

**Figure 2.2 Panel A: Volatility's Contribution to Expected Return,  $\omega(ROE)$**



**Panel B: SGER and Expected Return,  $\omega(ROE)$**



Notes: Panel A plots the fraction of expected return that arises from volatility,

$\left( \frac{1}{2} \pi^2 \sigma^2 ROE^2 / \pi \right) / \omega(ROE)$ . I plot this fraction with respect to market/book,  $\pi(ROE)$ , for two earnings

growth rates  $g=0.03$  and  $g=0.06$ . Earnings volatility is  $\sigma=0.2$ . The risk adjusted expected return for a business that permanently and hypothetically does not grow is  $r^*=0.12$ . Panel B plots  $SGER$  and expected return,  $\omega(ROE)$ , versus market/book,  $\pi(ROE)$ , with  $\sigma=0.2$ ,  $g=0.06$ , and  $r^*=0.12$ .

### 2.3 Data, Portfolio Formation, and Portfolio Characteristics

In this section, before I test for relations between returns and profitability for value and growth stocks in section 2.4, I describe the data I use, the portfolios I form, and some of the characteristics of these portfolios.

### 2.3.1 Data and Portfolio Selection Criteria

I impose a number of screens on firms for study inclusion. First, firms must have data from each of the *COMPUSTAT*, *CRSP*, and Thomson *I/B/E/S* databases. Firms that satisfy this screen are primarily US domestic companies but also include foreign inter-listed companies and American Depositary Receipts (ADRs).<sup>7</sup> Second, because both market/book and forward *ROE* for *SGER* in Equation (2.3) entail division by BVE, I require that firms have positive BVE from the latest reported quarterly or annual financial statements immediately prior to portfolio formation. Third, in my application of Blazenko and Pavlov's (2009) dynamic equity valuation model I presume that *ROE* follows a geometric Brownian motion, which means that *ROE* is always positive. This *ROE* property restricts my analysis from firms in financial distress, and therefore, I require positive trailing-twelve-month earnings. Fourth, I interpret dividends as a corporate response to growth-limits and, thus, a signal of these limits. So, to test the limits-to-growth hypothesis for equity returns, I impose the requirement that firms have positive trailing-twelve-month dividends at the time of portfolio formation.

### 2.3.2 Corporate Performance Forecasting and Financial Measures

Thomson *I/B/E/S* updates forecast data as often as five times a trading day, on over twenty corporate financial measures. These measures include annual and quarterly EPS for over 25,000 common shares worldwide (for both consensus and analyst-by-analyst forecasts). The Historical *I/B/E/S* database that I use reports a snapshot of these forecasts for the Thursday preceding the third Friday of the month which *I/B/E/S* refers to

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<sup>7</sup> If not in US dollars, I convert accounting data (forecast or historical) into US dollars.

as a “Statistical Period” date. My testing rebalances portfolios at closing prices on Statistical Period dates.

*COMPUSTAT* is my source for book equity (BVE), reported earnings (*EPS*), and other corporate financial data. I measure BVE as Total Assets less Total Liabilities less Preferred Stock plus Deferred Taxes and Investment Tax Credits (from the *COMPUSTAT* quarterly file). *CRSP* is my source for dividends, split factors, shares outstanding, daily share price, and daily returns. Thomson *I/B/E/S* is my source for reported EPS and consensus analysts’ EPS forecasts.

I forecast *ROE* in three ways with three different median *I/B/E/S* analysts’ EPS forecasts at a Statistical Period date. These EPS forecasts are for one, two, and three yet to be reported fiscal years hence. I use annual rather than quarterly *EPS* forecasts to avoid seasonality. Denote these median analysts’ *EPS* forecasts<sup>8</sup> as *EPS1*, *EPS2*, and *EPS3*. My three *ROE* forecasts for a firm are *EPS1/BPS*, *EPS2/BPS*, and *EPS3/BPS*, where the earnings forecasts are at a Statistical Period date and BVE is from the most recently reported quarterly or annual financial statements prior to a Statistical Period date. BPS is BVE divided by shares outstanding at a Statistical Period date. Denote these *ROE* forecasts as *ROE1*, *ROE2*, and *ROE3* and *SGER* in Equation (2.3) calculated with these *ROEs* as *SGER1*, *SGER2*, and *SGER3*, respectively. I use analysts’ earnings forecasts rather than historical *EPS* to forecast *ROE* because analysts’ forecasts are more current than historical earnings and should, therefore, better represent the information available to investors at a statistical period date for portfolio formation. Chapter 5 of this

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<sup>8</sup> My analysis (not reported) shows that analysts’ earnings forecasts are quite accurate for one unreported fiscal year hence and become overly optimistic only for longer forecast periods.

dissertation investigates both historical and analysts' *EPS* forecasts for forward *ROE* in *SGER* determination.

I make no claim that *ROE1*, *ROE2*, or *ROE3* are the best possible *ROE* forecasts. The simplicity of my *ROE* forecasts highlights the fact that I do not “snoop” the data for best fit measures that unlikely represent future returns as well. In the current Chapter, I opt for simplicity, but recognize that evidence I uncover might guide the search for better *ROE* forecasts for representing expected returns with *SGER*.

In using forecast earnings per share (*EPS*) divided by book equity per share (*BPS*) as a *ROE* forecast, I presume that accounting return is a good economic return forecast. It need not be. For example, if corporate managers choose inappropriate depreciation schedules, then both *EPS* and *BPS* mis-measure their corresponding economic counterparts. The net effect is to bias accounting returns relative to economic returns. There is a literature on the accuracy of accounting returns as economic return proxies. In addition, I present evidence later that accounting *ROE* overstates economic *ROE* for growth stocks and understates economic *ROE* for value stocks. Despite these limitations, investors can profit from accounting returns if investment strategies formed with *SGER* earn abnormal returns (that is, *SGER* is useful as a relative measure of return). On the other hand, Chapter 5 investigates several mean-reversion adjustments for forecast *ROE* to be used in *SGER* as an absolute return measure. An absolute return measure is particularly important, for example, for use in the weighted average cost of capital.

The first Statistical Period date, which begins the *I/B/E/S* database, is 1/15/1976. Common database coverage (that is, for *I/B/E/S*, *COMPUSTAT*, and *CRSP*) is up to August 2007 where the last Statistical Period date is 8/16/2007. My test period for

*SGER1* and *SGER2* is 31 years and 7 months, or equivalently, 379 months. My test period is shorter for *SGER3* because *I/B/E/S* begins reporting *EPS3*–forecast earnings three unreported fiscal year-ends hence—at the 9/20/1984 Statistical Period date. My test period for *SGER3* is between 9/20/1984 and 8/16/2007, which is 23 years, or equivalently, 276 months.

The forward dividend yield for *SGER* in Equation (2.3) is the current dividend yield—trailing-twelve-month dividends divided by closing share price on the Statistical Period date—adjusted by Equation (C2.4) in Appendix 2C. With this expression, because I use three separate *ROE* forecasts, there are three corresponding, forward dividend yields,  $dy_1$ ,  $dy_2$ , and  $dy_3$ , respectively. The market/book ratio for *SGER* in Equation (2.3) is the closing share price multiplied by shares outstanding (both on the Statistical Period date), divided by BVE from the most recently reported quarterly or annual financial statements prior to the Statistical Period date.

### **2.3.3 Descriptive Statistics and Portfolio Characteristics**

Figure 2.1 depicts non-linearity in the relation between return and profitability. Depending upon where firms in a particular sample fall along this hill-shaped curve, the linear relation between returns and profitability might be positive or negative, but it is unlikely to be strong or persistent. Therefore, I do a preliminary sort based on a financial variable related to profitability: book/market. This sort allows me to investigate the relation between returns and profitability in-the-large (the value premium) and in-the-small (for value and growth stocks separately).

For each Statistical Period date from 1/15/1976 to 8/16/2007 I calculate *SGER* in Equation (2.3) for each firm with positive trailing-twelve-month dividends, positive

trailing-twelve-month earnings, and positive BVE. I first sort firms into five book/market quintiles ( $b=1,2,3,4,5$ ) and then for each book/market quintile into five *SGER* portfolios ( $k=1,2,3,4,5$ ). This double sort leads to twenty-five portfolios that I rebalance at each statistical period date over the test period. In addition, because I sort firms within book/market quintiles in three ways, with *SGER1*, *SGER2*, and *SGER3*, I investigate 3  $25=75$  portfolios. Over my test periods (379 months for *SGER1* and *SGER2* and 276 months for *SGER3*), the average numbers of stocks in the 25 portfolios is 44.4, 39.6, and 14.9 respectively. The relatively small number of stocks in *SGER3* portfolios is because analysts' annual *EPS* forecasts are sparser for three unreported fiscal years hence compared to one and two unreported fiscal years hence. Since the average number of stocks in *SGER1*, *SGER2*, and *SGER3* portfolios is not overly great, the portfolios in Table 2.1 can be replicated by investors which increases the economic significance of my results.

Table 2.1 reports median market cap for the *SGER1*, *SGER2*, and *SGER3* portfolio sets. Notice first that low book/market (growth) firms tend to be larger than high book/market (value) firms. Second, for any book/market quintile and for any *SGER* portfolio, market cap increases for *SGER3* compared to *SGER2* compared to *SGER1* portfolios. This increase reflects the fact that analysts more likely forecast *EPS* further in the future for larger compared to smaller firms. Last, within book/market quintiles there is no strong relation between *SGER* and market cap for any of the *SGER1*, *SGER2*, or *SGER3* portfolio sets.



**Table 2.1 Descriptive Statistics**

book/market Quintile	SGER Quintile	Portfolio Ranking Measure			Portfolio Ranking Measure			Portfolio Ranking Measure		
		<i>SGER1</i>	<i>SGER2</i>	<i>SGER3</i>	<i>SGER1</i>	<i>SGER2</i>	<i>SGER3</i>	<i>SGER1</i>	<i>SGER2</i>	<i>SGER3</i>
		Median Market Cap (millions)			Most Common 1-Digit SIC			Percent of Firms with Most Common 1-Digit SIC		
		$MVE_{b,k}^1$	$MVE_{b,k}^2$	$MVE_{b,k}^3$						
Lowest book/market <i>b</i> = 1 Growth Stocks	Lowest <i>SGER</i> <i>k</i> = 1	1198	1381	4054	2000	2000	2000	29.3	31.3	30.7
	<i>k</i> = 2	1638	1687	4962	2000	2000	2000	33.0	33.1	32.7
	<i>k</i> = 3	1430	1458	6815	2000	2000	2000	29.7	29.2	31.4
	<i>k</i> = 4	948	1072	6480	2000	2000	2000	28.0	27.9	34.0
	Highest <i>SGER</i> <i>k</i> = 5	1179	1324	5797	3000	3000	2000	26.7	26.1	35.9
<i>b</i> = 2	Lowest <i>SGER</i> <i>k</i> = 1	822	992	3071	2000	2000	2000	23.7	26.7	27.1
	<i>k</i> = 2	805	852	2927	2000	2000	2000	27.1	26.7	26.6
	<i>k</i> = 3	664	845	2959	3000	3000	6000	25.7	26.4	26.6
	<i>k</i> = 4	738	755	2832	6000	6000	3000	29.1	29.7	28.3
	Highest <i>SGER</i> <i>k</i> = 5	506	555	1961	3000	3000	3000	30.5	31.8	32.5
<i>b</i> = 3	Lowest <i>SGER</i> <i>k</i> = 1	555	681	2236	3000	4000	4000	22.6	25.4	33.7
	<i>k</i> = 2	452	534	2209	6000	6000	2000	26.0	28.9	26.2
	<i>k</i> = 3	380	488	2262	6000	6000	6000	34.8	36.7	35.6
	<i>k</i> = 4	437	530	2081	6000	6000	6000	45.1	45.8	44.7
	Highest <i>SGER</i> <i>k</i> = 5	478	480	1894	6000	6000	6000	44.4	41.0	33.7
<i>b</i> = 4	Lowest <i>SGER</i> <i>k</i> = 1	368	510	1685	4000	4000	4000	21.5	32.9	49.2
	<i>k</i> = 2	443	591	2068	4000	4000	4000	37.6	39.8	55.8
	<i>k</i> = 3	340	427	1780	6000	6000	4000	32.4	34.9	30.0
	<i>k</i> = 4	304	376	1742	6000	6000	6000	46.9	46.3	39.3
	Highest <i>SGER</i> <i>k</i> = 5	348	416	1579	6000	6000	6000	54.6	52.4	46.3
Highest book/market <i>b</i> = 5 Value Stocks	Lowest <i>SGER</i> <i>k</i> = 1	167	197	1021	2000	6000	4000	24.0	23.4	35.3
	<i>k</i> = 2	216	403	2016	4000	4000	4000	25.8	39.8	66.4
	<i>k</i> = 3	351	502	2163	4000	4000	4000	40.4	42.6	60.3
	<i>k</i> = 4	354	394	1595	4000	6000	4000	35.2	33.8	38.7
	Highest <i>SGER</i> <i>k</i> = 5	219	258	1213	6000	6000	6000	53.6	55.0	44.4

Notes:  $MVE_{i,t,b,k}^j$  is market value of equity for firm  $i=1,2,\dots,N$ , in month  $t=1,2,\dots,TP$ , for portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ , where the 25 portfolios are formed by sorting all firms at a statistical period date by book/market into 5 quintiles and then for each quintile into 5 portfolios by *SGER1* ( $j=1$ ), *SGER2* ( $j=2$ ), and *SGER3* ( $j=3$ ), respectively.  $TP$  is 379 months (1/15/1976 to 8/16/2007) for *SGER1* and *SGER2* and 276 months (9/20/1984 to 8/18/2007) for *SGER3*. Table 2.1 reports  $median(MVE_{i,t,b,k}, i = 1,2,\dots,N, t=1,2,\dots,TP)$ . My three ROE forecasts are *EPS1/BPS*, *EPS2/BPS*, and *EPS3/BPS*, where the earnings forecasts are at a Statistical Period date and *BVE* is from the most recently reported quarterly/annual financial statements prior to the Statistical Period date. *BPS* is *BVE* divided by the number of shares on each Statistical Period date. *SGER1*, *SGER2*, and *SGER3* represent Equation (2.3) calculated with *ROE1*, *ROE2*, and *ROE3*. *EPS1*, *EPS2*, and *EPS3* are I/B/E/S consensus analysts *EPS* forecasts for the first unreported fiscal year, second unreported fiscal year, and third unreported fiscal year at a Statistical Period date.

Also in Table 2.1, I report the most common 1-digit SIC code and the percent of firms within a portfolio with that SIC code for each of the double sorted portfolios and for each of the three *SGER* portfolio sets. For reference purposes, for the overall sample of firms that satisfy my selection criteria, the percentage of firms in the 5 most common 1-digit SIC codes, 2000-2999, 3000-3999, 4000-4999, 5000-5999, and 6000-6999 are 19.74%, 21.01%, 13.81%, 8.54% and 27.26%, respectively.<sup>9</sup> The fractions in Table 2.1 do not vary markedly from these benchmarks, which indicates that my portfolios are not over-weight in particular industries compared to randomly selected portfolios. There is some evidence over my test period that a higher fraction of growth firms have 2000-2999 SIC codes and a higher fraction of value firms have 4000-4999 and 6000-6999 SIC codes compared to randomly selected portfolios.

Table 2.2 reports summary measures for the market/book ratio, current dividend yield, forward *ROE*, and implicit growth (that is, Equation C2.3) for the 75 portfolios I investigate.  $M/B1$ ,  $M/B2$ ,  $M/B3$  are median market/book ratios,  $dy1$ ,  $dy2$ ,  $dy3$  are median current dividend yields. In each case, the numbering 1, 2, 3 refers to portfolio sets *SGER1*, *SGER2*, and *SGER3*, respectively. Denote by  $\overline{ROE}_{b,k}^j$ , the median forward *ROE* for book/market quintile  $b=1,2,3,4,5$ , for *SGER* portfolio  $k=1,2,3,4,5$ , and for *SGER* measures  $j=1,2,3$ . Denote by  $\overline{g}_{b,k}^j$ , the median implicit growth (Equation B2.8) for book/market quintile  $b=1,2,3,4,5$ , for *SGER* portfolio  $k=1,2,3,4,5$ , and for *SGER* measure  $j=1,2,3$ .

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<sup>9</sup> SIC codes 2000-2999 are simple manufacturers, like, food products and textiles; 3000-3999 are manufacturers with more complex production processes, like, electronics, automobiles, and aircraft; 4000-4999 are transportation and telecommunications industries; 5000-5999 are retailers and wholesalers; 6000-6999 are financial firms.

For low book/market growth stocks ( $b=1$ ) in Table 2.2, the market/book ratio is, of course, high. Market/book is high for growth stocks because forward  $ROE$  and implicit growth are high. For high book/market value stocks ( $b=5$ ), market/book is, of course, low. Market/Book is low because forward  $ROE$  and implicit growth are low for value stocks. Within any book/market quintile,  $b=1,2,3,4,5$ , both forward  $ROE$ ,  $\overline{ROE}_{b,k}^j$ , and implicit growth,  $\overline{g}_{b,k}^j$ , increase from low  $SGER$  portfolios to high  $SGER$  portfolios,  $k=1,2,3,4,5$ .<sup>10</sup> For either growth stocks ( $b=1$ ) at the top of Table 2.2 or for value stocks ( $b=5$ ) at the bottom of Table 2.2, market/book tends to increase with  $SGER$  from the low  $SGER$  portfolio ( $k=1$ ) to the high  $SGER$  portfolio ( $k=5$ ). The reason for this increase is that  $SGER$  increases with forward  $ROE$  and more profitable firms have greater market/book ratios.

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<sup>10</sup> Empirical evidence in Table 2.2 shows a positive correlation between forward  $ROE$  and  $SGER$  within any book/market quintile. An interesting question is why I do not sort firms by  $ROE$  or another profitability measure like, for example, earnings yield,  $E/P$  rather than  $SGER$ . There are three answers to this question. First, I identify this positive relation only as the result of producing Table 2.2. This positive relation need not exist a priori. Figure 2.1 and Figure 2.2 in Section 2.2 shows that  $ROE$  and  $SGER$  can relate negatively. Second, Blazenko and Pavlov's (2009) dynamic equity valuation model suggests  $SGER$  as an important component of equity returns rather than an alternative measure (see, Equation 2.1). Third, while my primary purpose in this Chapter is to test the limits-to-growth hypothesis for equity returns, I also have an interest in  $SGER$  for its potential in cost of capital determination.  $SGER$  in Table 2.2 is a start to this analysis.

**Table 2.2 Portfolio Characteristics**

book/market Quintile	SGER Quintile	Market/Book			Current Dividend Yield			Forward ROE			Implicit Growth		
		M/B1	M/B2	M/B3	dy1	dy2	dy3	$\overline{ROE}_{b,k}^1$	$\overline{ROE}_{b,k}^2$	$\overline{ROE}_{b,k}^3$	$\overline{g}_{b,k}^{-1}$	$\overline{g}_{b,k}^{-2}$	$\overline{g}_{b,k}^{-3}$
Lowest book/market <i>b</i> = 1 Growth Stocks	Lowest SGER <i>k</i> =1	3.185	3.130	3.337	0.024	0.025	0.023	0.156	0.186	0.210	0.079	0.106	0.131
	<i>k</i> =2	3.188	3.181	3.596	0.018	0.017	0.016	0.184	0.214	0.247	0.121	0.149	0.180
	<i>k</i> =3	3.498	3.540	4.179	0.014	0.014	0.014	0.205	0.238	0.286	0.147	0.179	0.215
	<i>k</i> =4	3.979	4.026	4.890	0.014	0.013	0.013	0.238	0.281	0.348	0.175	0.214	0.263
	Highest SGER <i>k</i> =5	5.614	5.824	7.441	0.012	0.012	0.012	0.350	0.415	0.546	0.248	0.303	0.387
<i>b</i> = 2	Lowest SGER <i>k</i> =1	2.052	2.036	2.224	0.027	0.027	0.026	0.109	0.134	0.141	0.053	0.076	0.079
	<i>k</i> =2	2.083	2.067	2.263	0.023	0.023	0.021	0.139	0.160	0.172	0.088	0.106	0.119
	<i>k</i> =3	2.109	2.104	2.285	0.022	0.022	0.019	0.156	0.177	0.194	0.106	0.127	0.144
	<i>k</i> =4	2.155	2.164	2.361	0.021	0.019	0.018	0.172	0.196	0.218	0.124	0.148	0.169
	Highest SGER <i>k</i> =5	2.232	2.257	2.362	0.017	0.017	0.016	0.207	0.236	0.263	0.160	0.188	0.213
<i>b</i> = 3	Lowest SGER <i>k</i> =1	1.513	1.501	1.630	0.032	0.035	0.034	0.086	0.107	0.112	0.034	0.052	0.053
	<i>k</i> =2	1.507	1.507	1.652	0.029	0.029	0.027	0.114	0.131	0.139	0.068	0.085	0.090
	<i>k</i> =3	1.532	1.537	1.693	0.028	0.027	0.025	0.130	0.147	0.159	0.085	0.101	0.115
	<i>k</i> =4	1.542	1.539	1.693	0.027	0.027	0.023	0.147	0.164	0.181	0.101	0.120	0.140
	Highest SGER <i>k</i> =5	1.554	1.569	1.714	0.026	0.025	0.019	0.175	0.193	0.217	0.132	0.151	0.178
<i>b</i> = 4	Lowest SGER <i>k</i> =1	1.157	1.153	1.218	0.034	0.040	0.044	0.068	0.085	0.089	0.024	0.035	0.031
	<i>k</i> =2	1.158	1.152	1.231	0.039	0.038	0.039	0.091	0.103	0.106	0.046	0.059	0.057
	<i>k</i> =3	1.165	1.170	1.260	0.035	0.033	0.028	0.105	0.119	0.125	0.065	0.079	0.088
	<i>k</i> =4	1.194	1.194	1.295	0.032	0.030	0.025	0.123	0.137	0.147	0.083	0.098	0.111
	Highest SGER <i>k</i> =5	1.204	1.212	1.290	0.030	0.030	0.023	0.151	0.166	0.185	0.111	0.127	0.150
Highest book/market <i>b</i> = 5 Value Stocks	Lowest SGER <i>k</i> =1	0.743	0.705	0.783	0.027	0.028	0.033	0.037	0.052	0.059	0.014	0.029	0.026
	<i>k</i> =2	0.828	0.844	0.912	0.036	0.044	0.044	0.064	0.075	0.080	0.035	0.040	0.035
	<i>k</i> =3	0.862	0.856	0.890	0.051	0.052	0.050	0.078	0.086	0.089	0.040	0.049	0.051
	<i>k</i> =4	0.858	0.846	0.903	0.055	0.046	0.041	0.093	0.102	0.107	0.054	0.067	0.074
	Highest SGER <i>k</i> =5	0.863	0.872	0.937	0.043	0.039	0.029	0.116	0.129	0.139	0.082	0.096	0.110

Notes:  $M / B_{i,t,b,k}$ ,  $dy_{i,t,b,k}$ ,  $\overline{ROE}_{b,k}^j$ , and  $\overline{g}_{b,k}^{-j}$  are Market/Book, current dividend yield, forward ROE, and implicit growth (Equation (C2.3)), for firm  $i=1,2,\dots,N$ , in month  $t=1,2,\dots,TP$ , for portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ , where the 25 portfolios are formed by sorting all firms at a statistical period date by book/market into 5 quintiles and then for each quintile into 5 portfolios by SGER1 ( $j=1$ ), SGER2 ( $j=2$ ), and SGER3 ( $j=3$ ), respectively. TP is 379 months (1/15/1976 to 8/16/2007) for SGER1 and SGER2 and 276 months (9/20/1984 to 8/18/2007) for SGER3. Table 2.2 reports  $median(M / B_{i,t,b,k}, i = 1,2,\dots,N, t = 1,2,\dots,TP)$ ,

$median(dy_{i,t,b,k}, i = 1,2,\dots,N, t = 1,2,\dots,TP)$ ,  $\overline{ROE}_{b,k}^j = median(ROE_{i,t,b,k}, i = 1,2,\dots,N, t = 1,2,\dots,TP)$ , and  $\overline{g}_{b,k}^{-j} = median(g_{i,t,b,k}, i = 1,2,\dots,N, t = 1,2,\dots,TP)$ . The numbering 1, 2, and 3 represents sorting by SGER1 ( $j=1$ ), SGER2 ( $j=2$ ), and SGER3 ( $j=3$ ). My three ROE forecasts are EPS1/BPS, EPS2/BPS, and EPS3/BPS, where the earnings forecasts are at a Statistical Period date and BVE is from the most recently reported quarterly/annual financial statements prior to the Statistical Period date. BPS is book value of equity per share. SGER1, SGER2, and SGER3 represent Equation (2.3) calculated with ROE1, ROE2, and ROE3. EPS1, EPS2, and EPS3 are I/B/E/S consensus analysts EPS forecasts for the first unreported fiscal year, second unreported fiscal year, and third unreported fiscal year at a Statistical Period date.

For any book/market quintile ( $b=1,2,3,4,5$ ) and for any *SGER* portfolio ( $k=1,2,3,4,5$ ), median forward *ROE*,  $\overline{ROE}_{b,k}^j$ , increases for *SGER3* ( $j=3$ ) compared to *SGER2* ( $j=2$ ) compared to *SGER1* ( $j=1$ ) portfolio sets. That is,  $\overline{ROE}_{b,k}^3 > \overline{ROE}_{b,k}^2 > \overline{ROE}_{b,k}^1$ . These  $\overline{ROE}$ s use *EPS* forecasts three, two, and one unreported fiscal years hence, respectively. Because they use the same *BPS* denominator, but there is growth inherent in analysts' annual *EPS* forecasts further out in the future (in the numerator), *ROE* is greater for more distant forecasts.

The dividend yield of value stocks, at the bottom of Table 2.2, exceeds that of growth stocks at the top of Table 2.2. An interpretation of this result is that firms tend to maintain their dividends despite deteriorating financial conditions reflected by low share price and low forward *ROE*.

For the high book/market quintile value stocks ( $b=5$ ) and for each *SGER* ranked portfolio ( $k=1,2,3,4,5$ ) market/book is less than one, but implicit growth  $\overline{g}_{5,k}^{-j}$  is, nonetheless, positive. Growth with market/book less than one is inconsistent with Tobin (1969) and Blazenko and Pavlov (2009). On the other hand, Blazenko and Pavlov (2010) argue that development risk for business investments induces corporate growth even when market/book is less than one.

### 2.3.4 Realized Versus Expected Returns

I measure portfolio returns from a Statistical Period date, where I form a portfolio, to the following Statistical Period date, which is approximately a month later. Because I use book/market and *SGER* to rebalance portfolios at each Statistical Period date and measure portfolio returns for the following statistical period, my empirical results are out-

of-sample. Because Statistical Period dates are mid-month rather than month-end, I cannot use *CRSP* monthly returns. Instead, for firm  $i=1,2,\dots,N$ , in portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$  for Statistical Period month  $t=1,2,\dots,TP$ , where  $TP$  is the number of months in my test period,<sup>11</sup> I calculate return as the change in closing share price between Statistical Period dates plus dividends 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  $t=1,2,\dots,TP$ , for firm  $i=1,2,\dots,N$ , in portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ , between Statistical Period dates, is,

$$R_{i,t,b,k} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{i,b,k} \quad (4)$$

where  $P_t$  and  $P_{t+1}$  are closing share prices<sup>12</sup> on Statistical Period date  $t$  and  $t+1$ , and  $D_{t+1}$  is the dividend per share that has an ex-date between Statistical Period Dates  $t$  and  $t+1$ .

The equally weighted portfolio return<sup>13</sup> in month  $t$  is  $R_{t,b,k} = \frac{1}{N} \sum_{i=1}^N R_{i,t,b,k}$ . Because *SGER*

is an annual measure, I annualize realized monthly portfolio returns for comparison

purposes. Annualized portfolio return over my test period is  $\bar{R}_{b,k} = \frac{12}{TP} \sum_{t=1}^{TP} R_{t,b,k}$ .

<sup>11</sup>  $TP$  is 379 for portfolio sets *SGER1* and *SGER2* and 276 for portfolio set *SGER3*.

<sup>12</sup> If a stock is delisted during statistical period month  $t$  or closing share price is missing on the Statistical Period date  $t+1$ , I use the *CRSP* delisting price (if available) or last trading price in the statistical period month  $t$  as  $P_{t+1}$ . If closing share price is missing on the Statistical Period date  $t$ , I use the next opening price (if available from *CRSP*) or the first closing price in the statistical period month  $t$ . 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 (2.4), I also calculated returns for individual companies between Statistical Period dates by compounding *CRSP* daily returns. Results in this Chapter with this return methodology are qualitatively similar (not reported).

<sup>13</sup> Portfolio results in Table 2.3 are qualitatively the same with value-weighted returns. Abnormal return results in Table 2.5 are qualitatively similar, but weaker (results not reported). Of course, in the “market portfolio,” weights are value-weighted. Since individual investors need not and are unlikely to value weight their portfolios, I report portfolios results in this Chapter with equally weighted returns.

**Table 2.3 Realized Portfolio Returns, Expected Portfolio Returns, and Realized Minus Expected Portfolio Returns**

Book/Market Quintile	SGER Quintile	Average Portfolio Returns			Expected Portfolio Returns			Realized less Expected Returns		
		$\overline{R}_{b,k}^1$	$\overline{R}_{b,k}^2$	$\overline{R}_{b,k}^3$	$\overline{SGER}_{b,k}^1$	$\overline{SGER}_{b,k}^2$	$\overline{SGER}_{b,k}^3$	$\overline{R}_{b,k}^1 - \overline{SGER}_{b,k}^1$	$\overline{R}_{b,k}^2 - \overline{SGER}_{b,k}^2$	$\overline{R}_{b,k}^3 - \overline{SGER}_{b,k}^3$
Lowest Book/Market <i>b</i> =1 Growth Stocks	Lowest SGER <i>k</i> =1	0.092	0.084	0.108	0.083	0.115	0.142	0.008	-0.031	-0.034
	<i>k</i> =2	0.113	0.112	0.136	0.142	0.171	0.200	-0.029	-0.059	-0.064
	<i>k</i> =3	0.145	0.141	0.134	0.166	0.198	0.236	-0.021	-0.057	-0.102
	<i>k</i> =4	0.157	0.161	0.160	0.196	0.235	0.288	-0.039	-0.074	-0.128
	Highest SGER <i>k</i> =5	0.172	0.168	0.146	0.320	0.384	0.509	-0.148	-0.215	-0.363
<i>b</i> =2	Lowest SGER <i>k</i> =1	0.098	0.088	0.102	0.072	0.095	0.099	0.026	-0.007	0.003
	<i>k</i> =2	0.110	0.111	0.159	0.114	0.135	0.144	-0.004	-0.023	0.015
	<i>k</i> =3	0.143	0.140	0.165	0.131	0.153	0.167	0.011	-0.013	-0.002
	<i>k</i> =4	0.171	0.174	0.125	0.150	0.173	0.192	0.022	0.002	-0.067
	Highest SGER <i>k</i> =5	0.202	0.202	0.178	0.194	0.222	0.251	0.008	-0.020	-0.073
<i>b</i> =3	Lowest SGER <i>k</i> =1	0.106	0.096	0.125	0.066	0.085	0.084	0.040	0.012	0.041
	<i>k</i> =2	0.122	0.132	0.101	0.100	0.117	0.120	0.022	0.015	-0.019
	<i>k</i> =3	0.166	0.172	0.167	0.117	0.134	0.143	0.049	0.038	0.025
	<i>k</i> =4	0.200	0.201	0.196	0.133	0.151	0.166	0.067	0.049	0.030
	Highest SGER <i>k</i> =5	0.240	0.234	0.179	0.171	0.190	0.219	0.069	0.043	-0.040
<i>b</i> =4	Lowest SGER <i>k</i> =1	0.102	0.108	0.106	0.060	0.077	0.073	0.042	0.031	0.032
	<i>k</i> =2	0.141	0.136	0.148	0.089	0.102	0.099	0.052	0.034	0.048
	<i>k</i> =3	0.163	0.174	0.175	0.104	0.117	0.117	0.059	0.057	0.058
	<i>k</i> =4	0.215	0.212	0.183	0.120	0.135	0.140	0.095	0.078	0.043
	Highest SGER <i>k</i> =5	0.262	0.254	0.192	0.155	0.170	0.191	0.108	0.083	0.000
Highest Book/Market <i>b</i> =5 Value Stocks	Lowest SGER <i>k</i> =1	0.144	0.139	0.127	0.047	0.062	0.062	0.097	0.077	0.065
	<i>k</i> =2	0.185	0.182	0.146	0.076	0.088	0.086	0.109	0.094	0.060
	<i>k</i> =3	0.199	0.195	0.172	0.090	0.100	0.098	0.108	0.095	0.074
	<i>k</i> =4	0.239	0.237	0.180	0.104	0.115	0.114	0.135	0.122	0.066
	Highest SGER <i>k</i> =5	0.270	0.270	0.247	0.137	0.147	0.155	0.133	0.123	0.092
Average over 25 portfolios								0.041	0.018	-0.010

Notes: I measure portfolio returns from a Statistical Period date, where I form a portfolio, to the following Statistical Period date. Monthly return between Statistical Period dates, is,  $R_{t,b,k}^j = \frac{1}{N} \sum_{i=1}^N R_{i,t,b,k}^j = \sum_{i=1}^N \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{i,t,b,k}^j$ , where  $P_t$  and  $P_{t+1}$  are the share prices on Statistical Period Date  $t$  and  $t+1$ ,  $D_{t+1}$  is the dividends with ex-date between the Statistical Period Dates:  $t$  and  $t+1$ . Annualized mean portfolio return is  $\overline{R}_{b,k}^j = \frac{12}{TP} \sum_{t=1}^{TP} R_{i,t,b,k}^j$ , where TP is the number of months in the test period. Annual portfolio expected return is  $\overline{SGER}_{b,k}^j = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N SGER_{i,t,b,k}^j \right)$ , where  $SGER_{i,t,b,k}^j$  is SGER for firm  $i=1,2,\dots,N$ , month  $t=1,2,\dots, TP$ , in portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ . Table 2.3 reports returns, expected returns, and their difference,  $\overline{R}_{b,k}^j - \overline{SGER}_{b,k}^j$ , for 25 book/market and SGER portfolios formed with the expected returns SGER1 ( $j=1$ ), SGER2 ( $j=2$ ), and SGER3( $j=3$ ), respectively. See notes to Table 2.1 for the SGER1, SGER2, and SGER3 calculations.

Denote  $SGER$  for firm  $i=1,2,\dots,N$ , in portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ , for month  $t=1,2,\dots,TP$ , as  $SGER_{i,t,b,k}$ . Mean  $SGER$  for portfolio  $k$  is,

$$\overline{SGER}_{b,k} = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N SGER_{i,t,b,k} \right)$$

Table 2.3 reports these returns, expected returns, and their difference,

$\overline{R}_{b,k}^j - \overline{SGER}_{b,k}^j$ , for portfolio sets  $SGER1$ ,  $SGER2$ , and  $SGER3$  ( $j=1,2,3$ , respectively).

Within each of the five book/market quintiles, realized annual average portfolio returns,  $\overline{R}_{b,k}$ , increase from the low  $SGER$  portfolio ( $k=1$ ) to the high  $SGER$  portfolio ( $k=5$ ). This increase is monotonic for  $SGER1$  ( $j=1$ ) and  $SGER2$  ( $j=2$ ) portfolios and almost monotonic for the  $SGER3$  ( $j=3$ ) portfolios. Even for the  $SGER3$  portfolio, the high  $SGER$  portfolio ( $k=5$ ), always has a greater average realized return than the low  $SGER$  portfolio ( $k=1$ ). Realized returns strongly follow  $SGER$ , which gives me confidence that, despite the crudeness of my application, there is economic content to  $SGER$ .

There is a literature that either calculates or estimates expected return from share prices and an equity valuation model.<sup>14</sup> The purpose of these implicit expected returns is for the weighted average cost of capital and corporate capital budgeting or for corporate performance evaluation and value based management with financial measures like residual income or  $EVA$ <sup>®</sup>.<sup>15</sup> This objective requires that an expected equity return proxy

<sup>14</sup> See, for example, Easton (2004, 2006), Easton, Taylor, Shroff, and Sougannis (2002), Gebhardt, Lee, Swaminathan (2001), and Gode and Mohanram (2003). These equity valuation models often use an explicit forecast period/terminal value approach. The length of the explicit forecast period is arbitrary and is unlikely to be appropriate for all firms. However, results are not sensitive to the length of explicit forecast period that these authors use. This result suggests that even with static modeling, the assumption of constant growth indefinitely is likely sufficient. Blazenko and Pavlov's (2009) equity valuation model that I use in the current Chapter is a dynamic rather than a static two stage growth model.

<sup>15</sup> Residual income is accounting earnings less book equity times the required equity return.  $EVA$  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).



be unbiased, and therefore, this literature often compares these measures against average realized equity returns. Because this standard is rather demanding, in a study of seven expected return proxies, Easton and Monahan (2005) find that in the entire cross-section of firms, these proxies are unreliable and none has a positive association with realized returns. My analysis in the current Chapter suggests the reason for this result. These implicit expected returns are determined by discounting a financial measure related to profitability to share price. So, they are positively related to profitability. In the entire cross-section of firms, high profitability firms are growth firms with low returns. Thus, because of the value premium, these implicit expected returns relate negatively with realized returns. Alternatively, if these studies were to first sort firms into portfolios by book/market, then they would find that implicit returns relate positively with realized returns within each book/market sorting. These “conditional” implicit returns would undoubtedly be more useful for corporate finance purposes than the unconditional implicit returns that Easton and Monahan (2005) find are unreliable. For example, *SGER* that I study relates positively with realized returns within book/market quintiles.

There are differences between growth and value stocks in *SGER*'s representation of realized returns. For growth stocks at the top of Table 2.3, *SGER* tends to overstate realized returns. *SGER* is especially high for book/market quintile  $b=1$  with growth forecasts that are unlikely sustainable indefinitely. On the flip side, *SGER* is low compared to realized returns for value stocks in book/market quintile  $b=5$ . Because *ROE* is low, growth prospects, as measured by implicit growth, are low. These observations suggest that forward accounting *ROE*, calculated with analysts' forecasts of future *EPS*, understates economic *ROE* for value stocks and overstates economic *ROE* for growth

stocks. Possibly, economic *ROE* follows a mean-reverting process (Fama and French, 2000) rather than the random walk that I presumed in my dynamic equity valuation model represented by Equation (2.1). In Chapter 5, I investigate whether reversion in profitability reconciles the value-versus-growth bias for *SGER* in Table 2.3. I compare several *ROE* forecasts adjusted for profitability-reversion using both historical and analysts' earnings estimates. Nonetheless, *SGER* continues to overstate realized returns for growth stocks and understates realized returns for value stocks. On the other hand, regressions of realized returns on profitability, *ROE*, for value versus growth stocks are a conditional reduced-form version of the dynamic equity valuation model that I develop in Section 2.2. I call return forecasts from these regressions "dynamic growth expected returns," *DGER*. I show that, in large part, *DGER* eliminates the value-versus-growth bias. However, this result does not mean that *DGER* is always preferable to *SGER* for all applications. In Chapter 5, I find that mean squared forecast errors (squared differences between realized returns and either *SGER* or *DGER*) for individual stocks are lesser for *SGER* than for *DGER*. *DGER* removes the value-versus-growth bias but is subject to estimation risk that *SGER* does not have.

## 2.4 Profitability, Growth, and the Value Premium

### 2.4.1 The Value Premium

In this section, I investigate return differences between growth and value firms. The dynamic model in section 2.2 indicates that as profitability ( $ROE$ ) increases, risk can either increase or decrease. Low profitability firms (value firms in the left-most section of Figure 2.1) are at risk of suspending growth. Increasing profitability increases the likelihood of incurring ongoing growth-leverage which increases risk and expected return. On the other hand, profitability ( $ROE$ ) reduces risk for high profitability firms (the right-most section of Figure 2.1). For these firms (growth firms), high profitability covers the costs of growth which reduces growth-leverage risk and decreases expected return. Consequently, growth firms have low expected returns,  $\omega(ROE)$ . Greater return for value compared to growth firms is the value premium. The dynamic model is consistent with a value premium, but it does not guarantee a value premium. For example, if profitability,  $ROE$ , of both value and growth firms is lower than depicted in Figure 2.1, then because the return to value stocks decreases, but the return to growth stocks increases, then the value premium falls and can even reverse and become negative.

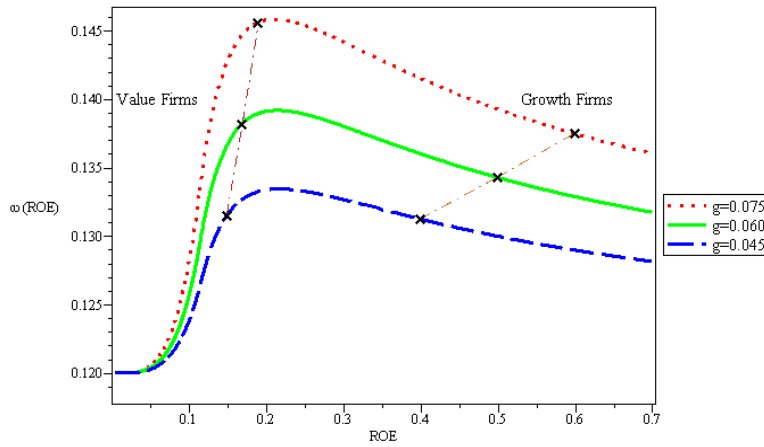
In Table 2.3, value firms (low market/book) have high realized average returns compared to growth firms (high market/book). For  $SGER$  measures  $j=1,2,3$  average portfolio returns are lower for growth compared to value firms,  $\bar{R}_{5,k}^j > \bar{R}_{1,k}^j$   $j=1,2,3$  and  $k=1,2,3,4,5$  (low  $SGER$  to high  $SGER$ ). This value premium is consistent with higher profitability,  $ROE$ , for growth stocks compared to value stocks. In Table 2.2, for  $SGER$  measures  $j=1,2,3$  median forward  $ROEs$  are higher for growth compared to value firms,

$\overline{ROE}_{5,k}^j > \overline{ROE}_{1,k}^j$   $j=1,2,3$  and  $k=1,2,3,4,5$  (low *SGER* to high *SGER*). Profitability measured by forward *ROE* is greater for growth than value firms.

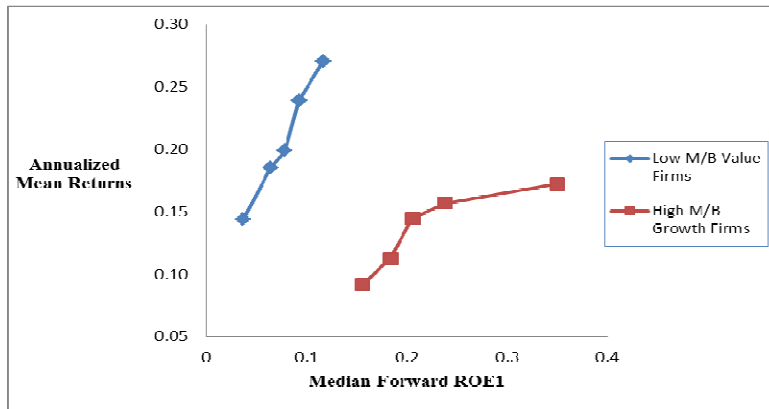
## 2.4.2 Profitability, Growth, and the Value Premium

The discussion above indicates that as profitability (*ROE*) increases, risk can either increase or decrease. It increases for value stocks but it decreases for growth stocks. However, for value and growth stocks separately (that is, within a book/market quintile), profitability increases return. In Table 2.2, for each of the *SGER* measures  $j=1,2,3$ , within any book/market quintile  $b=1,2,3,4,5$ , median forward *ROE* ( $\overline{ROE}_{b,k}^j$ ) increases with respect to *SGER* portfolio  $k=1,2,3,4,5$  (low *SGER* to high *SGER*). In addition, in Table 2.3, for each of the *SGER* measures  $j=1,2,3$ , within any book/market quintile  $b=1,2,3,4,5$ , realized average portfolio returns  $\overline{R}_{b,k}^j$  increase with respect to *SGER* portfolios  $k=1,2,3,4,5$ , (low *SGER* to high *SGER*). Panel B of Figure 2.3 plots this relation between return,  $\overline{R}_{b,k}^j$ ,  $k=1,2,3,4,5$ , and profitability,  $\overline{ROE}_{b,k}^j$ ,  $k=1,2,3,4,5$ , for growth ( $b=1$ ) and value stocks ( $b=5$ ) for portfolios sorted by *SGER*,  $j=1$ . For both value ( $b=5$ ) and growth ( $b=1$ ) portfolios, return increases with profitability. That is,  $\overline{R}_{5,k}^1$  increases with  $\overline{ROE}_{5,k}^1$ ,  $k=1,2,3,4,5$  and  $\overline{R}_{1,k}^1$  increases with  $\overline{ROE}_{1,k}^1$ ,  $k=1,2,3,4,5$ .

**Figure 2.3 Profitability, Growth, and the Value Premium**  
**Panel A**



**Panel B**



*Notes:* Figure 2.3 Panel A plots expected return,  $\omega(ROE)$ , versus profitability,  $ROE$ , for different earnings growth rates,  $g=0.075$ ,  $g=0.06$ ,  $g=0.045$  (with earnings volatility  $\sigma=0.2$  and expected return for a hypothetical firm that permanently does not grow  $r^*=0.12$ ). Panel B plots the relation between annualized mean return,  $\bar{R}_{b,k}^1$ ,  $k=1,2,3,4,5$ , from Table 2.3, and median profitability,  $\overline{ROE}_{b,k}^1$ ,  $k=1,2,3,4,5$ , from Table 2.2, for growth ( $b=1$ ) and value stocks ( $b=5$ ) for portfolios sorted by *SGERI*.

For value and growth stocks separately (that is, within a book/market quintile), there are two forces that impact returns as profitability  $ROE$  increases with the result that returns increase with profitability. First, in the dynamic model, holding maximum growth,  $g$ , constant, profitability,  $ROE$ , can either increase or decrease risk as represented

in Figure 2.1. Profitability,  $ROE$ , increases risk for value stocks, but profitability decreases risk for growth stocks. Second, there is evidence in Table 2.2, that profitability increases growth. In Table 2.2, for each of the  $SGER$  measures  $j=1,2,3$ , within any book/market quintile  $b=1,2,3,4,5$ , median forward  $ROE$  ( $\overline{ROE}_{b,k}^j$ ) increases and also implicit growth,  $\overline{g}_{b,k}^j$ , increases with respect to  $SGER$  portfolio  $k=1,2,3,4,5$  (low  $SGER$  to high  $SGER$ ). If firms are financially constrained (Froot, Scharfstein, and Stein, 1993), increasing profitability increases the ability of the firm to finance growth internally when they cannot finance externally which increases the maximum growth rate,  $g$ .

Panel A of Figure 2.3 plots expected return,  $\omega(ROE)$ , with respect to profitability,  $ROE$ , for different growth rates,  $g$ . For value firms (low market to book and low profitability), profitability,  $ROE$ , increases risk and expected return,  $\omega(ROE)$ , holding growth,  $g$ , constant (that is, on any one of the curves,  $g=0.045$ ,  $g=0.06$ , or  $g=0.07$ ). On the other hand, profitability increases growth, which Panel A of Figure 2.3 depicts as shifting upward to a higher growth curve. Higher growth,  $g$ , increases growth-leverage risk for any level of profitability,  $ROE$ , which increases expected return,  $\omega(ROE)$ . For value firms, these two forces work together to increase expected return,  $\omega(ROE)$ . Because these two forces work together to increase return with profitability, the relationship depicted for value firms at the left most section of Panel A of Figure 2.3 between expected return,  $\omega(ROE)$ , and profitability,  $ROE$ , is steep compared to growth firms at the right most section. Empirically, Panel B of Figure 2.3 depicts this pronounced relation between returns and profitability for value portfolios in the left most curve.

For growth firms (high market to book and high profitability), profitability,  $ROE$ , decreases risk and expected return,  $\omega(ROE)$ , holding growth,  $g$ , constant (that is, on any one of the curves,  $g=0.045$ ,  $g=0.06$ , or  $g=0.075$ ) in Panel A of Figure 2.3. On the other hand, profitability increases growth, which Panel A of Figure 2.3 depicts as shifting upward to a higher growth curve, which increases expected return,  $\omega(ROE)$ . For growth firms, these two forces work in opposite directions and therefore, either effect might dominate. Profitability,  $ROE$ , might either increase or decrease returns,  $\omega(ROE)$ , for growth firms. However, because these two forces work in opposite directions, regardless of whether it is positive or negative, I expect the relation between returns and profitability to be lesser for growth stocks compared to value stocks.

In Panel B of Figure 2.3, the empirical relation between returns and profitability is positive, but less steep for growth compared to value stocks. That is, the relation between  $\overline{R}_{1,k}^{-1}$  and  $\overline{ROE}_{1,k}^{-1}$ ,  $k=1,2,3,4,5$  is weaker than is the relation between  $\overline{R}_{5,k}^{-1}$  and  $\overline{ROE}_{5,k}^{-1}$ ,  $k=1,2,3,4,5$ . Novy-Marx (2010) finds the opposite result. He finds that the relation between returns and profitability is stronger for growth stocks than for value stocks. The difference between my results and his is that I focus on dividend paying stocks for which the limits-to-growth hypothesis is most appropriate. Novy-Marx investigates the entire cross-section of firms, including non-dividend paying firms for which the relation between returns and profitability is strongly positive (see, Chapter 3 of this dissertation).

**Table 2.4 Fama-MacBeth Regressions of Return on Profitability, ROE**

$$R_{i,t,b} = \gamma_{0,t,b} + \gamma_{1,t,b} ROE_{i,t,b}^j + u_{t,b} \quad i=1,2,\dots,N$$

Book To Market Quintile	$TP$	$\bar{\gamma}_{0,b}$	$SE(\bar{\gamma}_{0,b})$	$\bar{\gamma}_{1,b}$	$SE(\bar{\gamma}_{1,b})$	t-Statistic for $\bar{\gamma}_{1,5} - \bar{\gamma}_{1,1}$
ROE1 (Forward ROE One Unreported Fiscal Year Hence)						
Growth $b=1$	379	0.0095	0.0025	0.0085	0.0029	6.17
$b=2$	379	0.0010	0.0024	0.0704	0.0102	
$b=3$	379	0.0012	0.0024	0.0974	0.0127	
$b=4$	379	-0.0003	0.0021	0.1373	0.0147	
Value $b=5$	379	0.0091	0.0024	0.1052	0.0154	
ROE2 (Forward ROE Two Unreported Fiscal Years Hence)						
Growth $b=1$	379	0.0088	0.0024	0.0095	0.0026	6.16
$b=2$	379	-0.0010	0.0024	0.0724	0.0107	
$b=3$	379	-0.0014	0.0024	0.1035	0.0144	
$b=4$	379	-0.0005	0.0021	0.1237	0.0179	
Value $b=5$	379	0.0064	0.0023	0.1183	0.0175	
ROE3 (Forward ROE Three Unreported Fiscal Years Hence)						
Growth $b=1$	276	0.0116	0.0027	-0.0003	0.0030	3.41
$b=2$	276	0.0060	0.0036	0.0320	0.0159	
$b=3$	276	0.0039	0.0033	0.0560	0.0206	
$b=4$	276	0.0034	0.0034	0.0810	0.0270	
Value $b=5$	276	0.0048	0.0032	0.1065	0.0311	

*Notes:* Table 2.4 reports the parameter estimates from Fama-MacBeth (1973) cross-sectional regression of return on profitability, ROE. In each statistical period,  $t=1,2,\dots,TP$ , and for each book/market quintile,  $b=1,2,3,4,5$ , I estimate a cross sectional regression of monthly stock return on forward ROE (separately for ROE1, ROE2, and ROE3),  $R_{i,t,b} = \gamma_{0,t,b} + \gamma_{1,t,b} ROE_{i,t,b}^j + u_{t,b}$ . The dependent variable,  $R_{i,t,b}$ , is the monthly return for firm  $i$  in book/market quintile  $b$  for statistical month  $t$ . The independent variable  $ROE_{i,t,b}^j$  is the forward ROE, for firm  $i=1,2,\dots,N$ , for  $j=1,2,3$  as yet unreported fiscal years hence, in book/market quintile  $b=1,2,3,4,5$ , at the beginning of statistical period  $t=1,2,\dots,TP$ . The terms  $\bar{\gamma}_{0,b}$  and S.E. ( $\bar{\gamma}_{0,b}$ ) are average and standard error of intercept estimates,  $\gamma_{0,t,b}$ , and  $\bar{\gamma}_{1,b}$  and S.E. ( $\bar{\gamma}_{1,b}$ ) are average and standard error of slope estimates,  $\gamma_{1,t,b}$ , over 379 statistical periods for ROE1 and ROE2 and 276 statistical periods for ROE3 profitability measures. ROE1, ROE2, and ROE3 use I/B/E/S consensus analysts EPS forecasts (EPS1, EPS2, and EPS3) for the first, second, and third unreported fiscal year at a Statistical Period date. The t-statistic tests for difference in slopes,  $\bar{\gamma}_{1,5} - \bar{\gamma}_{1,1}$ , between value ( $b=5$ ) and growth ( $b=1$ ) stocks.



### 2.4.3 Returns Versus Profitability In-The-Small

Panel B of Figure 2.3 is a plot of summary statistics without formal statistical testing. Table 2.4 gives formal statistical results in the regression of stock returns on profitability,  $ROE$ . In each statistical period,  $t$ , I estimate a cross sectional regression of monthly stock returns on forward  $ROE$  (separately for  $ROE1$ ,  $ROE2$ , and  $ROE3$ ) for stocks in each market/book quintile,  $b=1,2,3,4,5$ . Forward  $ROE$  is at a statistical period date  $t$  and monthly return is for the following statistical period month. Because there are 5 book/market quintiles and  $TP$  statistical period months, there are  $b \times TP$  cross-sectional regressions for each of the regressions that use  $ROE1$ ,  $ROE2$ , and  $ROE3$  as the profitability measure,

$$R_{i,t,b} = \gamma_{0,t,b} + \gamma_{1,t,b} ROE_{i,t,b}^j + u_{t,b}, \quad i=1,2,\dots,N$$

The dependent variable,  $R_{i,t,b}$ , is the monthly return for firm  $i$  in book/market quintile  $b$  for statistical month  $t$ . The independent variable  $ROE_{i,t,b}^j$  is the forward  $ROE$ , for firm  $i=1,2,\dots,N$ , for  $j=1,2,3$  as yet unreported fiscal years hence, in book/market quintile  $b=1,2,3,4,5$ , at the beginning of statistical period  $t=1,2,\dots,TP$ . The terms  $\gamma_{0,t,b}$  and  $\gamma_{1,t,b}$  are intercept and slope coefficients.

For each book/market quintile ( $b=1,2,3,4,5$ ), Table 2.4 reports the temporal average (over the  $TP$  statistical period months) of cross-sectional estimated slope

coefficients,  $\bar{\gamma}_{1,b}$  in the Fama-MacBeth (1973) regression<sup>16</sup> of return on *ROE*. Generally, the slope,  $\bar{\gamma}_{1,b}$ , increases monotonically with book/market (from growth to value,  $b=1,2,3,4,5$ ) for each of the profitability measures *ROE1*, *ROE2*, and *ROE3*. All of the slopes,  $\bar{\gamma}_{1,b}$ , are positive with the exception of growth stocks ( $b=1$ ) with *ROE3* as the profitability measure. Holding book/market constant, the relation between returns and profitability is positive. The slope for value stocks ( $b=5$ ),  $\bar{\gamma}_{1,5}$ , is greater than for growth stocks ( $b=1$ ),  $\bar{\gamma}_{1,1}$ , for each of the profitability measures *ROE1*, *ROE2*, and *ROE3*. Statistical tests for slope differences between growth stocks ( $b=1$ ) and value stocks ( $b=5$ ),  $\bar{\gamma}_{1,5} - \bar{\gamma}_{1,1}$ , are all strongly significant for each of the profitability measures *ROE1*, *ROE2*, and *ROE3*. These results are consistent with the dynamic model and my discussion of Panel A of Figure 2.3. The relation between returns and profitability is stronger for value stocks than it is for growth stocks.

## 2.5 Do Investors Recognize the Relation Between Returns and Profitability in-the-Small?

*SGER* in Equation (2.3) is not inconsistent with the standard view that expected return is a riskless rate plus a risk premium. The riskless rate and the risk premium are implicit rather than explicit in *SGER*. They impact price, which determines market/book,  $\pi$ , in Equation (A2.1), and the dividend yield,  $dy$ , but not *SGER* in Equation (2.3) directly.

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<sup>16</sup> Rather than Fama-MacBeth regressions, results are qualitatively similar (not reported) using panel regression with standard errors clustered by statistical period. Analysis suggests a stronger time effect than a firm effect. When panel data have only a time effect, Petersen (2008) concludes that Fama-MacBeth regressions produce unbiased test statistics. Thus, I report results in Table 2.4 only for Fama-MacBeth regressions. In addition, rather than estimate the linear cross-sectional relation between profitability, *ROE*, and return, *R*, individually for each of the market/book quintiles  $b=1,2,3,4,5$  at statistical month  $t$ , I also jointly estimated these linear relations at statistical month  $t$  with dummy variables for the intercept and slope coefficients. Results are essentially the same (not reported).

*SGER* requires no statistical estimation of unknown model parameters that creates estimation risk.

All parameters on the right hand side of *SGER* in Equation (2.3) are forward looking. *ROE* is forward looking because it is a forecast. Dividend yield and market/book are forward looking because they use share price. If this impounding is accurate and complete, if I have the correct asset pricing model for benchmarking, and if my *ROE* forecast is no more informative than that of the market, then it should not be possible to earn abnormal returns from investment strategies based on *SGER* in Equation (2.3). This is my null hypothesis for empirical testing that follows.

### **2.5.1 Normal Returns**

The positive association between realized returns and *SGER* in Table 2.3 may be risk compensation and does not assure abnormal returns for investment strategies based on *SGER*. I test for these abnormal returns in this section.

I use a conditional four factor asset pricing model and a conditional three factor model to represent normal returns. 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.<sup>17</sup> Reinganum

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<sup>17</sup> Jaffe, Keim and Westerfield (1989) find that earnings yield explains stock returns beyond a market factor. However, Fama and French (1996) show that this earnings yield effect is subsumed by the book/market factor.

(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 I 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), Eckbo, Masulis, and Norli (2000), and Jegadeesh (2000), I include a momentum factor – the return difference between portfolios of “winners” and “losers.”

Chen, Novy-Marx, and Zhang (2010) represent returns with a market factor, an investment factor, and a profitability factor. The investment factor is the return difference between portfolios of firms with low investment/asset and firms with high investment/asset. The profitability factor is the return difference between portfolios of firms with high return on assets—calculated with reported rather than forecast earnings—and firms with low return on assets. The market factor is the difference between the return on a market portfolio and a risk-free rate. Chen, Novy-Marx, and Zhang (2010) argue that in some circumstances their three factor model summarizes cross-sectional return variation better than Fama and French (1996) and Carhart (1997).

Unconditional asset pricing models, like, Fama and French (1996) and Carhart (1997) or Chen, Novy-Marx, and Zhang (2010), 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

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 my sample period is over 31 years for *SGER1* and *SGER2*, and 23 years for *SGER3*, I 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,<sup>18</sup> I 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). I 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, I create monthly *SMB*, *HML*, *MOM* risk factors, and the market risk premium that I use to benchmark *SGER* portfolios.

I risk-adjust the 25 book/market and *SGER* sorted portfolios with four risk factors in the regression model:

$$R_{b,k,t} - R_{f,t} = \alpha_{b,k} + s_{b,k}SMB_t + h_{b,k}HML_t + m_{b,k}MOM_t + \beta_{b,k}(R_{M,t} - R_{f,t}) + \varepsilon_{b,k}, \quad (2.5)$$

$$\begin{aligned} s_{b,k} &= s_{0,b,k} + s_{1,b,k}DY_{t-1} + s_{2,b,k}R_{f,t} \\ h_{b,k} &= h_{0,b,k} + h_{1,b,k}DY_{t-1} + h_{2,b,k}R_{f,t} \\ m_{b,k} &= m_{0,b,k} + m_{1,m,k}DY_{t-1} + m_{2,b,k}R_{f,t} \\ \beta_{b,k} &= \beta_{0,b,k} + \beta_{1,b,k}DY_{t-1} + \beta_{2,b,k}R_{f,t} \end{aligned} \quad b=1,2,3,4,5, \quad k=1,2,3,4,5, \quad t=1,2,\dots, TP \quad (2.6)$$

<sup>18</sup> [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data\\_Library](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library)

where  $R_{b,k,t}$  denotes the return on portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ , in month  $t = 1,2,\dots,TP$ ,  $R_{f,t}$  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 (2.6) into (2.5) for  $s_{b,k}$ ,  $h_{b,k}$ ,  $m_{b,k}$ , and  $\beta_{b,k}$  yields the conditional Fama-French-Carhart four-factor model. I test my 25 book/market and *SGER* sorted portfolios ( $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ ) on the conditional four-factor model.

Following the methodology in Chen, Novy-Marx, and Zhang (2010), I form six size and investment/asset (INV) portfolios, and six size and return on asset (ROA) portfolios from *CRSP* and *COMPUSTAT* databases. I calculate daily value-weighted portfolio returns and compound daily returns for the six size and investment/asset portfolios and the six size and return on asset portfolios between the *I/B/E/S* statistical period dates (the portfolio rebalance dates). I create the monthly investment factor,  $r_{INV}$ , as the return difference between the low investment and the high investment portfolios, and the monthly profitability factor,  $r_{ROA}$ , the return difference between the high profitability and the low profitability portfolios.

I risk-adjust the 25 book/market and *SGER* sorted portfolios with these three risk factors in the regression model:

$$R_{b,k,t} - R_{f,t} = \alpha_{b,k} + \beta_{b,k} (R_{M,t} - R_{f,t}) + g_{b,k} r_{INVt} + p_{b,k} r_{ROAt} + u_{b,k}, \quad (2.7)$$

$$\begin{aligned} \beta_{b,k} &= \beta_{0,b,k} + \beta_{1,b,k} DY_{t-1} + \beta_{2,b,k} R_{f,t} \\ g_{b,k} &= g_{0,b,k} + g_{1,m,k} DY_{t-1} + g_{2,b,k} R_{f,t} \quad b=1,2,3,4,5, \quad k=1,2,3,4,5, \quad t=1,2,\dots,T \\ p_{b,k} &= p_{0,b,k} + p_{1,b,k} DY_{t-1} + p_{2,b,k} R_{f,t} \end{aligned} \quad (2.8)$$

where  $R_{b,k,t}$  denotes the return on portfolio  $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ , in month  $t = 1,2,\dots,TP$ ,  $R_{f,t}$  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,  $r_{INVt}$  and  $r_{ROAt}$  are the investment and profitability factors in month  $t$ .

Substituting (2.8) into (2.7) for  $\beta_{b,k}$ ,  $g_{b,k}$  and  $p_{b,k}$ , yields the conditional Chen, Novy-Marx, and Zhang three-factor model. I test my 25 book/market and *SGER* sorted portfolios ( $b=1,2,3,4,5$ ,  $k=1,2,3,4,5$ ) on the conditional Chen, Novy-Marx, and Zhang's three-factor model.

## 2.5.2 Null Hypothesis

In this section, I discuss multivariate tests of abnormal returns, the  $\hat{\alpha}$  s, of Equation (2.5) and (2.6) and Equation (2.7) and (2.8). The purpose of the Gibbons, Ross, and Shanken (1989) (GRS) test is to search for pricing errors in an asset pricing model. I use the GRS statistic to test the null hypothesis that the regression intercepts<sup>19</sup> are jointly equal to zero,  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ . The alternative hypothesis is that there is a

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<sup>19</sup> I do this multivariate test across the 5 *SGER* portfolios  $k=1,2,\dots,5$  for each of the 5 book/market quintiles. In order to interpret the  $\hat{\alpha}$  s, of Equation (2.5) and Equation (2.7) as "abnormal returns," the factors have to be traded assets, which they are. Dividend yield on the right-hand-side of Equation (2.6) and Equation (2.8) is not a traded asset. However, dividend yield is used only to represent variation in factor coefficients over time and, thus, need not be a traded asset for this purpose.

missing factor in the asset pricing model. In my sample, the GRS statistic is F distributed with degrees of freedom equal to (5, 362) for *SGER1* ( $j=1$ ) and *SGER2* ( $j=2$ ) portfolios, and (5,259) for *SGER3* ( $j=3$ ) portfolios.

Hansen's J statistic (Hansen 1982) tests the null hypothesis that abnormal returns jointly equal one another<sup>20</sup>,  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha$ , but do not necessarily equal zero. The purpose of Hansen's J test is to identify 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 my case, Hansen's J statistic is  $\chi^2$  distributed with degree of freedom equal to 4 (number of restrictions minus one) for *SGER1* ( $j=1$ ), *SGER2* ( $j=2$ ), and *SGER3* ( $j=3$ ) portfolios.

### 2.5.3 Abnormal Returns

I now turn to abnormal return evidence for the portfolios formed with *SGER1* ( $j=1$ ), *SGER2* ( $j=2$ ), and *SGER3* ( $j=3$ ), in Table 2.5. Panel A reports the abnormal returns from the conditional Fama-French-Carhart four factor asset pricing model. Panel B reports the abnormal returns from the conditional Chen, Novy-Marx, and Zhang three-factor asset pricing model. The evidence is very strong for *SGER1* ( $j=1$ ), and *SGER2* ( $j=2$ ), but weaker for *SGER3* ( $j=3$ ).

I begin with *SGER1* ( $j=1$ ) and *SGER2* ( $j=2$ ) portfolios in Table 2.5. In both Panel A and Panel B, for each book/market quintile,  $\hat{\alpha}$  for lowest *SGER* portfolios ( $k=1$ ) is always negative and statistically significant in Panel A (the conditional Fama-French-

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<sup>20</sup> 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.



Carhart four factor model), generally negative but sometimes insignificant in Panel B (the conditional Chen, Novy-Marx, and Zhang three factor model). On the other hand,  $\hat{\alpha}$  for the highest *SGER* portfolios ( $k=5$ ) is always positive in Panel A (the conditional Fama-French-Carhart four factor model) and statistically significant for high book/market quintiles ( $b=4,5$ ).  $\hat{\alpha}$  for the highest *SGER* portfolios ( $k=5$ ) is almost always positive in Panel B (the conditional Chen, Novy-Marx, and Zhang's three factor model), and is statistically significant for high book/market quintiles ( $b=3,4,5$ ). Further, within book/market quintiles, these alpha estimates,  $\hat{\alpha}$ , increase from most negative or slightly positive for lowest *SGER* portfolio ( $k=1$ ) to positive for highest *SGER* portfolio ( $k=5$ ) for both models.

The statistically significant abnormal returns, the  $\hat{\alpha}$ s, suggest that there is a missing factor in the conditional four factor asset pricing model. For both models, for each book/market quintile, the GRS test rejects the null hypothesis that alphas for the five *SGER* portfolios ( $k=1,2,3,4$ , and 5) jointly equal zero. The rejection of the hypothesis tested by GRS statistic in Panel A (the conditional Fama-French-Carhart four factor model) suggests that there is a missing factor in the Carhart's conditional four factor asset pricing model. The missing factor is possibly related to the two primary determinants of *SGER*: profitability (*ROE*) and growth. Table 2.2 shows that within each book/market quintile,  $b= 1, 2, 3, 4$ , and 5, forward *ROE* and implicit growth increase monotonically with *SGER*. The monotonic relation between *SGER* and pricing errors, the  $\hat{\alpha}$ s, in Table 2.5, and between *SGER*, forward *ROE* and implicit growth in Table 2.2 suggests that profitability (*ROE*), and growth can explain returns beyond the conditional Fama-French-Carhart four factor asset pricing model.

**Table 2.5 Abnormal Returns**

**Panel A: Conditional Fama-French-Carhart Four-Factor Asset Pricing Model**

$$R_{b,k,t} - R_{f,t} = \alpha_{b,k} + s_{b,k}SMB_t + h_{b,k}HML_t + m_{b,k}MOM_t + \beta_{b,k}(R_{M,t} - R_{f,t}) + \varepsilon_{b,k},$$

$$s_{b,k} = s_{0,b,k} + s_{1,b,k}DY_{t-1} + s_{2,b,k}R_{f,t} \quad h_{b,k} = h_{0,b,k} + h_{1,b,k}DY_{t-1} + h_{2,b,k}R_{f,t} \quad m_{b,k} = m_{0,b,k} + m_{1,m,k}DY_{t-1} + m_{2,b,k}R_{f,t} \quad \beta_{b,k} = \beta_{0,b,k} + \beta_{1,b,k}DY_{t-1} + \beta_{2,b,k}R_{f,t}$$

$$b=1,2,3,4,5, \quad k=1,2,3,4,5, \quad t=1,2,\dots, TP$$

Book/Market Quintile	SGER Quintile	SGER1		Hansen's J	GRS	SGER2		Hansen's J	GRS	SGER3		Hansen's J	GRS
		$\alpha$	t( $\alpha$ )	(p-value)	(p-value)	$\alpha$	t( $\alpha$ )	(p-value)	(p-value)	$\alpha$	t( $\alpha$ )	(p-value)	(p-value)
Lowest Book/Market b=1 Growth Stocks	Lowest SGER k=1	<b>-0.0049</b>	<b>-5.66</b>	<b>21.28</b>	<b>7.07</b>	<b>-0.0055</b>	<b>-5.84</b>	<b>28.63</b>	<b>9.49</b>	<b>-0.0042</b>	<b>-3.21</b>	5.72	<b>1.90</b>
	k=2	<b>-0.0032</b>	<b>-3.35</b>	<b>(0.0003)</b>	<b>(0.0000)</b>	<b>-0.0039</b>	<b>-3.65</b>	<b>(0.0000)</b>	<b>(0.0000)</b>	-0.0017	-1.21	(0.2207)	<b>(0.0942)</b>
	k=3	-0.0016	-1.40			-0.0009	-0.88			-0.0010	-0.61		
	k=4	0.0003	0.31			0.0006	0.51			0.0004	0.30		
	Highest SGER k=5	0.0005	0.35			0.0002	0.15			-0.0019	-0.78		
b=2	Lowest SGER k=1	<b>-0.0061</b>	<b>-4.88</b>	<b>17.74</b>	<b>8.89</b>	<b>-0.0064</b>	<b>-5.22</b>	<b>20.37</b>	<b>9.66</b>	-0.0027	-1.09	1.60	0.75
	k=2	<b>-0.0050</b>	<b>-5.07</b>	<b>(0.0014)</b>	<b>(0.0000)</b>	<b>-0.0053</b>	<b>-4.48</b>	<b>(0.0004)</b>	<b>(0.0000)</b>	-0.0021	-1.14	(0.8092)	(0.5904)
	k=3	<b>-0.0029</b>	<b>-2.28</b>			-0.0023	-1.78			-0.0009	-0.53		
	k=4	-0.0013	-0.99			-0.0015	-1.07			-0.0025	-1.41		
	Highest SGER k=5	0.0003	0.18			0.0007	0.48			0.0000	0.00		
b=3	Lowest SGER k=1	<b>-0.0056</b>	<b>-4.39</b>	<b>37.75</b>	<b>12.88</b>	<b>-0.0058</b>	<b>-4.51</b>	<b>24.84</b>	<b>8.74</b>	-0.0018	-0.72	6.47	1.66
	k=2	<b>-0.0056</b>	<b>-5.15</b>	<b>(0.0000)</b>	<b>(0.0000)</b>	<b>-0.0042</b>	<b>-3.63</b>	<b>(0.0001)</b>	<b>(0.0000)</b>	<b>-0.0043</b>	<b>-2.31</b>	(0.1665)	(0.1453)
	k=3	-0.0016	-1.35			-0.0016	-1.31			-0.0023	-1.11		
	k=4	0.0011	0.81			0.0007	0.46			0.0020	0.92		
	Highest SGER k=5	<b>0.0032</b>	<b>2.14</b>			<b>0.0029</b>	<b>1.98</b>			-0.0002	-0.09		
b=4	Lowest SGER k=1	<b>-0.0064</b>	<b>-5.04</b>	<b>32.80</b>	<b>11.41</b>	<b>-0.0053</b>	<b>-4.25</b>	<b>21.32</b>	<b>7.16</b>	-0.0031	-1.26	2.07	0.56
	k=2	<b>-0.0033</b>	<b>-3.05</b>	<b>(0.0000)</b>	<b>(0.0000)</b>	<b>-0.0035</b>	<b>-3.03</b>	<b>(0.0003)</b>	<b>(0.0000)</b>	-0.0005	-0.21	(0.7228)	(0.7296)
	k=3	-0.0016	-1.31			-0.0010	-0.82			0.0005	0.24		
	k=4	0.0023	1.84			0.0011	0.84			0.0005	0.21		
	Highest SGER k=5	<b>0.0040</b>	<b>2.48</b>			<b>0.0033</b>	<b>2.01</b>			0.0008	0.29		
Highest Book/Market b=5 Value Stocks	Lowest SGER k=1	<b>-0.0049</b>	<b>-3.96</b>	<b>22.12</b>	<b>6.86</b>	<b>-0.0046</b>	<b>-3.92</b>	<b>23.94</b>	<b>6.53</b>	-0.0024	-1.07	2.7361	0.52
	k=2	-0.0011	-0.94	<b>(0.0002)</b>	<b>(0.0000)</b>	-0.0013	-1.00	<b>(0.0001)</b>	<b>(0.0000)</b>	-0.0008	-0.36	(0.6029)	(0.7634)
	k=3	0.0008	0.64			0.0004	0.27			-0.0001	-0.02		
	k=4	<b>0.0045</b>	<b>3.09</b>			<b>0.0041</b>	<b>2.95</b>			0.0023	0.82		
	Highest SGER k=5	<b>0.0045</b>	<b>2.49</b>			0.0035	1.87			0.0009	0.24		

Notes:  $R_{t,m,k}$  denotes the return on portfolio  $b=1,2,3,4,5, k=1,2,3,4,5$ , in month  $t=1,2,\dots, TP$ ,  $R_{f,t}$ , the riskless rate, is the yield on a US Government 1-month Treasury bill,  $R_{M,t}$ , the return on the market portfolio, is the return on the CRSP value weighted index of common stocks in month  $t$ ,  $SMB_t$  and  $HML_t$  are the small-minus-big and high-minus-low Fama-French factors,  $MOM_t$  is the momentum factor in month  $t$ , and  $DY_{t-1}$  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.

(Continued)

**Table 2.5 Abnormal Returns -Continued**  
**Panel B: Conditional Chen, Novy-Marx, and Zhang's Three-Factor Asset Pricing Model**

$$R_{b,k,t} - R_{f,t} = \alpha_{b,k} + \beta_{b,k} (R_{M,t} - R_{f,t}) + g_{b,k} r_{INVt} + p_{b,k} r_{ROAt} + u_{b,k},$$

$$\beta_{b,k} = \beta_{0,b,k} + \beta_{1,b,k} DY_{t-1} + \beta_{2,b,k} R_{f,t} \quad g_{b,k} = g_{0,b,k} + g_{1,m,k} DY_{t-1} + g_{2,b,k} R_{f,t} \quad p_{b,k} = p_{0,b,k} + p_{1,b,k} DY_{t-1} + p_{2,b,k} R_{f,t}$$

$b=1,2,3,4,5, \quad k=1,2,3,4,5, \quad t=1,2,\dots, TP$

Book/Market Quintile	SGER Quintile	SGER1				SGER2				SGER3			
		$\alpha$	t( $\alpha$ )	Hansen's (p-value)	GRS (p-value)	$\alpha$	t( $\alpha$ )	Hansen's (p-value)	GRS (p-value)	$\alpha$	t( $\alpha$ )	Hansen's (p-value)	GRS (p-value)
Lowest Book/Market $b=1$ Growth Stocks	Lowest SGER $k=1$	<b>-0.0048</b>	<b>-4.99</b>	<b>19.78</b>	<b>7.72</b>	<b>-0.0055</b>	<b>-5.55</b>	<b>25.43</b>	<b>10.59</b>	<b>-0.0043</b>	<b>-3.41</b>	5.92	<b>2.90</b>
	$k=2$	<b>-0.0040</b>	<b>-4.18</b>	<b>(0.0006)</b>	<b>(0.0000)</b>	<b>-0.0044</b>	<b>-4.82</b>	<b>(0.0000)</b>	<b>(0.0000)</b>	<b>-0.0031</b>	<b>-2.40</b>	(0.2056)	<b>(0.0145)</b>
	$k=3$	-0.0018	-1.80			<b>-0.0020</b>	<b>-2.19</b>			-0.0025	-1.85		
	$k=4$	-0.0008	-0.81			-0.0004	-0.42			0.0000	-0.02		
	Highest SGER $k=5$	0.0001	0.08			-0.0003	-0.22			-0.0020	-1.02		
$b=2$	Lowest SGER $k=1$	<b>-0.0031</b>	<b>-2.47</b>	<b>21.66</b>	<b>6.78</b>	<b>-0.0040</b>	<b>-3.30</b>	<b>22.75</b>	<b>7.31</b>	-0.0036	-1.67	5.66	1.34
	$k=2$	<b>-0.0036</b>	<b>-3.73</b>	<b>(0.0002)</b>	<b>(0.0000)</b>	<b>-0.0038</b>	<b>-3.46</b>	<b>(0.0001)</b>	<b>(0.0000)</b>	-0.0013	-0.73	(0.2260)	(0.2479)
	$k=3$	-0.0018	-1.47			-0.0014	-1.22			0.0004	0.25		
	$k=4$	0.0002	0.13			0.0001	0.08			-0.0021	-1.12		
	Highest SGER $k=5$	0.0024	1.40			0.0024	1.45			0.0018	0.78		
$b=3$	Lowest SGER $k=1$	-0.0020	-1.72	<b>43.69</b>	<b>10.17</b>	<b>-0.0028</b>	<b>-2.34</b>	<b>35.36</b>	<b>8.01</b>	-0.0006	-0.29	7.34	1.61
	$k=2$	-0.0019	-1.61	<b>(0.0000)</b>	<b>(0.0000)</b>	-0.0009	-0.82	<b>(0.0000)</b>	<b>(0.0000)</b>	-0.0037	-1.89	(0.1189)	(0.1583)
	$k=3$	0.0017	1.29			0.0023	1.73			0.0012	0.57		
	$k=4$	<b>0.0040</b>	<b>2.92</b>			<b>0.0034</b>	<b>2.40</b>			0.0035	1.78		
	Highest SGER $k=5$	<b>0.0067</b>	<b>4.33</b>			<b>0.0066</b>	<b>4.19</b>			0.0017	0.59		
$b=4$	Lowest SGER $k=1$	-0.0020	-1.51	<b>41.03</b>	<b>11.17</b>	-0.0013	-1.07	<b>28.12</b>	<b>7.14</b>	-0.0028	-1.36	5.31	1.29
	$k=2$	0.0010	0.93	<b>(0.0000)</b>	<b>(0.0000)</b>	0.0006	0.49	<b>(0.0000)</b>	<b>(0.0000)</b>	-0.0001	-0.05	(0.2574)	(0.2666)
	$k=3$	0.0025	1.88			<b>0.0033</b>	<b>2.42</b>			0.0023	1.16		
	$k=4$	<b>0.0066</b>	<b>4.47</b>			<b>0.0055</b>	<b>3.66</b>			0.0032	1.31		
	Highest SGER $k=5$	<b>0.0089</b>	<b>4.94</b>			<b>0.0084</b>	<b>4.46</b>			0.0036	1.38		
Highest Book/Market $b=5$ Value Stocks	Lowest SGER $k=1$	0.0014	0.79	<b>27.04</b>	<b>9.82</b>	0.0010	0.62	<b>31.41</b>	<b>8.87</b>	0.0007	0.30	6.25	1.43
	$k=2$	<b>0.0042</b>	<b>2.89</b>	<b>(0.0000)</b>	<b>(0.0000)</b>	<b>0.0038</b>	<b>2.35</b>	<b>(0.0000)</b>	<b>(0.0000)</b>	0.0002	0.08	(0.1815)	(0.2154)
	$k=3$	<b>0.0056</b>	<b>3.74</b>			<b>0.0048</b>	<b>3.26</b>			0.0023	0.99		
	$k=4$	<b>0.0091</b>	<b>5.68</b>			<b>0.0086</b>	<b>5.18</b>			0.0044	1.52		
	Highest SGER $k=5$	<b>0.0110</b>	<b>5.49</b>			<b>0.0107</b>	<b>5.05</b>			<b>0.0070</b>	<b>2.28</b>		

Notes:  $R_{t,m,k}$  denotes the return on portfolio  $b=1,2,3,4,5, k=1,2,3,4,5$ , in month  $t = 1,2,\dots, TP$ ,  $R_{f,t}$ , the riskless rate, is the yield on a US Government 1-month Treasury bill,  $R_{M,t}$ , the return on the market portfolio, is the return on the CRSP value weighted index of common stocks in month  $t$ ,  $r_{INVt}$  and  $r_{ROAt}$  are the low-minus-high investment factor and high-minus-low profitability factor in Chen, Novy-Marx, and Zhang (2010), and  $DY_{t-1}$  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.

The rejection of the hypothesis tested by GRS statistic in Panel B (the conditional Chen, Novy-Marx, and Zhang's three factor model) indicates that the pricing error is beyond their investment and profitability factors. Since Chen, Novy-Marx, and Zhang's factor model controls for corporate profitability (with reported rather than forecast earnings) and for investment, statistically significant alphas in Panel B of Table 2.5 arise either from non-linearity in the relation between expected return and profitability as predicted by Blazenko and Pavlov's (2009) dynamic equity valuation model (see section 2.2 and Figure 2.1) or from the information content of analyst's earnings forecasts that I use in *SGER* beyond that available from reported earnings.

In the latter case, a monotonic relation between  $\hat{\alpha}$  and *SGER*, negative  $\hat{\alpha}$  estimates for lowest *SGER* portfolios ( $k=1$ ), and positive  $\hat{\alpha}$  estimates for highest *SGER* portfolios ( $k=5$ ) in Panels A and Panel B of Table 2.5 suggests that investors might use *SGER* as a stock selection measure with some benefit. For both models, for each book/market quintile,  $b= 1, 2, 3, 4,$  and  $5$ , Hansen's J-statistic rejects the null hypothesis of joint equality of abnormal returns for the five portfolios within a book/market quintile. The statistically significant differences in abnormal returns within a book/market quintile suggest that investors can form a long/short investment strategy that generates excess return beyond the conditional asset pricing model. In particular, in Panel A (the conditional Fama-French-Carhart four factor model), negative  $\hat{\alpha}$  for lowest *SGER* portfolio ( $k=1$ ) suggests that the best investor use of *SGER* is to identify stocks not to hold or to short in their portfolios. It appears that investors might use long/short investment strategies to some advantage.

In Panel B (the conditional Chen, Novy-Marx, and Zhang's three-factor model), *SGER* successfully discriminates negative abnormal returns for lowest *SGER* portfolios ( $k=1$ ) in the growth quintile ( $b=1$ ), and positive abnormal returns for highest *SGER* portfolios ( $k=5$ ) in the value quintile ( $b=5$ ). This evidence suggests that investors can generate abnormal returns by holding value stocks with high *SGER*, or shorting growth firms with low *SGER*.

While useful for both, there is evidence in both Panel A and Panel B in Table 2.5 that *SGER* is a better stock selection measure for value compared to growth stocks. In both Panel A and Panel B, for book/market quintiles 4 and 5 (value stocks) the estimated alpha difference between portfolio  $k=5$  (high *SGER* portfolios) and portfolio  $k=1$  (low *SGER* portfolios) is greater than for book/market quintiles  $b=1$  and  $b=2$  (growth stocks). In Panel A (the conditional Fama-French-Carhart four factor model), the greatest estimated alpha difference,  $\hat{\alpha}_5 - \hat{\alpha}_1$ , is 1.04% per month for book/market quintile  $b=4$  for *SGER1* ( $j=1$ ) portfolios and 0.94% per month for book/market quintile  $b=5$  for *SGER2* ( $j=2$ ) portfolios. In Panel B (the conditional Chen, Novy-Marx, and Zhang three factor model), the greatest estimated alpha difference,  $\hat{\alpha}_5 - \hat{\alpha}_1$ , is 1.09% per month for book/market quintile  $b=4$  for *SGER1* ( $j=1$ ) portfolios and 0.96% per month for book/market quintile  $b=5$  for *SGER2* ( $j=2$ ) portfolios. These alpha differences represent the potential increase in a value investor's average monthly portfolio returns from holding high *SGER* and avoiding low *SGER* stocks.

## 2.5.4 Asset Pricing Errors

It is interesting to compare the asset pricing errors for *SGER* that I report in Table 2.3 with the asset pricing errors (abnormal returns) for the Fama-French-Carhart and the

Chen, Novy-Marx, Zhang models in Table 2.5. In Table 2.3, the maximum difference between realized and *SGER*1 is for growth stocks ( $b=1$ ) with the highest *SGER* ( $k=5$ ). The absolute value of this difference is 14.8% per annum. On the other hand, the maximum absolute value of estimated  $\alpha$  for the Fama-French-Carhart model is 0.64%/month ( $b=4, k=1$  in Panel A), which when annualized is  $12 \times 0.64 = 7.68\%$  per annum. The maximum absolute value of estimated  $\alpha$  for the Chen, Novy-Marx, Zhang model is 1.10%/month ( $b=5, k=5$  in Panel B), which when annualized is  $12 \times 1.1 = 13.2\%$  per annum. All of these are disconcertingly large pricing errors. The greatest of these maximum pricing errors is for *SGER*, but, in this comparison, it has the disadvantage that it is an ex-ante measure of expected return benchmarked against out-of-sample realized returns. On the other hand, Table 2.5 reports  $\alpha$  estimated from either the Fama-French-Carhart or the Chen, Novy-Marx, Zhang models with ex-post in-sample data. A fairer comparison would be between *SGER* and ex-ante versions of Fama-French-Carhart and Chen, Novy-Marx, Zheng.

## 2.6 Expected Return versus Volatility

### 2.6.1 Preliminaries

In this section, I investigate the relation between returns and volatility. In sections 2.2.2 and 2.2.3, in my numerical analysis of Blazenko and Pavlov's (2009) model of a dynamically expanding business, I concluded that the contribution of earnings volatility,  $\sigma$ , to expected return,  $\omega(ROE)$ , is modest. Because of this modest contribution, in sections 2.3, 2.4 and 2.5 of this paper, I focused on *SGER* (which is only a portion of expected return,  $\omega$ ) as a return guide for common equity investing. In this section, I investigate the relation between expected return and volatility in more detail. In addition,

I present evidence that the impact of volatility beyond *SGER* and the market/book ratio on returns is statistically insignificant. This evidence is consistent with my conclusion that *SGER* on its own is a useful measure for common equity investing.

Recent literature documents a negative relation between past idiosyncratic return volatility and future returns (Ang et. al 2006, 2009). Barinov (2007) argues that high idiosyncratic volatility decreases the beta of growth options, which decreases expected return. Studies show that, as an earnings volatility measure, analysts' forecast dispersion has a negative relation with future returns. Han and Manry (2000) find that analysts' forecasts dispersion is negatively related to future *ROE* and future returns. They argue that firms anticipating good prospects are more willing to disclose information to analysts, which reduces forecast dispersion. Diether et. al (2002) report that stocks with higher dispersion earn lower future risk-adjusted returns than stocks with lower dispersion. They argue that because of analysts' optimism and short-sale constraints, high dispersion drives up the stock prices, which reduces expected return. Johnson (2004) suggests that analysts' forecast dispersion proxies for idiosyncratic uncertainty about the future cash flows of levered firms. Idiosyncratic risk increases the option value of equity, which decreases expected return. Sadma and Scherbina (2007) regard the high forecast dispersion associated lower stock returns as mispricing. They find that dispersion is negatively correlated with market liquidity. However, Avramov et. al (2009) show that dispersion effects are not significantly different for levered and unlevered firms and liquidity measures do not capture the dispersion effect. They suggest that the dispersion anomaly is more pronounced for financially distressed firms. I investigate the impact of volatility on expected return beyond market/book and *SGER*.

## 2.6.2 Returns Versus Earnings Volatility

In standard option pricing, Galai and Masulis (1976) show that the expected return on a call option decreases with volatility. Volatility increases the expected payoff to option exercise relative to the expected cost of buying the underlying asset through the option contract. An increase in payoff relative to cost is a leverage (risk) reduction that decreases expected option return. Unlike Galai and Masulis (1976), I find that earnings volatility,  $\sigma$ , can increase or decrease expected return,  $\omega(ROE)$ . Figure 2.4 plots expected return,  $\omega(ROE)$ , and the expansion boundary,  $\xi^*$ , versus earnings volatility,  $\sigma$ . Holding profitability constant,  $ROE=0.105$ , and with a growth rate,  $g=0.06$ , expected return  $\omega(ROE)$  increases with earnings volatility,  $\sigma$ , when volatility,  $\sigma$ , is small and market/book is less than one ( $\pi < 1$ ). In Galai and Masulis (1976), volatility does not change the exercise price of the call option. However, in my dynamic equity valuation model, earnings volatility,  $\sigma$ , decreases the equivalent, the value maximizing expansion boundary,  $\xi^*$ . For an indefinite sequence of growth options that are undiminished by the exercise of any of these opportunities, the manager is relatively more concerned with upside earnings potential rather than downside earnings risk. While greater volatility increases both upside potential and downside risk, the manager focuses on greater upside potential. Increased value appeal of business expansion to the manager reduces the value maximizing expansion boundary.<sup>21</sup> A lower expansion threshold means that the manager expands with investments that have more marginal profitability,  $ROE$ . Lower profitability means greater growth-leverage risk, and therefore, in the leftmost section of Figure 2.4, expected return,  $\omega(ROE)$ , increases with earnings volatility,  $\sigma$ .

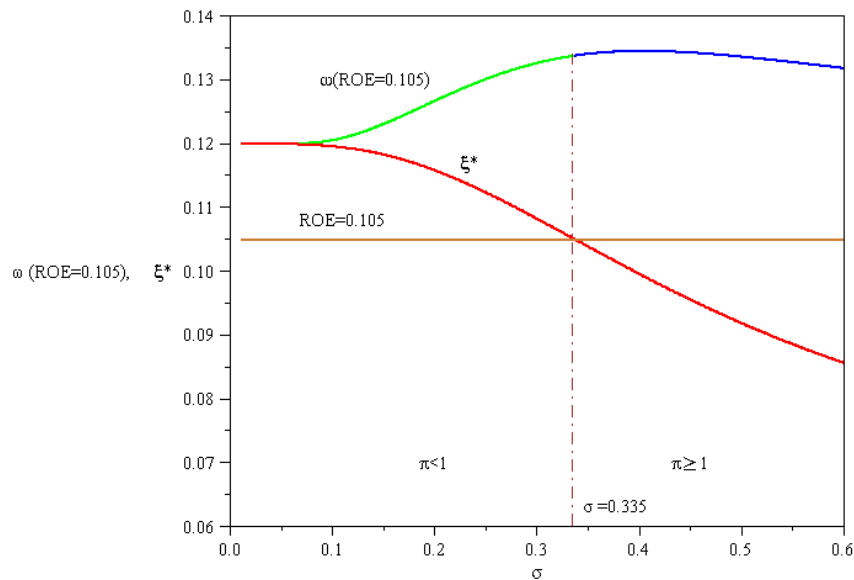
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<sup>21</sup> See Blazenko and Pavlov (2009) for more on the relation between earnings volatility and the value maximizing return threshold for business expansion.



On the other hand, when market/book is greater than one,  $\pi \geq 1$ , the fall in the value maximizing expansion boundary,  $\xi^*$ , with volatility,  $\sigma$ , is generally less pronounced than when market/book is less than one,  $\pi < 1$ . In this case, the Galai and Masulis (1976) effect dominates. For market/book greater than one,  $\pi \geq 1$ , the rightmost section of Figure 2.4, earnings volatility,  $\sigma$ , generally decreases expected return,  $\omega(ROE)$ . Notice, however, that these two forces appear to be rather balanced, and therefore, earnings volatility,  $\sigma$ , has only a modest impact on expected return,  $\omega(ROE)$ , for market/book greater than one,  $\pi \geq 1$ . Because my empirical testing focuses on firms with economic market/book greater than one, I expect that earnings volatility will have a modest impact on equity returns.

**Figure 2.4 Expected Return and Volatility**



*Notes:* Figure 2.4 plots the expected return,  $\omega(ROE)$ , with profitability held constant ( $ROE=0.105$ ) and the value maximization expansion boundary,  $\xi^*$ , against earnings volatility,  $\sigma$  (with an earnings growth rate  $g=0.06$  and an expected return for a common equity of a firm that hypothetically never grows  $r^*=0.12$ ).

### 2.6.3 Volatility Measures

I investigate the relation between returns and a number of measures of volatility: analysts' earnings forecast dispersion, monthly return volatility, and earnings volatility.

Analysts' earnings forecast dispersion is the standard deviation of analysts' *EPS* forecasts,  $\sigma(EPSt)$ , for the fiscal period scaled by book value of equity per share (*BPS*).

Denote by *DISP1* the analysts' earnings forecast dispersion for the first unreported fiscal year hence,  $DISP1 \equiv \sigma(EPSt) / BPS$ . Denote monthly stock return volatility as  $\sigma(R)$ .

Monthly stock return volatility,  $\sigma(R)$ , is the standard deviation of monthly returns for up to sixty months prior to the *I/B/E/S* Statistical Period date. Denote earnings volatility as  $\sigma(E)$ . Earnings volatility,  $\sigma(E)$ , is the standard deviation of earnings changes for the latest 5 fiscal years scaled by the most recently reported book value of equity,

$$\sigma(E) = \frac{\sigma(\Delta E)}{BVE}$$

For each Statistical Period date, I sort firms into book/market triplets (Low, Med, and High). Then, for each book/market triplet I sort firms into *SGERI* triplets (Low, Med, and High). Finally, I sort the firms within each of the nine book/market and *SGERI* sorts into three volatility portfolios (Low, Med, and High). This triple sorting leads to twenty-seven portfolios that I rebalance at each Statistical Period date over the 379 month test period. Because the first two sorts are common (book/market and *SGERI*), but I use three different volatility measures, *DISP1*,  $\sigma(R)$ , and  $\sigma(E)$ , as the third sorting key, I investigate  $3 \times 27 = 81$  portfolios over the 379 month test period.

**Table 2.6 Return and Volatility**

Book to Market	SGERI	Volatility	Volatility Measure 1: Analysts' Dispersion $DISP1 \equiv \frac{\sigma(EPSt)}{BPS}$		Volatility Measure 2: Returns Volatility $\sigma(R)$		Volatility Measure 3: Earnings Volatility $\frac{\sigma(\Delta E)}{BVE}$	
			Annualized Mean Return $\bar{R}_v$	F Stat (p-Value)	Annualized Mean Return $\bar{R}_v$	F Stat (p-Value)	Annualized Mean Return $\bar{R}_v$	F Stat (p-Value)
Low	Low	Low	0.1114	0.040	0.1205	0.081	0.0972	0.379
		Med	0.1169	(0.961)	0.1031	(0.922)	0.1044	(0.684)
		High	0.1047		0.1095		0.1331	
	Med	Low	0.1743	0.451	0.1510	0.024	0.1545	0.101
		Med	0.1398	(0.637)	0.1526	(0.977)	0.1369	(0.904)
		High	0.1334		0.1431		0.1548	
High	Low	0.2057	0.253	0.1866	0.000	0.1915	0.037	
	Med	0.1895	(0.776)	0.1882	(1.000)	0.1776	(0.964)	
	High	0.1673		0.1875		0.1886		
Med	Low	Low	0.1119	0.031	0.1151	0.023	0.1053	0.051
		Med	0.1054	(0.970)	0.1063	(0.978)	0.1158	(0.950)
		High	0.1154		0.1118		0.1174	
	Med	Low	0.1790	0.064	0.1635	0.072	0.1773	0.041
		Med	0.1755	(0.938)	0.1758	(0.930)	0.1659	(0.960)
		High	0.1643		0.1796		0.1759	
High	Low	0.2643	0.445	0.2304	0.360	0.2337	0.064	
	Med	0.2404	(0.641)	0.2227	(0.698)	0.2304	(0.938)	
	High	0.2141		0.2658		0.2483		
High	Low	Low	0.1737	0.255	0.1369	0.276	0.1397	0.126
		Med	0.1495	(0.775)	0.1700	(0.759)	0.1591	(0.882)
		High	0.1433		0.1606		0.1595	
	Med	Low	0.2208	0.136	0.1706	1.840	0.1840	0.614
		Med	0.2039	(0.873)	0.2047	(0.159)	0.2142	(0.542)
		High	0.2016		0.2523		0.2283	
High	Low	0.3074	0.138	0.2574	0.613	0.2756	0.157	
	Med	0.2857	(0.871)	0.3060	(0.542)	0.2876	(0.855)	
	High	0.2817		0.3101		0.3046		

Notes: I measure portfolio returns from a Statistical Period date, where I form a portfolio, to the following

Statistical Period date. Monthly return between Statistical Period dates, is,  $R_{i,t,v} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{i,v}$ , for

firm  $i=1,2,\dots,N$ , month  $t=1,2,\dots,379$ , in portfolio  $v=1,2,\dots,27$ , where  $P_t$  and  $P_{t+1}$  are the closing share prices on Statistical Period date  $t$  and  $t+1$ ,  $D_{t+1}$  is the dividend per share with ex-date between the Statistical Period dates  $t$  and  $t+1$ . The 27 portfolios ( $v=1,2,\dots,27$ ) are formed by sorting all firms at a statistical period date by book/market into 3 triplets(Low, Med, and High), then for each triplet into 3 triplets (Low, Med, and High) by *SGERI*, and finally for each of the nine book/market and *SGERI* sorts by volatility measure into three portfolios (Low, Med, and High). Table 2.6 reports annualized mean portfolio

$$\text{return } \bar{R}_v = \left[ 1 + \frac{1}{379} \sum_{t=1}^{379} \left[ \frac{1}{N} \sum_{i=1}^N R_{i,t,v} \right] \right]^{12} - 1. \text{ DISP1} \equiv \frac{\sigma(EPSt)}{BPS} \text{ is the analysts' earnings forecast dispersion for}$$

the first unreported fiscal year  $\sigma(EPSt)$  scaled by the *BPS* from the most recently reported quarterly/annually financial statement prior to the statistical period. Return volatility,  $\sigma(R)$ , is the standard deviation of monthly returns for up to sixty months prior to the *I/B/E/S* statistical period end. Earnings volatility,  $\sigma(E) = \frac{\sigma(\Delta E)}{BVE}$ , is the standard deviation of *ROE* changes for the latest 5 fiscal years scaled by the most recently reported book value of equity (*BVE*). The F-Statistic tests for differences between annualized mean returns among 3 volatility-sorted portfolios within each of the nine book/market and *SGERI* sorts. p-value underlies F-Stat.

I measure annualized mean portfolio returns between the statistical dates, averaged over firms  $i=1,2,\dots,N$ , and test period  $t=1,2,\dots,379$ , for volatility portfolios  $v=1,2,\dots,27$ ,

$$\bar{R}_v = \left[ 1 + \frac{1}{379} \sum_{t=1}^{379} \left[ \frac{1}{N} \sum_{i=1}^N R_{i,t,v} \right] \right]^{12} - 1$$

where  $R_{i,t,v} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{i,v}$  and  $i=1,2,\dots,N$ ,  $t=1,2,\dots,379$ ,  $v=1,2,\dots,27$ .

## 2.6.4 Portfolio Returns Versus Volatility

Table 2.6 reports the average monthly portfolio returns of 81 book/market, *SGER1*, and volatility sorted portfolios. Consistent with Han and Manry (2000), and Diether et. al (2002), within most book/market – *SGER1* sorts the relation between analysts' forecast dispersion (*DISPI*) and portfolio returns is negative. However, the F-statistics for the differences between mean returns among volatility portfolios (within each book/market – *SGER1* sort) are all insignificant, which suggests a weak relation. For the other volatility measures,  $\sigma(R)$ , and  $\sigma(E)$ , within most book/market–*SGER1* sorts the relation between volatility and portfolio return tends to be positive, but is also statistically insignificant.

Recall from my analysis depicted in Figure 2.2 that the relation between *SGER* and market/book  $\pi$  is similar to the relation between expected return ( $\omega(ROE)$  from my dynamic equity valuation model) and market/book,  $\pi$ . Consistent with the similarity between these relations, Table 2.6 reveals at best only a weak relation between earnings volatility and equity returns beyond *SGER* and market/book. The evidence is so weak and inconsistent between volatility measures that I conclude that *SGER* on its own is a useful

measure for common share investing. This weak relation between earnings volatility and equity returns does not mean dynamic models of equity valuation are unnecessary for equity return representation and that a static model is sufficient. The principal proposition that I develop in this Chapter, that the relation between returns and profitability in-the-small is stronger for value stocks than for growth stocks, arises only from a dynamic equity valuation model and not from a static equity valuation model. The confirming empirical evidence that I present indicates the importance of dynamic models of equity valuation for return representation.

## **2.7 Conclusion for Chapter 2**

While rational financial-economic analysis guides my empirical investigation of the relation between returns and corporate profitability, as is the case with any investment study, I cannot definitely conclude whether abnormal return evidence arises from market inefficiency or mis-specification of the asset pricing models I use for testing. Further, I do not want to dogmatically accept one interpretation of the evidence over the other for fear of unduly influencing the direction of research that others might begin from mine. To do so would impede rather than promote unbiased scientific inquiry in the study of financial markets. However, because I find evidence that the relation between returns and profitability, *ROE*, differs for value versus growth stocks—which is consistent with my dynamic equity valuation model—I lean towards the view that abnormal returns arise from mis-specification of the two conditional asset pricing models that I use. In other words, the risk/return relation that investors use appears to differ between value and growth firms.

Like any good empirical analysis, my study suggests avenues for future research. First, I report evidence that, *SGER* based on analysts' forecasts over-states realized returns for growth stocks and under-states realized returns for value stocks. A likely source of this bias is forward accounting *ROE*. It appears that forward accounting *ROE* overstates economic *ROE* for growth firms and understates economic *ROE* for value firms. If *ROE* follows a mean-reverting process rather than the random walk that I presume, then an order bias (e.g., Blume 1975) arises for *ROE* forecasts. *ROEs* in the value and growth quintiles are more extreme than their true values and will revert to a grand mean over time. A possible solution to reduce this order bias is to use shrinkage or Bayesian estimators for *ROE* in my *SGER* measure. Chapter 5 of this dissertation investigates several mean-reversion adjustments for forecast *ROE* to be used in *SGER* as an absolute return measure. An absolute return measure is particularly important, for example, for use in the weighted average cost of capital.

Second, the current Chapter investigates dividend paying stocks. Alternatively, Chapter 3 investigates dynamic models of equity valuation for firms not currently paying dividends and who instead use earnings to finance growth. My 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 that I investigate in the current Chapter. On the other hand, for non-dividend paying firms, profitability reduces financing constraints, which increases growth which increases growth-leverage risk and increases expected return. Thus, in Chapter 3 of this dissertation, I find no evidence of the value premium for non-dividend paying firms.

Third, my expected return measure, *SGER*, includes analysts' earnings forecasts as an input. Table 2.5 indicates that *SGER* discriminates stocks with abnormal returns when benchmarked against either of two conditional asset pricing models. There is a literature that finds that analysts forecast over-optimistically and favor firms with particular characteristics. For example, Chan et. al (2007) report evidence that earnings surprises are more negative for value rather than growth stocks. Jegadeesh et al.(2004) show that analysts make favorable recommendations for glamour stocks—stocks with high momentum and/or growth characteristics. In current research, I investigate the determinants of earnings surprises and analysts' recommendations. Beyond analysts' preferences for growth and glamour stocks, I find evidence that analysts' favor high return stocks (that is, high *SGER*) and that this preference is incrementally strong for non-dividend paying companies.

Last, an attraction of my expected return proxy is that it requires no estimation. Since mean-variance efficient portfolio weights are sensitive to estimation risk (see, Chopra and Ziemba, 1993) my expected return proxy may be useful for optimal portfolio design. I investigate this issue in future research.

## Appendix 2A

The market/book ratio,  $\pi(ROE)$ , for the corporate investment environment

described in section 2.2 and used in Equation (2.1) for expected return, for

$0 \leq g < r^*$  and  $r^* \equiv r + \theta\sigma_{x,c}$ , is (Blazenko and Pavlov, 2009),

$$\pi(ROE) = \begin{cases} \frac{ROE}{r^* - g} + \frac{g\xi^*}{r^*(r^* - g)} \frac{(1-\alpha)}{(\alpha-\lambda)} \left(\frac{ROE}{\xi^*}\right)^\lambda - \frac{g}{(r-g)} \left(1 - \frac{\alpha}{(\alpha-\lambda)} \left(\frac{ROE}{\xi^*}\right)^\lambda\right), & \text{growth, } ROE \geq \xi^* \\ \frac{ROE}{r^*} + \frac{g\xi^*}{r^*(r^* - g)} \frac{(1-\lambda)}{(\alpha-\lambda)} \left(\frac{ROE}{\xi^*}\right)^\alpha - \frac{g}{(r-g)} \frac{\lambda}{(\lambda-\alpha)} \left(\frac{ROE}{\xi^*}\right)^\alpha, & \text{suspend growth, } ROE < \xi^* \end{cases} \quad (\text{A2.1})$$

$$\text{where, } \alpha \equiv \frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2} + \sqrt{\frac{2r}{\sigma^2} + \left(\frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2}\right)^2}, \quad (\text{A2.2})$$

$$\lambda \equiv \frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2} - \sqrt{\frac{2(r-g)}{\sigma^2} + \left(\frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2}\right)^2},$$

$$\xi^* = r^* \times \left[\frac{r^* - g}{r - g}\right] \times \left[\frac{\alpha}{(\alpha-1)}\right] \times \left[\frac{\lambda}{(\lambda-1)}\right]. \quad (\text{A2.3})$$

The parameter,  $\theta$ , is constant relative risk aversion for a representative investor.

The parameter  $\sigma_{x,c}$  measures business risk of the common share and equals covariance of the log of  $ROE$  (equivalently the log of earnings) with the log of aggregate consumption in the economy. For expositional simplicity, I presume,  $\theta\sigma_{x,c} > 0$ , which means that risk premiums for equity ownership are positive. The parameter,  $r$ , is risk free rate. The risk adjusted rate for a firm that permanently does not growth,  $r^* \equiv r + \theta\sigma_{x,c}$ , is risk free rate,  $r$ , plus the risk premium  $\theta\sigma_{x,c}$ .

On the branch of Equation (A2.1) with suspended growth, the first term is the value of a firm that permanently does not grow. The second term (positive) is the expected incremental profit in the option to incur growth investment. The third term



(negative) is the expected expansion cost if the manager expands the business sometime in the future when profitability exceeds the expansion boundary,  $ROE \geq \xi^*$ . On the growth branch of Equation (A2.1), the first term is the value of a permanently growing firm. The second term (negative), is the expected profit foregone if profitability falls below expansion boundary,  $ROE < \xi^*$ , and the manager suspends growth. The third term (negative) is the expected cost of growth expenditures recognizing that the manager avoids these costs upon possible suspension of growth at times in the future. Equation (A2.3) is the value maximizing expansion boundary,  $\xi^*$ . The first two terms,

$r^* \times \left[ \frac{r^* - g}{r - g} \right]$ , are the expansion boundary for a hypothetical permanently growing firm.

The third term,  $\left[ \frac{\alpha}{(\alpha - 1)} \right] > 1$ , measures the delaying force of irreversible growth

investments for firms that have suspended growth (see, Dixit and Pindyck 1994). The

fourth term,  $\left[ \frac{\lambda}{(\lambda - 1)} \right] < 1$ , measure a force that accelerates growth investment. With

limits on investment, current investment increases the size and value of future growth

investments upon stochastically improved profitability (see, Blazenko and Pavlov 2009).

The product of the last two term,  $\left[ \frac{\alpha}{(\alpha - 1)} \right] \times \left[ \frac{\lambda}{(\lambda - 1)} \right]$ , is less than one. Because the

manager has the option to incur or suspend growth indefinitely in the dynamic

environment, the expansion boundary is lower than in the static setting.

## Appendix 2B

In this appendix, I show that *SGER* in Equation (2.3) is expected return from the static growth discounted dividend model – the *Gordon Growth Model*. If forward dividend per share per annum is  $D$ , if  $g$  is the expected per annum dividend growth rate, and if *SGER* is expected per annum return, then share price,  $P_0$ , is,

$$P_0 = \frac{D}{SGER - g} \quad (B2.1)$$

Rearrange Equation (B2.1) to rewrite the forward dividend yield as

$dy \equiv \frac{D}{P_0} = SGER - g$ . Write share price as the forward dividend discounted, as a non-growing perpetuity, at the forward dividend yield,

$$P_0 = \frac{D}{dy} \quad (B2.2)$$

One way a firm can finance growth is to retain rather than pay earnings as dividends. Let  $b$  be the retention ratio. The payout ratio is one minus retention,

$$1 - b = \frac{D}{EPS}$$

where *EPS* is forward earnings per share per annum. Rearrange this equation to express forward dividend  $D$  as the product of the payout ratio and forward earnings,

$$D = (1 - b) * EPS \quad (B2.3)$$

The return on business investment for shareholders, the forward rate of return on equity, *ROE*, is,

$$ROE = \frac{EPS}{BPS} \quad (B2.4)$$

where  $BPS$  is book equity per share. For earnings generation,  $ROE$  applies to both existing operations with in-place assets and growth investments. Equation (B2.4) indicates that every corporate investment or reinvestment generates cash earnings (expected) at a per annum non-growing rate. Dividend and  $EPS$  growth is not spontaneous, but arises from ongoing corporate investment. Substitute Equations (B2.3) and (B2.4) into Equation (B2.2) and divide by book equity,  $BPS$ , to write market/book as,

$$\frac{P_0}{BPS} = \frac{(1-b) \times ROE}{dy} \quad (B2.5)$$

Market/book is the payout ratio times forward  $ROE$  divided by forward dividend yield. Simplify and rearrange Equation (B2.5),

$$\frac{P_0}{BPS} dy = ROE - b \times ROE = ROE - g \quad (B2.6)$$

The second equality in Equation (B2.6) uses the “sustainable growth” relation,<sup>22</sup>

$$g = b \times ROE \quad (B2.7)$$

In the constant growth discounted dividend model, almost all corporate features grow at the sustainable growth rate, including, dividends, earnings, book equity, and ex-date share prices. Shareholders’ wealth, however, grows faster than the sustainable rate because  $SGER$  is dividend yield plus growth,  $SGER = dy + g$ , and dividend yield is positive. Rearrange Equation (B2.6),

$$g = ROE - \left( \frac{P_0}{BPS} \right) dy \quad (B2.8)$$

Corporate growth is forward  $ROE$  minus market/book times dividend yield.

Forward dividend yield,  $dy$ , in Equation (B2.8) is unobservable. However, current

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<sup>22</sup> See Higgins (1974, 1977, 1981) for more on sustainable growth. This rate is “sustainable” because it is the rate that a firm grows without changing its fundamental ratios, like the debt to equity ratio.

dividend yield—the current dollar rate of dividend payment per share per annum divided by share price—is observable. Equation (C2.4) in the Appendix 2C shows how to calculate a firm’s forward dividend yield,  $dy$ , from forward  $ROE$ , market/book and current dividend yield,  $dy_0$ . I refer to Equation (B2.8) as implicit static growth because it is based the market’s assessment of profitability,  $ROE$ . Because expected return is dividend yield plus growth, and with Equation (B2.8),

$$SGER = ROE + \left(1 - \frac{P_0}{BPS}\right) dy \quad (B2.9)$$

Equation (B2.9) is expected return,  $SGER$ , in the static setting for a firm that, hypothetically, commits to permanent growth regardless of profitability,  $ROE$ .

## Appendix 2C

In this Appendix, I show how to calculate the forward dividend yield from current dividend yield,  $dy_0$ . Forward dividend yield,  $dy$ , incorporating expected dividend growth over the upcoming year, is,

$$dy = dy_0 * (1 + g) \quad (C2.1)$$

Substitute Equation (C2.1) into Equation (B2.8),

$$g = ROE - \left(\frac{P_0}{BPS}\right) dy_0 (1 + g) \quad (C2.2)$$

Rearrange Equation (C2.2) to find an expression for growth in terms of observable or easily forecast financial variables,

$$g = \frac{ROE - \left(\frac{P_0}{BPS}\right) dy_0}{1 + \left(\frac{P_0}{BPS}\right) dy_0} \quad (C2.3)$$

Substitute Equation (C2.3) into Equation (C2.1) and rearrange,

$$dy = \left( \frac{1 + ROE}{1 + \left( \frac{P_0}{BPS} \right) dy_0} \right) dy_0 \quad (C2.4)$$

Equation (C2.4) measures the forward dividend yield,  $dy$ , from the current dividend yield,  $dy_0$ , forward  $ROE$ , and market/book,  $\left( \frac{P_0}{BPS} \right)$ .

# CHAPTER 3: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. I 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, I 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 I benchmark the returns of portfolios formed by ranking forward *ROE* and return volatility against a conditional asset-pricing model, I find negative abnormal returns for low risk value-stocks and positive abnormal returns for high risk growth-stocks. While rational financial-economic analysis guides my empirical investigation, I 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.

## 3.1 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. In Chapter 2, I 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. Chapter 2 reports 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, limits-to-growth hypothesis for the value premium does not apply to non-dividend paying companies. Because Chapter 2 does not consider non-dividend paying companies, I investigate the value premium for non-dividend paying companies in this Chapter.

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 I test in this Chapter is that there is no value premium for non-dividend paying companies.

To structure this hypothesis, I 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. I find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability companies. Rather, I 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, I 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, I use analysts' earnings forecasts for corporate profitability in forward *ROE*. I find that *ROE* relates positively with realized returns. Also, my development of the limits-to-growth hypothesis for returns predicts, and I 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, I find that non-dividend paying firms have a negative value premium.

Evidence of a value premium is abundant in US and international capital markets. Fama and French (1992) find that the value premium exists for post-1963 U.S. stock returns. Chan, Hamao, and Lakonishok (1991) find a value premium for Japanese firms. Fama and French (1998) find that value stocks outperform growth stocks in twelve of thirteen international markets in the period 1975-1995.

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 Chapter 2 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 Chapter, I argue that growth opportunities are less limited for non-dividend paying firms than they are for dividend paying firms. Thus, I 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. Han and Manry (2000), Diether et. al (2002),

Johnson (2004), Sadka and Scherbina (2007) and Avramov et. al (2009) attribute this negative relation to information asymmetry, short-sale constraints, the option value of the equity, market liquidity, and financial distress, respectively. For non-dividend paying firms, I find no strong relations between the profitability motivated changes in the measures of volatility that I investigate and equity returns. This evidence suggests that any relation between returns and volatility is encompassed in the relation between returns and profitability that I investigate.

This Chapter investigates the conditions under which value or growth stocks are more risky with expected rates of return that are higher as a result. If a risk measure like Beta of the CAPM captures these risk differences, then, the financial economic explanation is nonetheless of interest for understanding financial market pricing. However, Fama and French (1996) find that the return difference between portfolios of value stocks and growth stocks is a “priced factor” in asset pricing models that include a market factor. This incremental return impact makes the study of the value premium of even greater interest. In a similar fashion, I investigate whether investors and the asset pricing model that I use to benchmark realized returns recognize the negative value premium for non-dividend paying stocks. Because this asset pricing model includes the return difference between portfolios of value and growth stocks as a factor, I presume that investors recognize, at a minimum, the value premium in in the entire cross section of firms. I find negative abnormal returns for low risk value-stocks and positive abnormal returns for high risk growth-stocks. Thus, effectively I find evidence of a negative value premium for non-dividend paying stocks in both raw returns and abnormal returns. This joint result suggests that the economic phenomenon that I investigate is very strong and is

not hidden by other risk sources. Rational analysis guides my empirical investigation, but I cannot dismiss market-inefficiency as an explanation for abnormal-returns. To do so would bias future scientific inquiry that my 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 my paper is organized as follows. In section 3.2, I develop a dynamic equity valuation model for non-dividend paying firms that predicts that expected return is the forward rate of return on equity (*ROE*) plus a term that depends on earnings volatility. In sections 3.3 and 3.4 I empirically investigate the relations between the value premium and corporate profitability predicted by my dynamic model. In section 3.5, I investigate whether or not investors anticipate the negative value premium for non-dividend paying stocks. Section 3.6 concludes, summaries my findings, and suggests topics for future research.

## **3.2 Dynamic Financial Analysis**

### **3.2.1 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 my study of dividend paying firms in Chapter 2, I find that high profitability growth firms have lower returns than low profitability value firms. I 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.

### 3.2.2 Equity Valuation

I believe that there are two important differences between dividend paying<sup>23</sup> firms and non-dividend paying firms. First, because they pay no dividends, non-dividend paying firms are more likely financially constrained.<sup>24</sup> 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 more likely face organizational limits on their business growth opportunities than do non-dividend paying firms. I incorporate these two assumptions about dividend paying versus non-dividend paying companies in a dynamic three state growth model. This model is an extension of Blazenko and Pavlov’s (2009) dynamic equity valuation model. In the first

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<sup>23</sup> My theoretical model makes no distinction between dividends and share repurchases. For simplicity I refer to a payment from the firm to shareholders as a dividend. Empirically, I restrict my attention to non-dividend paying firms for a number of reasons. First, Lee and Rui (2007) find that repurchases and dividends are imperfect substitutes. Repurchases are associated with temporary components of earnings, whereas dividends depend on permanent components of earnings. Second, Grullon and Michaely (2002) find that most repurchasing firms are also dividend paying firms. They find that 88% of share repurchases are by dividend paying firms.

<sup>24</sup> In my model, I presume that managers of firms cannot finance from external financial markets. I need this assumption, of course, only to simplify the model and it is not meant to be descriptively precise. With required additional modeling, external financing could be added to the model. The principal results of my model will continue to hold as long as impediments to financial market financing remain.

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. I report the technical development of this equity valuation model in Appendix 3A.

### 3.2.3 Equity Return

A constant returns to scale technology with stochastic return on equity,  $ROE_t$ , generates earnings  $X_t$ . That is,  $X_t = ROE_t \cdot B_t$  (where  $B$  is equity capital). Neither capital,  $B$ , nor earnings,  $X_t$ , grows when the manager suspends growth. Equity capital,  $B$ , and earnings,  $X_t$ , 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). The return on equity ( $ROE$ ) follows a non-growing geometric diffusion,  $dROE_t/ROE_t = \sigma dz$  (where  $\sigma$  is earnings volatility). In this case, expected return on equity value, which I denote as  $\omega$ , is the right-hand-side of equation (A3.5) in Appendix 3A divided by the market/book ratio  $\pi(ROE)$ ,

$$\omega(ROE) = \begin{cases} ROE + (1 - \pi) * \frac{ROE - g}{\pi} + \frac{1}{2} \pi'' \sigma^2 \frac{ROE^2}{\pi}, & ROE > \xi^*, \quad growth = g, \\ ROE + \frac{1}{2} \pi'' \sigma^2 \frac{ROE^2}{\pi}, & \psi^* \leq ROE \leq \xi^*, \quad growth = ROE, \\ \frac{ROE}{\pi} + \frac{1}{2} \pi'' \sigma^2 \frac{ROE^2}{\pi}, & ROE < \psi^*, \quad growth = 0 \end{cases} \quad (3.1)$$

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 (3.1) mean that at the lower threshold ( $\psi^*$ ), the market to book ratio is one ( $\pi = 1$ ), and at the upper threshold  $ROE$  equals the maximum corporate growth rate ( $ROE = \xi^* = g$ ). Panels A and B of Figure 3.1 plot value ( $\pi$ ) 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 3.1, 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 3.1).

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 3.1), 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.

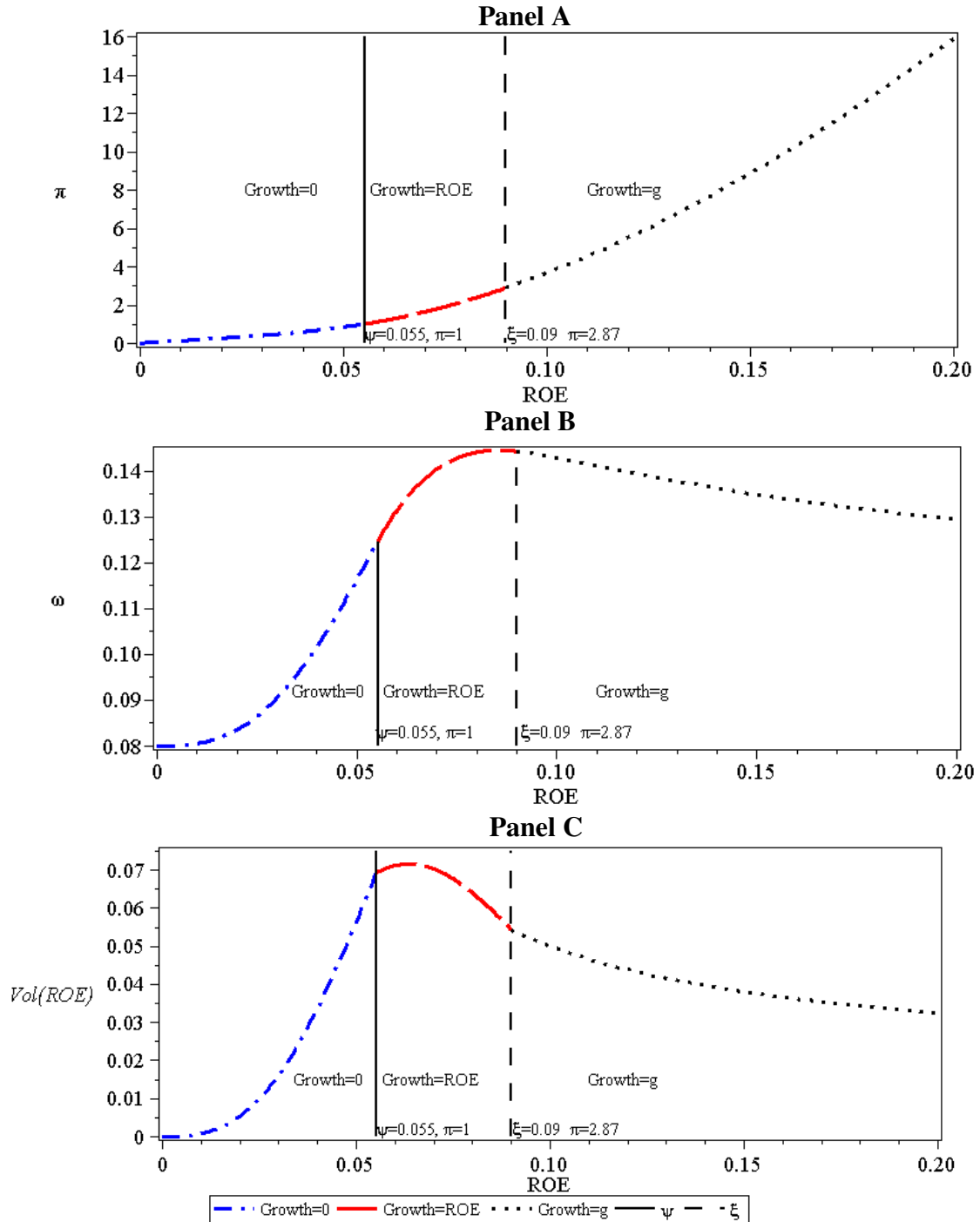
When the manager has suspended growth investments (the left-most section in Panel B of Figure 3.1), he/she pays dividends at the maximum rate allowed by profitability,  $ROE$ . Even though corporate profitability ( $ROE$ ) is low and the manager does not need immediate cash to fund growth (which has been suspended), and, thus, he/she pays earnings as a dividend, recognizing financing constraints 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 my modeling as simple as possible, I do not do this. So, while my 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, I refer to the firm on left in Panel B of Figure 3.1 (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 3.1 plots the portion of expected return,  $\omega(ROE)$ , from equation (3.1) that is determined by earnings volatility which I 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). I interpret these observations to mean that for non-dividend paying firms, volatility is a more important determinant of expected return when  $ROE$  is high.

My model, represented by Figure 3.1, 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 I test in the remainder of this paper.

**Figure 3.1 Market/Book ( $\pi$ ), Expected Return ( $\omega$ ), and Volatility Versus ROE**



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,  $\pi^2 \sigma^2 ROE^2 / (2\pi)$ . 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).

### 3.3 Data, Portfolio Formation, and Portfolio Characteristics

#### 3.3.1 Data

I test the negative value-premium hypothesis on portfolios of non-dividend paying firms. I use firms that have data from *COMPUSTAT*, *CRSP*, and Thomson *I/B/E/S*. These are US domestic, foreign interlisted companies, and American Depositary Receipts (ADRs)<sup>25</sup> that trade on US exchanges. *COMPUSTAT* is my source for book equity<sup>26</sup> (*BVE*), reported earnings (*EPS*), and other corporate financial data. I use *CRSP* for dividends (to verify that a firm has not paid dividends), split factors, shares outstanding, daily share price, and daily returns. I use Thomson *I/B/E/S* for reported *EPS* and consensus analysts' *EPS* forecasts.<sup>27</sup> Finally, I use Ken French's website<sup>28</sup> to retrieve daily portfolio and risk-less rate data for benchmarking *ROE* based portfolios.

#### 3.3.2 Portfolio Selection Criteria

Because *ROE* entails division by *BVE*, I 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*, I require *BPS* greater than one dollar. Second, my model presumes a geometric Brownian motion for *ROE* and therefore earnings can never be negative. Thus, the model restricts me away from firms in financial distress.<sup>29</sup> To be consistent in my empirical testing, I investigate firms that have positive

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<sup>25</sup> If not in US dollars, I convert the accounting data (historical or forecast) of foreign interlisted companies and ADRs into US dollars.

<sup>26</sup> Book equity (*BVE*) is Total Assets less Total Liabilities less Preferred Stock plus Deferred Taxes and Investment Tax Credits (from the *COMPUSTAT* quarterly file).

<sup>27</sup> 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 Research in Security Prices: Graduate School of Business, University of Chicago. The acronym *I/B/E/S* stands for Institutional Brokers Estimate System. I use the *I/B/E/S* summary statistics file and the actual data file, both of which are unadjusted for stock splits and stock dividends. I use *CRSP* daily cumulative stock factors to adjust for splits and stock dividends.

<sup>28</sup> [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data\\_Library](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library)

<sup>29</sup> I investigate firms in financial distress in Chapter 4.

trailing-twelve-month earnings at the time of portfolio formation. Last, I restrict my testing to firms that have paid no dividends in the trailing-twelve-months from the time of portfolio formation.

### 3.3.3 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. My testing uses portfolios that I rebalance at closing prices on Statistical Period dates. I define a "statistical period month" as the interval between adjacent statistical period dates.

I forecast *ROE* in three ways with three different consensus *I/B/E/S* analysts' *EPS* forecasts at a Statistical Period date.<sup>30</sup> These *EPS* forecasts are for the first,<sup>31</sup> second, and third ( $J=1,2,3$ ) yet to be reported fiscal year-end in the future. I use annual *EPS* forecasts to avoid seasonality in quarterly earnings. My *ROE* forecasts are  $EPS_J/BPS$  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. I 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 I calculate forward *ROE* for firms with zero trailing-twelve-month dividends, positive

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<sup>30</sup> *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 my study.

<sup>31</sup> 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.

trailing-twelve-month reported earnings, and positive *BVE*. At each Statistical Period date, I sort firms into twenty five *ROE* portfolios ( $b=1,2,\dots,25$ ) with an equal number of firms (approximately) in each portfolio. This sorting leads to twenty-five portfolios that I rebalance at each Statistical Period date over the test period. In addition, because I sort firms in three ways, with  $ROE_j$ ,  $J=1,2,3$ , I investigate  $3 \times 25=75$  portfolios.

Chapter 2 reviews the literature on accounting returns (*ROE*) as proxies for economic returns. Further, consistent with my theoretical model, represented by Equation (3.1) and depicted in Panel B of Figure 3.1, I report evidence in Table 3.1 of a positive relation between realized returns and forward *ROE*. This association suggests a correspondence between accounting returns and economic returns. Finally, evidence in section 3.5 of abnormal returns from portfolios formed with forward *ROE* suggests information content of accounting returns that is not fully recognize by investors or the asset pricing model that I use for testing.

My test period for  $ROE_1$  and  $ROE_2$  is 33 years and 8 months (1/15/1976 to 10/15/2009) which is 404 statistical period months. My test period is shorter for  $ROE_3$  because *I/B/E/S* only begins reporting  $EPS_3$ —forecast earnings three unreported fiscal year-ends hence—at the 9/20/1984 Statistical Period date. Thus, my test period for  $ROE_3$  is between 9/20/1984 and 10/15/2009 which is 25 years and 1 month (301 statistical period months). Over my test periods, the average numbers of stocks in the 25  $ROE_j$ ,  $J=1,2,3$  portfolios is 43.7, 39.5, and 17.1, respectively.<sup>32</sup> The smaller number of stocks in

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<sup>32</sup> Total number of observations in my sample for  $ROE_1$ ,  $ROE_2$ ,  $ROE_3$  portfolio sets as 441,758, 398,476, and 128,681, respectively. Because there 404 and 301 Statistical Period months for  $ROE_1$ ,  $ROE_2$  and  $ROE_3$  portfolios with 25 portfolios each, the average number of stocks in a portfolio is  $441,758/(25 \times 404)=43.7$ ,  $398,476/(25 \times 404)=39.5$ , and  $128,681/(25 \times 301)=17.1$ , respectively.

$ROE_3$  portfolios is because analyst annual  $EPS$  forecasts are sparser for three unreported fiscal years hence compared to one and two unreported fiscal years hence.

More precisely,  $EPS_{J,i,t,b}$ , is the median analysts'  $EPS$  forecast and  $ROE_{J,i,t,b} = EPS_{J,i,t,b} / BPS$  is the median analysts'  $ROE$  forecast for firm  $i$  at the beginning of statistical period month  $t$  which is one of the stocks in portfolio  $b=1,2,\dots,25$ . The median forecast return on equity,<sup>33</sup>  $ROE_{J,b}$ , for portfolio  $b=1,2,\dots,25$  formed by ranking firms into 25 portfolios with  $ROE_{J,i,t,b}$ ,  $J=1,2,3$  is,

$$ROE_{J,b} = \underset{t=1 \text{ to } TP}{\text{median}} \left( \underset{i=1 \text{ to } N}{\text{median}} (ROE_{J,i,t,b}) \right) = \underset{t=1 \text{ to } TP}{\text{median}} (ROE_{J,t,b}) \quad J=1,2,3 \text{ and} \\ b=1,2,\dots,25$$

Column A of Table 3.1 reports  $ROE_{J,b}$ , the median forecast  $ROE$  for portfolio  $b$  formed by ranking firms into 25 portfolios with  $ROE_J$ ,  $J=1,2,3$ . Since one of my screens on firms for study inclusion is that it has positive trailing-twelve-month earnings at a statistical period date, all of the average  $ROE$  forecasts are positive and increase monotonically from portfolio  $b=1$  to  $b=25$  for each of the sets of portfolios  $J=1,2,3$ .

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<sup>33</sup> Because  $ROE$  is forecast  $EPS$  divided by  $BPS$ , which can approach zero,  $ROE$  can have extreme values. To limit the impact of these extreme values on my analysis, I use median rather than mean  $ROE$ .

**Table 3.1 Descriptive Statistics**

ROE Portfolios	A. Median Forward ROE			B. Average Portfolio Returns			C. Mean MVE (Millions)			D. Median Market/Book		
	ROE <sub>J,b</sub>			$\bar{R}_{J,b}$			MVE <sub>J,b</sub>			M/B <sub>J,b</sub>		
	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3
Lowest ROE b=1	0.000	0.012	0.003	0.076	0.093	0.102	404	490	939	0.736	0.371	0.137
b=2	0.023	0.049	0.032	0.133	0.106	0.077	488	605	1274	0.592	0.616	0.477
b=3	0.040	0.068	0.066	0.102	0.147	0.096	518	747	1739	0.802	0.807	0.791
b=4	0.053	0.082	0.089	0.128	0.094	0.109	683	699	1689	0.987	0.947	1.066
b=5	0.065	0.095	0.106	0.132	0.108	0.115	584	660	1696	1.037	1.037	1.241
b=6	0.074	0.104	0.122	0.145	0.121	0.102	580	669	1931	1.105	1.151	1.388
b=7	0.083	0.113	0.133	0.133	0.127	0.121	610	729	1800	1.196	1.237	1.534
b=8	0.091	0.122	0.142	0.140	0.199	0.155	714	701	1702	1.249	1.301	1.674
b=9	0.100	0.131	0.154	0.123	0.167	0.135	683	775	1705	1.361	1.375	1.762
b=10	0.107	0.140	0.166	0.157	0.159	0.118	733	835	1821	1.407	1.550	1.923
b=11	0.115	0.148	0.179	0.180	0.149	0.163	748	850	1893	1.559	1.667	2.051
b=12	0.123	0.157	0.190	0.169	0.160	0.179	892	812	1801	1.623	1.735	2.201
b=13	0.130	0.166	0.200	0.150	0.138	0.108	831	876	1811	1.759	1.885	2.331
b=14	0.137	0.176	0.215	0.146	0.165	0.164	849	822	2093	1.850	2.032	2.462
b=15	0.145	0.185	0.227	0.167	0.155	0.151	911	942	2295	1.968	2.182	2.776
b=16	0.153	0.196	0.242	0.172	0.135	0.188	883	1037	2407	2.117	2.296	2.913
b=17	0.162	0.207	0.257	0.161	0.155	0.089	953	1079	2451	2.240	2.457	3.164
b=18	0.172	0.221	0.274	0.163	0.132	0.152	1101	1108	2938	2.448	2.713	3.361
b=19	0.183	0.234	0.292	0.202	0.163	0.144	1172	1518	3570	2.645	2.894	3.502
b=20	0.197	0.253	0.316	0.161	0.169	0.136	1381	1539	3272	2.868	3.190	3.866
b=21	0.213	0.273	0.346	0.168	0.133	0.137	1630	1637	3669	3.194	3.444	4.269
b=22	0.234	0.301	0.385	0.166	0.164	0.084	1880	1827	4159	3.540	3.841	4.842
b=23	0.261	0.341	0.437	0.185	0.174	0.119	1877	2031	4609	3.993	4.432	5.558
b=24	0.310	0.405	0.509	0.190	0.213	0.171	2381	2322	4264	4.799	5.248	6.579
Highest ROE b=25	0.446	0.572	0.727	0.230	0.203	0.178	2313	2302	4791	7.140	7.984	9.686

ROE Portfolios	E. Analysts' Earnings Forecast Dispersion			F. Past Return Volatility			G. Volatility of Earnings Level			H. Earnings Volatility		
	$\sigma(FOREPS)_{J,b}$			$\sigma(RET)_{J,b}$			$\sigma(EPS)_{J,b}$			$\sigma(\Delta EPS)_{J,b}$		
	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3
Lowest ROE b=1	0.023	0.018	0.024	0.148	0.129	0.115	0.141	0.113	0.079	0.184	0.141	0.100
b=2	0.009	0.012	0.011	0.137	0.134	0.117	0.071	0.066	0.062	0.096	0.090	0.080
b=3	0.011	0.014	0.016	0.146	0.140	0.128	0.075	0.066	0.067	0.104	0.091	0.091
b=4	0.010	0.014	0.016	0.147	0.140	0.132	0.072	0.067	0.069	0.100	0.087	0.088
b=5	0.010	0.013	0.017	0.147	0.139	0.137	0.073	0.058	0.060	0.100	0.076	0.078
b=6	0.010	0.014	0.019	0.146	0.139	0.138	0.066	0.061	0.063	0.090	0.080	0.083
b=7	0.010	0.014	0.019	0.145	0.141	0.138	0.065	0.059	0.068	0.087	0.077	0.091
b=8	0.009	0.014	0.022	0.143	0.141	0.138	0.061	0.061	0.060	0.078	0.080	0.077
b=9	0.009	0.014	0.020	0.143	0.140	0.139	0.062	0.060	0.059	0.080	0.074	0.070
b=10	0.009	0.014	0.021	0.143	0.140	0.140	0.061	0.058	0.063	0.077	0.071	0.075
b=11	0.009	0.014	0.021	0.141	0.141	0.142	0.064	0.061	0.063	0.081	0.074	0.075
b=12	0.009	0.015	0.019	0.140	0.142	0.141	0.063	0.063	0.066	0.077	0.075	0.073
b=13	0.009	0.015	0.023	0.141	0.143	0.144	0.070	0.063	0.065	0.086	0.075	0.075
b=14	0.010	0.015	0.023	0.142	0.142	0.143	0.066	0.065	0.082	0.080	0.075	0.105
b=15	0.009	0.016	0.022	0.143	0.145	0.144	0.066	0.069	0.161	0.078	0.083	0.210
b=16	0.010	0.016	0.023	0.143	0.146	0.145	0.067	0.095	0.134	0.077	0.121	0.168
b=17	0.010	0.017	0.025	0.144	0.149	0.146	0.087	0.110	0.195	0.108	0.141	0.240
b=18	0.011	0.018	0.029	0.146	0.151	0.150	0.110	0.092	0.113	0.141	0.117	0.161
b=19	0.011	0.018	0.030	0.148	0.152	0.151	0.095	0.104	0.103	0.117	0.133	0.122
b=20	0.011	0.020	0.033	0.149	0.153	0.151	0.103	0.097	0.089	0.130	0.109	0.094
b=21	0.013	0.022	0.033	0.152	0.155	0.154	0.099	0.098	0.092	0.113	0.115	0.106
b=22	0.014	0.024	0.039	0.154	0.157	0.153	0.100	0.104	0.105	0.113	0.122	0.115
b=23	0.017	0.029	0.042	0.158	0.162	0.156	0.117	0.115	0.111	0.139	0.136	0.120
b=24	0.020	0.034	0.055	0.162	0.168	0.159	0.136	0.138	0.139	0.162	0.164	0.152
Highest ROE b=25	0.039	0.063	0.103	0.166	0.171	0.163	0.270	0.266	0.271	0.342	0.337	0.335

Notes: At each Statistical Period date ( $t=1,2,\dots,TP$ ), I sort firms into twenty five portfolios ( $b=1,2,\dots,25$ ) with an equal number of firms, approximately, in each portfolio by  $ROE_{J,t,b} = \text{median}_{i=1 \text{ to } N_t} (EPS_{J,t,b} / BPS_{i,t,b})$ , where  $EPS_{J,t,b}$  is the consensus earnings forecast for  $J$  as-yet-unreported fiscal years, and  $BPS_{i,t,b}$  is the book equity per share for firm  $i=1,2,\dots,N$ , at a Statistical Period date  $t=1,2,\dots,TP$ , in portfolio  $b=1,2,\dots,25$ .  $\bar{R}_{J,b}$  is the annualized portfolio returns,  $ROE_{J,b} = \text{median}_{i=1 \text{ to } TP} (\text{median}_{i=1 \text{ to } N} (ROE_{J,t,b}))$  is the median ROE,  $MVE_{J,b} = \sum_{t=1}^{TP} (\sum_{i=1}^N \frac{MVE_{J,t,b}}{N}) / TP = \sum_{t=1}^{TP} (MVE_{J,t,b}) / TP$  is the average market value of equity, and  $M/B_{J,b} = \text{median}_{i=1 \text{ to } TP} (\text{median}_{i=1 \text{ to } N} (M/B_{J,t,b}))$  is the median Market to Book ratio for the twenty five portfolios ( $b=1,2,\dots,25$ ) over statistical period month  $t=1,2,\dots,TP$ , sorted by  $ROE_{J,b}$ ,  $J=1,2,3$ .  $\sigma(FOREPS)_{J,b}$  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.  $\sigma(RET)_{J,b}$  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  $ROE_{J,b}$   $J=1,2,3$  into 25 portfolios.

### 3.3.4 Portfolio Returns

I measure portfolio returns from a Statistical Period date, where I form a portfolio, to the following Statistical Period date, which is approximately a month later. Because I use *ROE* to rebalance portfolios at each Statistical Period date and measure portfolio realized returns for the following statistical period month, my empirical results are out-of-sample. Because Statistical Period dates are mid-month rather than month-end, I cannot use *CRSP* monthly returns. Instead, for firm  $i=1,2,\dots,N$ , sorted into portfolio  $b=1,2,\dots,25$ , with  $ROE_j$   $J=1,2,3$ , at the beginning of statistical period month  $t=1,2,\dots,TP$ , where  $TP$  is the number of months in my test period,<sup>34</sup> monthly return between Statistical Period dates is,

$$R_{J,i,t,b} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{J,i,b} \quad (3.2)$$

where  $P_t$  and  $P_{t+1}$  are closing share prices<sup>35</sup> 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  $t+1$ . I adjust both the dividend  $D_{t+1}$  and the end of month share price  $P_{t+1}$  for stock splits and stock dividends.

<sup>34</sup>  $TP$  is 404 for portfolio sets  $ROE_1$  and  $ROE_2$  and 301 for portfolio set  $ROE_3$ .

<sup>35</sup> If a stock is delisted during statistical period month  $t$  or closing share price is missing on the Statistical Period date  $t+1$ , I 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  $t$ , I 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 (3.2), I also calculated returns for individual companies between Statistical Period dates by compounding *CRSP* daily returns. Results in this Chapter with this return methodology are qualitatively very similar (not reported).



The equally weighted portfolio return<sup>36</sup> in statistical period month  $t=1,2,\dots,TP$ , for portfolio  $b=1,2,\dots,25$ , is  $R_{J,t,b} = \frac{1}{N} \sum_{i=1}^N R_{J,i,t,b}$ . Because *ROE* is an annual measure, for comparison purposes in Table 3.1 and Figure 3.2, I annualize realized monthly portfolio returns. Annualized average portfolio return over my test period is  $\bar{R}_{J,b} = 12 \cdot \sum_{t=1}^{TP} \left( \frac{R_{J,t,b}}{TP} \right)$ ,  $J=1,2,3$ ,  $b=1,2,\dots,25$ .

### 3.3.5 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  $MVE_{J,i,t,b}$ , be the market capitalization of firm  $i$  at the beginning of statistical period month  $t$  which is one of the stocks in portfolio  $b=1,2,\dots,25$  formed by ranking firms by  $ROE_J$ ,  $J=1,2,3$ , respectively into 25 portfolios. The average market capitalization,  $MVE_{J,b}$ , for portfolio  $b=1,2,\dots,25$  formed by ranking firms into 25 portfolios with  $ROE_J$ ,  $J=1,2,3$  is,

$$MVE_{J,b} = \sum_{t=1}^{TP} \left( \sum_{i=1}^N \left( \frac{MVE_{J,i,t,b}}{N} \right) \right) / TP = \sum_{t=1}^{TP} (MVE_{J,t,b}) / TP \quad J=1,2,3 \text{ and } b=1,2,\dots,25$$

Column C of Table 3.1 reports  $MVE_{J,b}$ , the average market value of equity for the twenty five portfolios ( $b=1,2,\dots,25$ ), 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

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<sup>36</sup> Portfolio results in Table 3.1 are qualitatively the same with value-weighted returns. Abnormal return results in Table 3.3 are qualitatively similar. However, positive abnormal returns are more positive and negative abnormal returns are less negative. Positive abnormal returns remain statistically significant, but negative abnormal returns become insignificant (results not reported). Of course, in the “market portfolio,” weights are value-weighted. Since individual investors need not and are unlikely to value weight their portfolios, I report portfolios results in this Chapter with equally weighted returns.

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.

### 3.3.6 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  $b=1,2,\dots,25$  formed by ranking firms by  $ROE_J$ ,  $J=1,2,3$ , respectively into 25 portfolios. The median market to book ratio,<sup>37</sup>  $M / B_{J,b}$ , for portfolio  $b=1,2,\dots,25$  formed by ranking firms into 25 portfolios with  $ROE_J$ ,  $J=1,2,3$  is,

$$M / B_{J,b} = \underset{t=1 \text{ to } TP}{\text{median}} \left( \underset{i=1 \text{ to } N}{\text{median}} (M / B_{J,i,t,b}) \right) = \underset{t=1 \text{ to } TP}{\text{median}} (M / B_{J,t,b}) \quad J=1,2,3 \text{ and } b=1,2,\dots,25$$

Column D of Table 3.1 reports  $M / B_{J,b}$ , median market/book for the twenty five portfolios ( $b=1,2,\dots,25$ ), 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. This relation suggests that analysts have an inherent preference for growth stocks over value stocks as argued by Haugen (1999).

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<sup>37</sup> The market/book ratio can have extreme values when  $BVE$  is close to zero. To reduce the impact of these extreme values on my analysis, I use the median rather than the mean market/book ratio.

### 3.3.7 Volatility Versus Returns

I 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 (A3.2), I 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  $ROE_J$ ,  $J=1,2,3$ , respectively into 25 portfolios. I 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  $b=1,2,\dots,25$  formed by ranking firms into 25 portfolios with  $ROE_J$ ,  $J=1,2,3$ , is,

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

Let  $\sigma(EPS)_{J,i,t,b}$  be the standard deviation of annual *EPS* reported during the sixty months<sup>38</sup> 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  $ROE_J$ ,  $J=1,2,3$ , into 25 portfolios. I 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  $b=1,2,\dots,25$  formed by ranking with  $ROE_J$ ,  $J=1,2,3$ , is,

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<sup>38</sup> In order to calculate the standard deviation of *EPS*, firms must have reported earnings at least twice in this sixty month window.

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

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  $ROE_J$   $J=1,2,3$  into 25 portfolios. I refer to  $\sigma(\Delta EPs)_{J,i,t,b}$  as earnings volatility. Average earnings volatility for portfolio  $b=1,2,\dots,25$  formed by ranking with  $ROE_J$ ,  $J=1,2,3$ , is,

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

Let  $\sigma(RET)_{J,i,t,b}$  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. I refer to  $\sigma(RET)_{J,i,t,b}$  as return volatility. The average return volatility, for portfolio  $b=1,2,\dots,25$  formed by ranking with  $ROE_J$ ,  $J=1,2,3$ , is,

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

Table 3.1 reports my 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 ( $b=1,2,\dots,25$ ) 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 3.1,  $\bar{R}_{J,b}$ , also increase with  $ROE$ , returns,  $\bar{R}_{J,b}$ , and volatility also tend to be positively related for the twenty five portfolios ( $b=1,2,\dots,25$ ) 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 my dynamic equity valuation model, Panel C of Figure 3.1 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 3.5, I investigate whether the positive relation between returns and volatility motivated by increasing profitability suggested by Table 3.1 is extraordinary or, instead, is subsumed in existing risk factors commonly investigated in the financial literature.

### **3.4 The Negative Value-Premium for Non-Dividend Paying Stocks**

#### **3.4.1 Returns Versus Profitability, $ROE$**

Column B of Table 3.1 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 my dynamic equity valuation model, represented by Panel B of Figure 3.1, which predicts that returns strictly increase with profitability ( $ROE$ ). Panels A, B, and C of Figure 3.2 plot  $\bar{R}_{J,b}$  versus

$ROE_{J,b}$  for the 25 portfolios formed by sorting  $ROE_J$ ,  $J=1,2,3$ , respectively. While my investigation at this stage is preliminary and exploratory, a positive relation between returns and profitability for non-dividend paying firms is clearly evident. I present statistical tests in the next subsection.

### 3.4.2 Testing the Relation Between Returns and Profitability, $ROE$

I estimate Fama-MacBeth (1973) regressions of monthly returns of 25  $ROE$  portfolios on portfolio profitability,  $ROE$ . In each statistical period month,  $t$ , I 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  $b=1,2,\dots,25$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  is an error term,  $\gamma_{0,J,t}$  and  $\gamma_{1,J,t}$  are intercept and slope coefficients.

Table 3.2 reports the average of cross-sectional estimated intercepts,

$$\bar{\gamma}_{0,J} = \sum_{t=1}^{TP} \left( \gamma_{0,J,t} / TP \right), \text{ and slope coefficients, } \bar{\gamma}_{1,J} = \sum_{t=1}^{TP} \left( \gamma_{1,J,t} / TP \right) \text{ in the Fama-MacBeth}$$

(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 my dynamic model as depicted in Panel B of Figure 3.1.

**Table 3.2 Returns Versus ROE and Returns Versus Market/Book**

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

$$R_{J,t,b} = \gamma_{0,J,t} + \gamma_{1,J,t} ROE_{J,t,b} + u_{J,t}$$

Portfolios Sorted by $ROE_J$	$\bar{\gamma}_{0,J}$	$t(\bar{\gamma}_{0,J})$	$\bar{\gamma}_{1,J}$	$t(\bar{\gamma}_{1,J})$
$ROE_1$	0.0096	3.01	0.0231	4.37
$ROE_2$	0.0098	3.17	0.0141	2.70
$ROE_3$	0.0093	2.55	0.0067	1.34

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

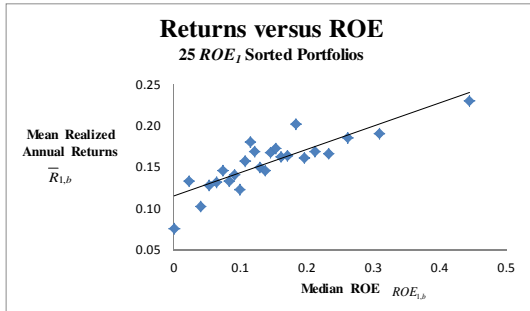
$$R_{J,t,b} = \gamma_{0,J,t} + \gamma_{1,J,t} \frac{M}{B_{J,t,b}} + u_{J,t}$$

Portfolios Sorted by $ROE_J$	$\bar{\gamma}_{0,J}$	$t(\bar{\gamma}_{0,J})$	$\bar{\gamma}_{1,J}$	$t(\bar{\gamma}_{1,J})$
$ROE_1$	0.0102	3.21	0.0014	3.40
$ROE_2$	0.0106	3.43	0.0008	1.78
$ROE_3$	0.0089	2.41	0.0007	1.67

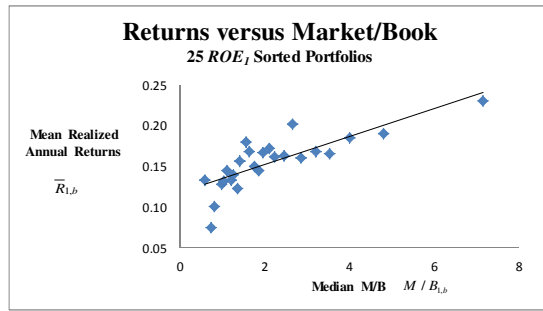
*Notes:* In Panel A, for each statistical period month,  $t$ , I estimate a cross sectional regression of monthly returns of 25 ROE portfolios ( $R_{J,t,b}$ ) on forward ROE ( $ROE_{J,t,b}$ ) (separately for  $ROE_J, J=1,2,3$ ), where  $R_{J,t,b}$  is the monthly portfolio return and  $ROE_{J,t,b}$  is forward ROE, for portfolio  $b=1,2,\dots,25$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  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,  $\bar{\gamma}_{0,J} = \sum_{t=1}^{TP} \gamma_{0,J,t} / TP$ , and slope coefficients,  $\bar{\gamma}_{1,J} = \sum_{t=1}^{TP} \gamma_{1,J,t} / TP$  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,  $t$ , I estimate a cross sectional regression of monthly returns of 25 ROE portfolios ( $R_{J,t,b}$ ) on Market/Book ( $M/B_{J,t,b}$ ) (separately for  $ROE_J, J=1,2,3$ ), where  $R_{J,t,b}$  is the monthly portfolio return and  $M/B_{J,t,b}$  is median Market/Book for portfolio  $b=1,2,\dots,25$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  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,  $\bar{\gamma}_{0,J} = \sum_{t=1}^{TP} \gamma_{0,J,t} / TP$ , and slope coefficients,  $\bar{\gamma}_{1,J} = \sum_{t=1}^{TP} \gamma_{1,J,t} / TP$  over the 404 statistical period months for  $ROE_1$  and  $ROE_2$  portfolios and 301 statistical period months for  $ROE_3$  portfolios.

**Figure 3.2 Returns Versus ROE and Returns Versus Market/Book**

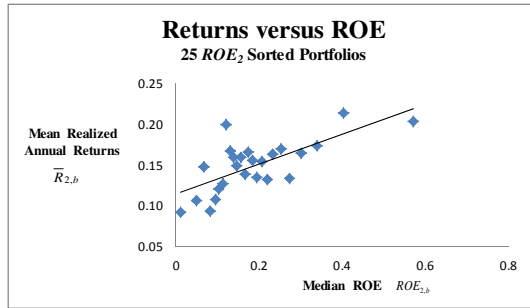
**Panel A**



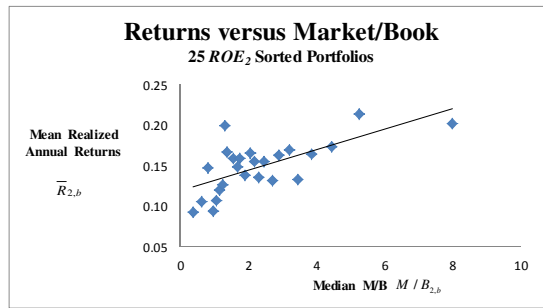
**Panel D**



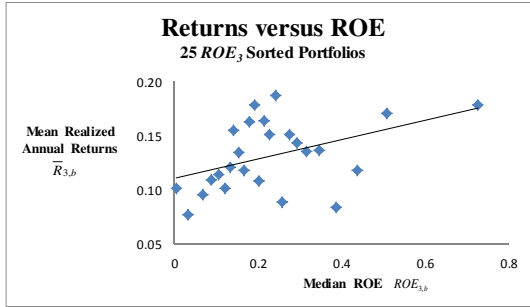
**Panel B**



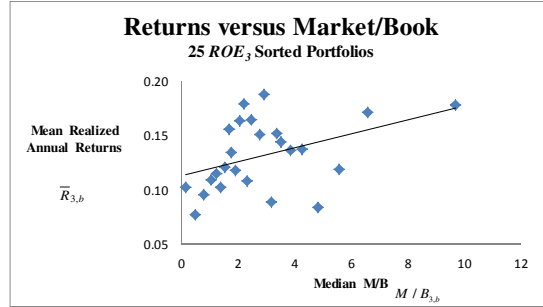
**Panel E**



**Panel C**



**Panel F**



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,  $M / B_{J,b}$ ,  $b=1,2,\dots,25$ , for  $J=1,2,3$ , respectively.



### 3.4.3 The Negative Value-Premium

Table 3.1 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 3.2 plot average annual portfolio returns,  $\bar{R}_{J,b}$ , against portfolio market/book ratios,  $M / B_{J,b}$ ,  $b=1,2,\dots,25$ , 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. I present statistical tests in the next subsection.

### 3.4.4 Testing the Relation Between Returns and Market/Book

I estimate Fama-MacBeth (1973) regressions of monthly returns of 25 *ROE* portfolios on their Market/Book ratio. In each statistical period month,  $t$ , I 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* <sub>$J$</sub> ,  $J=1,2,3$ ).

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

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

Panel B of Table 3.2 reports the average of cross-sectional estimated intercepts,  $\bar{\gamma}_{0,J} = \sum_{t=1}^{TP} \left( \gamma_{0,J,t} / TP \right)$ , and slope coefficients,  $\bar{\gamma}_{1,J} = \sum_{t=1}^{TP} \left( \gamma_{1,J,t} / TP \right)$ , 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.

### **3.5 Do Investors Recognize the Negative Value Premium for Non-Dividend Paying Stocks?**

In this section, I investigate whether investors anticipate a negative value premium for non-dividend paying firms. If I 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 3.2, my 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 3.1 suggest that both profitability and volatility are important determinants of returns. In this section, I investigate whether these relations are “abnormal” or subsumed in the factors used in standard asset pricing models by investigating portfolios that I form by a double sort of profitability ( $ROE$ ) and volatility on Statistical Period dates. I use past return volatility as

my volatility measure in this section,  $\sigma(RET)$ , but results are qualitatively similar for any of the volatility measures from Table 3.1.

I first sort firms into five *ROE* quintiles ( $k=1,2,\dots,5$ ), and then for each *ROE* quintile into five volatility portfolios ( $v=1,2,\dots,5$ ) at each statistical period date. This double sorting leads to twenty-five portfolios that I 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 I sort firms by *ROE* in three ways, with  $ROE_1$ ,  $ROE_2$ , and  $ROE_3$ , I investigate  $3 \times 25 = 75$  portfolios.

For firm  $i=1,2,\dots,N$ , in portfolio  $J=1,2,3$ ,  $k=1,2,\dots,5$ ,  $v=1,2,\dots,5$ , for statistical period month  $t=1,2,\dots,TP$ , where  $TP$  is the number of months in my test period,<sup>39</sup> I 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  $t=1,2,\dots,TP$ , for firm  $i=1,2,\dots,N$ , in portfolio  $J=1,2,3$ ,  $k=1,2,\dots,5$ ,  $v=1,2,\dots,5$ , for statistical period month  $t=1,2,\dots,TP$ , is,

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

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  $t+1$ .

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<sup>39</sup>  $TP$  is 404 for portfolio sets  $ROE_1$  and  $ROE_2$  and 301 for portfolio set  $ROE_3$ .

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

$$\bar{R}_{J,t,k,v} = \frac{1}{N} \sum_{i=1}^N R_{J,i,t,k,v}$$

### 3.5.1 Normal Returns

The negative value premium reported in Table 3.2 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. I test for abnormal returns in this section.

I use a conditional four factor asset pricing model to represent normal returns.<sup>40</sup> 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

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<sup>40</sup> I 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, I do not report results. Further, it is beyond the scope of my paper to search for new and better asset-pricing models.

factor is the return difference between portfolios of small and large cap firms. The CAPM justifies a market factor, which I 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), I 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 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 my sample period is over 33 years for  $ROE_1$  and  $ROE_2$ , and 25 years for  $ROE_3$ , I 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, I 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). I 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, I create monthly *SMB*, *HML*, *MOM*, and market risk factors (for statistical period months rather than calendar months) that I use to benchmark portfolios formed by a double sort of forward profitability (*ROE*) and volatility.

I risk-adjust the 25 *ROE* and volatility sorted portfolios with four risk factors in the regression model:

$$R_{J,t,k,v} - R_{f,t} = \alpha_{J,k,v} + s_{J,k,v}SMB_t + h_{J,k,v}HML_t + m_{J,k,v}MOM_t + \beta_{J,k,v}(R_{M,t} - R_{f,t}) + \varepsilon_{J,k,v}, \quad (3.3)$$

$$\begin{aligned} s_{J,k,v} &= s_{0,J,k,v} + s_{1,J,k,v}DY_{t-1} + s_{2,J,k,v}R_{f,t} \\ h_{J,k,v} &= h_{0,J,k,v} + h_{1,J,k,v}DY_{t-1} + h_{2,J,k,v}R_{f,t} \\ m_{J,k,v} &= m_{0,J,k,v} + m_{1,J,k,v}DY_{t-1} + m_{2,J,k,v}R_{f,t} \\ \beta_{J,k,v} &= \beta_{0,J,k,v} + \beta_{1,J,k,v}DY_{t-1} + \beta_{2,J,k,v}R_{f,t} \end{aligned} \quad k=1,2,\dots,5, v=1,2,\dots,5, t=1,2,\dots, TP \quad (3.4)$$

where  $R_{J,t,k,v}$  denotes the return on portfolio  $J=1,2,3$ ,  $k=1,2,\dots,5$ ,  $v=1,2,\dots,5$ , in month  $t = 1,2,\dots,TP$ ,  $R_{f,t}$  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 (3.4) into (3.3) 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. I test my 25 *ROE* and volatility sorted portfolios ( $J=1,2,3$ ,  $k=1,2,\dots,5$ ,  $v=1,2,\dots,5$ ) on the conditional four-factor model. Table 3.3 reports

abnormal returns,  $\hat{\alpha}$  s, of regression (3.3) and (3.4) for portfolios formed with *ROE* and volatility.

### 3.5.2 Null Hypothesis

In this section, I discuss multivariate tests of abnormal returns, the  $\hat{\alpha}$  s, of equation (3.3) and (3.4). The purpose of the Gibbons, Ross, and Shanken (1989) (GRS) test is to search for pricing errors in an asset pricing model. I 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<sup>41</sup>,  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha$ , 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 my case, Hansen's J statistic is  $\chi^2$  distributed with degree of freedom equal to 4 (number of restrictions minus one) for *ROE*<sub>1</sub>, *ROE*<sub>2</sub>, and *ROE*<sub>3</sub> portfolios.

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<sup>41</sup> 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.

**Table 3.3 Abnormal Returns**  
**Conditional Fama-French-Carhart Four-Factor Asset Pricing Model**

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

$$s_{J,k,v} = s_{0,J,k,v} + s_{1,J,k,v}DY_{t-1} + s_{2,J,k,v}R_{f,t} \quad h_{J,k,v} = h_{0,J,k,v} + h_{1,J,k,v}DY_{t-1} + h_{2,J,k,v}R_{f,t} \quad m_{J,k,v} = m_{0,J,k,v} + m_{1,J,k,v}DY_{t-1} + m_{2,J,k,v}R_{f,t} \quad \beta_{J,k,v} = \beta_{0,J,k,v} + \beta_{1,J,k,v}DY_{t-1} + \beta_{2,J,k,v}R_{f,t}$$

$$k=1,2,3,4,5, \quad v=1,2,3,4,5, \quad t=1,2,\dots, TP, \quad J=1,2,3$$

ROE Quintile	Ret-Vol Quintile	ROE <sub>1</sub>				ROE <sub>2</sub>				ROE <sub>3</sub>			
		$\alpha$	t( $\alpha$ )	Hansen's J (p-value)	GRS (p-value)	$\alpha$	t( $\alpha$ )	Hansen's J (p-value)	GRS (p-value)	$\alpha$	t( $\alpha$ )	Hansen's J (p-value)	GRS (p-value)
Lowest ROE k=1	Lowest Ret-Vol v=1	-0.0023	-1.49	3.50	<b>2.78</b>	<b>-0.0054</b>	<b>-2.91</b>	5.92	<b>2.73</b>	-0.0043	-1.69	0.49	0.83
	v=2	-0.0030	-1.76	(0.4783)	<b>(0.0177)</b>	-0.0025	-1.27	(0.2056)	<b>(0.0192)</b>	-0.0033	-1.20	(0.9743)	(0.5282)
	v=3	<b>-0.0045</b>	<b>-2.75</b>			<b>-0.0049</b>	<b>-2.55</b>			-0.0034	-1.14		
	v=4	-0.0010	-0.47			-0.0007	-0.29			-0.0028	-1.01		
	Highest Ret-Vol v=5	<b>-0.0050</b>	<b>-2.15</b>			-0.0017	-0.81			-0.0005	-0.10		
k=2	Lowest Ret-Vol v=1	-0.0021	-1.16	0.72	1.36	-0.0035	-1.74	1.80	0.84	-0.0004	-0.18	4.81	0.99
	v=2	-0.0025	-1.62	(0.9487)	(0.2378)	-0.0018	-0.86	(0.7733)	(0.5197)	-0.0029	-1.22	(0.3070)	(0.4261)
	v=3	-0.0017	-1.05			-0.0002	-0.11			0.0029	0.95		
	v=4	-0.0020	-1.02			-0.0032	-1.73			0.0000	0.00		
	Highest Ret-Vol v=5	-0.0036	-1.70			-0.0008	-0.31			-0.0053	-1.41		
k=3	Lowest Ret-Vol v=1	-0.0024	-1.56	4.08	0.77	-0.0010	-0.68	5.88	1.17	-0.0043	-1.80	7.19	1.33
	v=2	-0.0001	-0.07	(0.3958)	(0.5728)	0.0018	0.96	(0.2084)	(0.3233)	0.0001	0.02	(0.1264)	(0.2495)
	v=3	0.0019	1.12			0.0023	1.24			0.0017	0.63		
	v=4	0.0001	0.06			-0.0016	-0.89			0.0060	1.79		
	Highest Ret-Vol v=5	-0.0002	-0.10			-0.0028	-0.87			0.0022	0.56		
k=4	Lowest Ret-Vol v=1	0.0007	0.56	7.59	1.65	0.0015	0.80	1.53	0.35	0.0007	0.30	2.48	0.96
	v=2	0.0007	0.40	(0.1076)	(0.1463)	0.0006	0.33	(0.8208)	(0.8853)	0.0006	0.24	(0.6476)	(0.4452)
	v=3	0.0010	0.66			-0.0001	-0.03			0.0048	1.73		
	v=4	<b>0.0053</b>	<b>2.93</b>			0.0027	1.51			0.0049	1.40		
	Highest Ret-Vol v=5	-0.0003	-0.13			0.0012	0.53			0.0048	1.02		
Highest ROE k=5	Lowest Ret-Vol v=1	0.0025	1.56	7.08	<b>2.55</b>	0.0027	1.54	6.19	<b>1.83</b>	0.0039	1.46	5.57	1.48
	v=2	<b>0.0039</b>	<b>2.26</b>	(0.1315)	<b>(0.0274)</b>	0.0035	1.79	(0.1857)	<b>(0.1057)</b>	-0.0007	-0.22	(0.2339)	(0.1951)
	v=3	<b>0.0064</b>	<b>3.01</b>			<b>0.0060</b>	<b>2.58</b>			<b>0.0081</b>	<b>2.13</b>		
	v=4	0.0011	0.59			0.0014	0.59			0.0020	0.55		
	Highest Ret-Vol v=5	0.0020	0.91			-0.0001	-0.04			0.0037	0.89		

Notes:  $R_{J,t,k,v}$  denotes the return on portfolio  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ , in month  $t=1,2,\dots, TP$ , for portfolio sets  $ROE_J$ ,  $J=1,2,3$ .  $R_{f,t}$ , the riskless rate, is the yield on a US Government 1-month Treasury bill,  $R_{M,t}$ , the return on the market portfolio, is the return on the CRSP value weighted index of common stocks in month  $t$ ,  $SMB_t$  and  $HML_t$  are the small-minus-big and high-minus-low Fama-French factors,  $MOM_t$  is the momentum factor in month  $t$ , and  $DY_{t-1}$  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.



### 3.5.3 Abnormal Returns

I now turn to abnormal return evidence—non-zero alphas—for the portfolios formed with *ROE* and volatility. Table 3.3 reports abnormal returns from the conditional Fama-French-Carhart four factor asset pricing model.

In Table 3.3,  $\hat{\alpha}$  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.

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*<sub>1</sub>, *ROE*<sub>2</sub>, and *ROE*<sub>3</sub> 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.

If alpha estimates from the conditional 4-factor Fama-French-Carhart model suggest abnormal returns, then an interesting question is why I do not use an estimated version of my theoretical model for benchmarking realized returns. In the entire financial

literature, when enough evidence accumulates on pricing errors of linear models, then it will be time to abandon them. Until then, abandoning linear models in favor of non-linear models is premature. The evidence I present is part of the process of accumulating evidence that a non-linear model like mine is a better representation of expected equity return than is possible from a linear model.

### **3.6 Conclusion for Chapter 3**

I 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. My 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 Chapter 2. 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 I report evidence of a negative value-premium for non-dividend paying firms.

Like any good empirical analysis, my study suggests avenues for future research. First, because my dynamic equity valuation model presumes a geometric Brownian motion for *ROE*, and thus, because *ROE* is always positive, one of the screens I impose

on firms for inclusion in my 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 I investigate in the current Chapter. 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 Chapter, 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<sup>42</sup> and *EVA*<sup>®</sup>.<sup>43</sup> 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. I use expected return in my dynamic equity valuation model in equation (3.1) only for guidance for testing the negative value-premium hypothesis for non-dividend paying firms. However, with appropriate heuristics

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<sup>42</sup> Residual income is accounting earnings less book equity times the required equity return.

<sup>43</sup> *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).

and approximations, I could develop this theoretical measure into one that could be useful in cost of capital calculations. If my purpose is to develop an unbiased measure of expected return, then the results I report in Table 3.1 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 I 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 I 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 I presume in the current Chapter. I suspect that I 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 3A

In this appendix, I 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 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,

$$dB_t/B_t = \begin{cases} g, & \text{growth constrained by business opportunitites} \\ ROE, & \text{growth contrained by financing} \\ 0, & \text{no growth} \end{cases} \quad (A3.1)$$

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,

$$dROE_t/ROE_t = \sigma dz, \quad (A3.2)$$

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,  $E\left[ROE_t\right] = ROE_0$ .

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.<sup>44</sup> However, this is not the nature of the investment I study. In my 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 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  $X_t$  is

$$dX_t/X_t = \begin{cases} gdt + \sigma dz, & \text{growth constrained by business opportunities} \\ ROEdt + \sigma dz, & \text{growth constrained by financing} \\ \sigma dz, & \text{no growth} \end{cases} \quad (A3.3)$$

The risk-adjusted process,  $X'$ , for earnings is,

$$dX'_t/X'_t = \begin{cases} (g - \theta\sigma_{x,c})dt + \sigma dz, & \text{growth constrained by business opportunities} \\ (ROE - \theta\sigma_{x,c})dt + \sigma dz, & \text{growth constrained by financing} \\ -\theta\sigma_{x,c}dt + \sigma dz, & \text{no growth} \end{cases} \quad (A3.4)$$

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<sup>44</sup> 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,  $IRR = ROE+g$ .

where  $\theta \geq 0$  is the coefficient of constant relative risk aversion for a representative investor,  $\sigma_{xc}$  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), I combine the process for equity capital in equation (A3.1) with the risk-adjusted process for earnings in equation (A3.4), to develop an ordinary differential equation (with 3 branches) for the market to book ratio,

$$r\pi = \begin{cases} (ROE - g) - \theta\sigma_{x,c}ROE\pi' + \frac{\sigma^2}{2}ROE^2\pi'' + g\pi, & \text{growth constrained by business opportunitites} \\ -\theta\sigma_{x,c}ROE\pi' + \frac{\sigma^2}{2}ROE^2\pi'' + ROE\pi, & \text{growth contrained by financing} \\ ROE - \theta\sigma_{x,c}ROE\pi' + \frac{\sigma^2}{2}ROE^2\pi'', & \text{no growth} \end{cases} \quad (A3.5)$$

The left-hand side of equation (A3.5) 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 (A3.5) 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 ( $\sigma^2ROE^2\pi''/2$ ), 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 (A3.5) 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 (A3.5) 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 my 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  $g dt$  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,  $ROE dt$  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 (A3.5), branch by branch, is,

$$\pi = \begin{cases} \frac{ROE}{r^* - g} - \frac{g}{r - g} + c_1 ROE^{\lambda_1}, & ROE > \xi^*, \text{ growth} = g, \\ c_2 ROE^{\lambda_2} BesselJ\left(\phi, \frac{2\sqrt{2}\sqrt{ROE}}{\sigma}\right) + c_3 ROE^{\lambda_2} BesselY\left(\phi, \frac{2\sqrt{2}\sqrt{ROE}}{\sigma}\right), & \psi^* \leq ROE \leq \xi^*, \text{ growth} = ROE, \\ \frac{ROE}{r^*} + c_4 ROE^{\lambda_3}, & ROE < \psi^*, \text{ growth} = 0 \end{cases} \quad (A3.6)$$



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

where,

$$\lambda_2 = \frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2}$$

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

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

$$r^* = r + \theta\sigma_{x,c}$$

and,  $c_1, c_2, c_3, c_4$  are arbitrary constants.

On the “growth constrained by business opportunities” branch of equation (A3.6), 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 (A3.6), 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,  $c_4 ROE^{\lambda_3}$  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 (A3.6) 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  $\zeta^*$ .

My 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 (A3.6),  $c_1$ ,  $c_2$ ,  $c_3$ , and  $c_4$ . Smooth pasting and value matching conditions at  $\xi$  and  $\psi$  give me four relations:

$$\begin{aligned}
 \pi_g(\xi) &= \pi_{ROE}(\xi) \\
 \pi'_g(\xi) &= \pi'_{ROE}(\xi) \\
 \pi_g(\psi) &= \pi_0(\psi) \\
 \pi'_g(\psi) &= \pi'_0(\psi)
 \end{aligned}
 \tag{A3.7}$$

where  $\pi_g$ ,  $\pi_{ROE}$ , and  $\pi_0$  are the market to book ratios in the upper, middle, and lower branches of equation (A3.6), 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 (A3.7) 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  $\psi$ . I 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 (A3.7).

I need two more relations to ensure value maximization. I maximize the value function  $\pi$  on the “growth constrained by financing” branch of equation (A3.6) with respect to  $\xi$ , and  $\psi$ .

$$\begin{aligned}
 \frac{\partial \pi_{ROE}(\xi)}{\partial \xi} &= 0 \\
 \frac{\partial \pi_{ROE}(\psi)}{\partial \psi} &= 0
 \end{aligned}
 \tag{A3.8}$$

Equation (A3.8) has an expression in terms of model parameters and  $\zeta$  and  $\psi$ . However, because this expression is long, I do not report it. Equations (A3.7) and (A3.8) are non-linear in  $\zeta$  and  $\psi$ , and therefore, there is no closed form solution for the value maximizing R&D return thresholds,  $\zeta^*$  and  $\psi^*$ . However, with numeric values for model parameters, the joint solution to equations (A3.7) and (A3.8) give a numeric solution for the value maximizing return thresholds for expansion at the rate  $g$ ,  $\zeta^*$ , and the value maximizing expansion threshold for expansion at the rate  $ROE$ ,  $\psi^*$ . For a set of presumed parameters, Panel A of Figure 3.1 plots the value function  $\pi$  in its three regions as the  $ROE$  increases from 0 to 20%.

# CHAPTER 4: FINANCIAL DISTRESS AND THE VALUE PREMIUM

## Abstract

The “value-premium” is the empirical observation that returns are higher for low market/book “value” stocks than they are for high market/book “growth” stocks. I show that distress-risk is part of the reason for the value-premium despite the commonly reported anomalous observation that high distress-risk firms have low returns. Profitability impacts two risks in opposite ways, it decreases distress-risk but it increases growth-leverage. Thus, high profitability firms with low distress-risk and high growth-leverage can have higher returns than low profitability firms with high distress-risk and low growth-leverage. The value-premium arises from a U-shaped relation between returns and profitability and a hill-shaped relation between market/book and profitability. When market/book is low (high or low profitability), returns are high. I develop these relations and report confirming evidence.

## 4.1 Introduction

I investigate the value premium for firms in financial distress. In a dynamic equity valuation model that I use for guidance, expected return is the forward earnings yield plus a term that depends upon earnings volatility. The relation between returns and profitability (the forward rate of return on equity, *ROE*) is U-shaped. At low profitability, *ROE* relieves financial distress which decreases equity returns. At high profitability, *ROE* increases the likelihood of growth which increases risk and increases return. Consistent with these predictions, I find strong evidence of both of relations. On the face of it, one would not expect a value premium—high returns for low market/book “value”

stocks—from a U-shaped relation between returns and profitability. Any reasonable equity valuation model, including the one that I use, predicts a positive relation between market/book and profitability, *ROE*. Thus, depending upon where firms in a particular sample fall along this U-shaped curve, returns and market/book might relate positively or negatively, but this relation is unlikely to be strong or persistent.

I find that *ROE* initially increases but then decreases market/book. A negative relation between *ROE* and market/book suggests that *ROE* changes an economic factor that I presume fixed in my theoretical model. I find that *ROE* decreases volatility of operating earnings for firms in financial distress. This decrease in volatility does not arise solely from a fall in financial leverage because it occurs for not only for earnings but also for operating earnings before interest. Rather, consistent with Jensen and Meckling (1976), I argue that managers “risk-shift” into higher risk business investments with financial distress because they put creditors’ (rather than shareholders’) capital at risk with impunity. This behavior is consistent with the view that distress-risk accentuates the call option features of common equity. As *ROE* decreases volatility, value falls because lower volatility decreases call option value. Thus, for firms in financial distress, but with relatively great *ROE*, earnings-volatility is low, value is low, and market/book is low. For both exceptionally low *ROE* and high *ROE* (amongst the firms in financial distress that I study), market/book is low. There is a hill-shaped relation between market/book and profitability. Along with a U-shaped relation between returns and profitability, there is a value premium for firms in financial distress. When market/book is low (high or low profitability), returns are high.

Katz, Lilien, and Nelson (1985), Dichev (1998), Griffin and Lemmon (2002), and Campbell, Hilscher and Szilagyi (2008) report an anomalous empirical observation that firms in financial distress have lower returns than firms not in financial distress. Consequently, Griffin and Lemmon (2002) conclude that the value-premium does not arise from financial distress. I show that the value premium arises in part because of distress-risk despite the fact that returns can be lower for firms with greater distress-risk. I investigate two types of risk: distress-risk and growth-leverage. Profitability decreases distress-risk but increases growth-leverage. High profitability firms with low distress-risk and high growth-leverage can have higher returns than low profitability firms with high distress-risk and low growth-leverage.

Garlappi and Yan (2011) argue that shareholder recovery in resolution of financial distress reduces distress risk which reduces returns. This lower risk for extreme financial distress makes the relation between returns and the probability of financial distress hill-shaped. There are several differences between Garlappi and Yan (2011) and this Chapter. First, Garlappi and Yan (2011) search only for relations between financial distress and returns. In my study, corporate profitability impacts two types of risk. It decreases financial distress, but it increases growth-leverage. Second, as financial health of firms improve (Garlappi and Yan's estimate of the probability of financial distress decreases), returns increase and then decrease. My empirical results are effectively opposite. In my intimate investigation of financial distress, I find that as the financial health of firms improves (profitability increases), returns decrease and then increase. The relation between profitability and returns is U-shaped. Third, I intimately investigate the returns of firms in financial distress rather than the entire cross-section of returns.

Combined risk, distress risk and growth-leverage, is at a minimum when forward *ROE* is approximately zero. Thereafter, returns increase with profitability which suggests that for firms in better financial health, that is, with greater profitability, the dominate risk in the determination of returns is growth-leverage. So, the impact of profitability on these two types of risk is best studied for low profitability firms rather than in the entire cross-section. Forth, my explanation for low returns for firms in financial distress is quite different than Garlappi and Yan's explanation. They argue that the likelihood of shareholder recovery makes distress risk low and, therefore, returns low when the likelihood of financial reorganization is highest. I argue that returns are not really that low for firms in financial distress. They are just lower than for firms that have high growth-leverage from higher profitability. This contention is supported by a U-shaped relation between returns and profitability.

There are a number of explanations for the value-premium: profitability, growth-option exercise, investment irreversibility, and limits to growth. First, Fama and French (1995, 1998) argue that the value-premium reflects financial distress from poor profitability. In Carlson, Fisher, and Giammarino (2004) and Garcia-Feijoo and Jorgensen (2007), operating leverage (which depends on profitability) increases returns but decreases market/book. Second, Anderson and Garcia-Feijoo (2006) argue that the exercise of growth-options by high market/book firms decreases risk and return. In Fama and French (2007), growth-option exercise reduces market/book for growth-firms and restructuring improves market/book for value-firms. This market/book convergence means lower returns for high market/book growth-stocks and higher returns for low

market/book value-stocks. Third, Zhang (2005) argues that the irreversibility of in-place assets makes value-firms riskier than growth-firms.

Fourth, Chapter 2 argues that the source of the value-premium is limits to growth. In Arrow (1974), organizational limits mean that managers cannot undertake all possible wealth creating business investments that they uncover. These limits restrict managers from using high profitability for further business investment, and, instead, this profitability “covers” ongoing growth capital expenditures. This coverage reduces risk. Consequently, high profitability growth-firms, with great market/book, have lower risk and lower return than value-firms. Chapter 2 reports supporting evidence for profitable dividend paying companies. In the pecking order hypothesis for corporate financing, companies pay dividends from “excess” profit (beyond what they need to finance growth). On the other hand, the decision by 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 firms to finance internally when they cannot finance externally which increases growth, growth-leverage, and expected return. Thus, Chapter 3 argues that high market/book non-dividend paying growth firms have high profitability and high returns. Chapter 3 reports evidence of this negative value-premium for profitable non-dividend paying stocks.

Results in Chapter 2 and Chapter 3 illustrate that some classes of firms have, and others do not have, a value premium. In either cases, I design the analysis for firms not in financial distress. For example, one of the sample selection criteria is that firms have positive trailing-twelve-month earnings. This Chapter differs because I study firms in



financial distress. Further, my explanation of the value-premium for firms in financial distress is distinct from the explanation for profitable dividend paying firms.

For firms in financial distress, I investigate the conditions under which value or growth stocks are more risky with expected rates of return that are higher as a result. Even if the risk difference between value and growth stocks is fully explained by an empirical asset-pricing model, the reason that value or growth stocks are more risky is important for my understanding of financial markets. Nonetheless, I find evidence of negative abnormal returns for the least risky amongst the firms in financial distress that I study—those with intermediate profitability (neither low nor high). Thus, effectively I find evidence of a value-premium for firms in financial distress for both raw and abnormal returns. The combination of these results suggests that the economic phenomenon that I investigate is very strong and is not hidden by other types of risk.

The rest of my paper is organized as follows. In section 4.2, I develop a dynamic equity valuation model for firms in financial distress which predicts a U-shaped relation between returns and profitability, *ROE*. In sections 4.3 and 4.4 I empirically investigate the relation between the value premium and corporate profitability for firms in financial distress. In section 4.5, I investigate whether or not investors and/or current asset-pricing models recognize the U-shaped relation between returns and profitability. Because this is my third in a set of three research papers on the value-premium, Section 4.6 summarizes and relates my findings across all of these papers.

## **4.2 Dynamic Financial Analysis**

### **4.2.1 Preliminaries**

When earnings growth requires capital growth, Blazenko and Pavlov (2009) value the assets of a business whose manager has a dynamic option to suspend and recommence growth indefinitely. If the return on capital (*ROC*) falls below a value-maximizing threshold, the manager suspends growth. If *ROC* rises above this threshold, the manager recommences growth at a fixed rate  $g > 0$ . Blazenko and Pavlov use this model to show that the endogenously determined cost of capital uniformly exceeds the value maximizing threshold for growth which means that the cost of capital is an unduly conservative benchmark for 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  $g$ . Appendix 4A describes Blazenko and Pavlov's (2009) model of asset valuation.

### **4.2.2 Equity Valuation**

Chapter 2 and Chapter 3 presume that a business manager maintains a target financial structure by increasing debt at the rate  $g\%$  per annum to finance growth investment when he/she grows a firm and, alternatively, uses operating cash flow to repay debt (de-levers) at the rate  $g\%$  per annum when he/she suspends growth. Because the manager de-levers upon poor profitability, equity-holders never default and the firm is never in financial distress. Since in Chapter 2 and Chapter 3, I restrict my empirical investigation to firms that are not in financial distress, this modeling is appropriate.

To make my financial-distress modeling as simple as possible I make a number of assumptions. First, because I investigate firms in financial distress, I presume that when

the manager grows the business he/she grows capital, debt, and book equity at the rate  $g\%$  per annum. Alternatively, the manager pays interest on accumulated debt without reducing principal when he/she suspends growth. In either case, the manager maintains a target financial structure (with respect to book capital and book equity). Debt grows as the business grows, but principal never decreases. Financial distress for shareholders arises from constant dollar per annum interest payments despite profit deterioration and despite growth suspension by the manager.

Second, I do not consider agency issues and instead presume that despite the existence of debt in the financial structure of the firm, the manager's objective in operating the business is to maximize asset-value (the so-called "first-best" solution for the firm's value maximization problem) rather than maximize equity-value (the so-called "second-best" solution). So, despite the existence of debt in the financial structure of the firm, Equation (A4.3) gives the manager's value-maximizing *ROC* threshold for business growth.

Third, the lender requires principal repayment from the borrower on demand. Because the lender has this demand feature, it is a *call* loan which I refer to *callable*.<sup>45</sup> The manager never defaults on debt, but instead, creditors call the loan when asset-value falls to principal on debt. Since the equity-value goes to zero at the call of debt, the likelihood of this event creates distress-risk for shareholders. I use call loans because otherwise modeling requires the joint determination of second-best optimal return

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<sup>45</sup> Commercial loans often have a demand option for lenders. This loan feature is distinct from the *call* feature of many publicly traded bonds that gives the borrower the right to repay principal prior to maturity (subject to contract terms). At the same time, most publicly traded bonds, regardless of whether or not they have a call feature, have covenants in the bond indenture agreement that require the borrower maintain credit related ratios at minimum levels. In violation of these covenants, the borrower is in default of the bond agreement and bondholders can seek remedy which is effectively a demand option for repayment of principal.

thresholds for corporate growth and for default on non-callable debt. In addition, if I use non-callable debt and recognize the possibility of optimal default by managers at the expense of creditors, then, I need to face the tricky issue of the default spread for newly issued debt as the firm grows. With callable debt, because the lender never loses principal, the interest rate on debt is the riskless interest rate. Since the modeling complexities of non-callable debt are more than I require to motivate my empirical analysis, I use callable debt.<sup>46</sup>

Fourth, I model neither transactions costs nor taxes that would make debt more or less attractive relative to equity in the financial structure of the firm. Since I consider no “dead-weight” costs, creditors sell the business upon call of debt at a price equal to asset-value given by Equation (A4.1) per dollar of capital to recover principal. New shareholders restructure the debt of the firm, but  $\pi_c$  in Equation (A4.1), which Panel A of Figure 4.1 depicts, continues to represent asset-value per dollar of capital (even to the left of the call threshold at the far left-hand side of Panel A). Because creditors call the loan when asset-value falls to the principal on debt, their principal is never at risk. Thus, the interest rate on debt is the riskless rate,  $r$ .

Last, I presume that the manager maintains a debt/capital ratio in book terms,  $0 < \gamma < 1$ . Because my economic environment is consistent with Modigliani and Miller (1958), there is no optimal financial structure for the business. To maintain this ratio, when the manager grows the business, debt and book equity both grow at the rate  $g$ . On

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<sup>46</sup> Regardless of the type of debt that one might use there is a U-shaped relation between returns and profitability in any corporate growth model when managers do not decrease debt as profitability falls. Profitability always impacts two types of risk. When profitability is low, distress-risk is high and thus returns are high. At the other extreme, when profitability is high, growth-leverage is high and returns are high as well.

the other hand, when the manager suspends business growth, he/she neither alters principal on debt nor changes book equity. Constant book equity requires that the manager pay dividends equal to positive net income (a 100% payout ratio) and finance net income deficits with equity infusions from new or existing shareholders.

The return on capital,  $ROC=Y$ , is a weighted average of the interest rate on debt,  $r$ , and the rate of return on equity,  $ROE$ , with the debt/capital ratio as the weight on debt,

$$ROE = \frac{Y - r\gamma}{1 - \gamma} \quad (4.1)$$

I can state the manager's value maximizing  $ROC=Y$  growth threshold as a value maximizing  $ROE$  growth threshold. Define this  $ROE$  threshold as  $\xi_e^*$ . Then,

$$\xi_e^* = \frac{\xi_c^* - r\gamma}{1 - \gamma} \quad (4.2)$$

When  $ROE$  exceeds  $\xi_e^*$ , the manager grows the business at the rate  $g$  with capital growth at the rate  $g$ . When  $ROE$  is less than  $\xi_e^*$ , the manager suspends growth ( $g=0$ ) until profitability improves.

The market/book ratio for equity, which I denote as  $\pi_e(ROE)$ , is related to the market/book for capital,  $\pi_c(Y)$ . Because the interest rate on debt matches its opportunity cost (the riskless interest rate), the market value of debt is always equal its book-value (principal).<sup>47</sup> Because asset-value is debt-value plus equity-value,

$$\pi_e(ROE) = \frac{\pi_c(Y) - \gamma}{1 - \gamma} \quad (4.3)$$

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<sup>47</sup> This is also true, even though corporate debt might grow in the future, because new debt issues are “zero-NPV” investments for new creditors. This financing does not either create or destroy wealth for shareholders.

Creditors call the loan when asset-value equals principal on debt. Define the call threshold as the return on capital at which creditors call the loan,  $Y = \psi_c^*$ . Then,

$$\pi_c(\psi_c^*) = \gamma \quad (4.4)$$

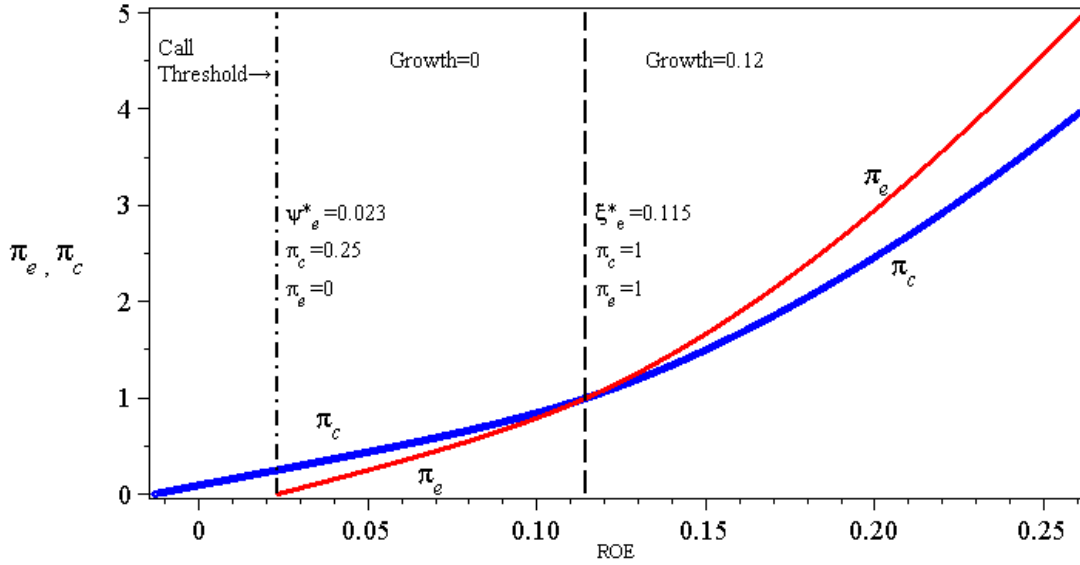
Creditors call the loan when market/book for capital equals the manager's target debt/capital ratio. Equivalently, the call threshold in terms of *ROE* is,

$$\psi_e^* = \frac{\psi_c^* - r\gamma}{1 - \gamma}$$

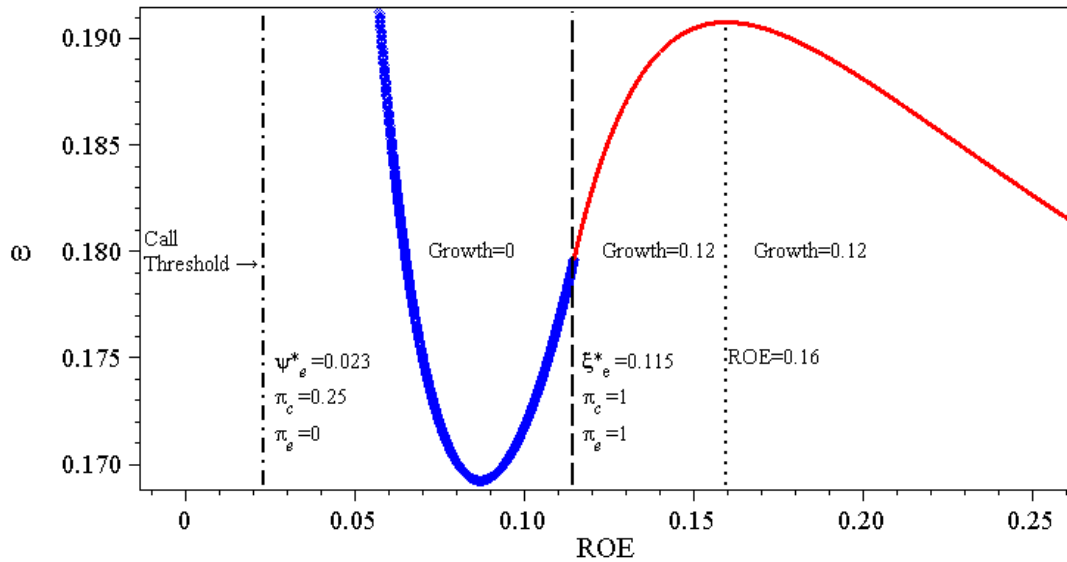
At the *ROE* call threshold,  $\psi_e^*$ , the market value of equity is zero,  $\pi_e(\psi_e^*) = 0$ , which is the source of financial distress for shareholders.

**Figure 4.1 Market/Book , and Expected Return ( $\omega$ ) Versus  $ROE$**

**Panel A: Market/Book ( $\pi_e$  and  $\pi_c$ ) Versus  $ROE$**



**Panel B: Expected Return ( $\omega$ ) Versus  $ROE$**



*Notes:* In Panel A,  $\pi_e$  and  $\pi_c$  are market/book ratios for equity and capital respectively. In Panel B,  $\omega$  is expected equity return. Parameter values in these plots are:  $g=0.12$  (maximum corporate growth),  $r^*=0.11$  (cost of capital for a firm that hypothetically never grows),  $\sigma=0.2$  (earnings volatility),  $r=0.04$  (the riskless rate of interest),  $\gamma=0.25$  (debt to asset ratio).

For a numerical example, Panel A of Figure 4.1 plots both market/book for equity and capital ( $\pi_e$  and  $\pi_c$ ) with respect to  $ROE$ . In this example, parameter values are:  $g=0.12$  (maximum corporate growth),  $r^*=0.11$  (cost of capital for a firm that hypothetically never grows),  $\sigma=0.2$  (earnings volatility),  $r=0.04$  (the riskless rate of interest),  $\gamma=0.25$  (debt to capital ratio). The value maximizing  $ROE$  threshold for corporate growth is  $\xi_e^* = 0.115$ . At this growth threshold, both capital and equity market/books equal one,  $\pi_e = 1$  and  $\pi_c = 1$ . The  $ROE$  threshold for calling the loan is  $\psi_e^* = 0.023$ . This threshold is positive because shareholders will not infuse money into a business when they are about to lose it to a creditor call. At the call threshold, market/book for equity is zero,  $\pi_e = 0$ , and market/book for capital is the target debt/capital ratio,  $\pi_c = 0.25$ . When the manager grows the business,  $ROE \geq \xi_e^* = 0.115$ , market/book for equity exceeds market/book for capital,  $\pi_e \geq \pi_c$ . On the other hand, when the manager suspends growth,  $ROE < \xi_e^* = 0.115$ , market/book for capital exceeds market/book for equity,  $\pi_e < \pi_c$ . Note that the relation between market/book (for either capital or for equity) and  $ROE$  in Panel A is strictly positive. Profitability increases market/book.

### 4.2.3 Equity Return

Expected equity return is operating profit per dollar of capital (the rate of return on capital,  $ROC=Y$ ), less growth expenditures (if incurred) less interest plus expected capital gain from changes in operating profit, all divided by value per dollar of book



equity (equity market/book). Denote  $\omega(ROE)$  as the expected return on equity. Using Ito's lemma with Equation (A4.1) and stating results with both  $ROE$  and market/book for equity,  $\pi_e$ , expected return is:

$$\omega(ROE) = \begin{cases} \frac{ROE}{\pi_e} + \frac{1}{2} \frac{\pi_e''}{\pi_e} \sigma^2 \left( ROE + \frac{r\gamma}{(1-\gamma)} \right)^2, & \text{suspend growth, } \psi_e^* < ROE < \xi_e^*, \\ ROE + (1-\pi_e) \left( \frac{ROE-g}{\pi_e} \right) + \frac{1}{2} \frac{\pi_e''}{\pi_e} \sigma^2 \left( ROE + \frac{r\gamma}{(1-\gamma)} \right)^2, & \text{growth, } ROE \geq \xi_e^* \end{cases} \quad (4.5)$$

Return matching between branches of Equation (4.5) ensures no arbitrage (Shackleton and Sødal, 2005). This condition means that market/book is one at the growth threshold,  $\pi_e(\xi_e^*) = 1$ .

The lower branch of Equation (4.5) represents profitable growth firms. Capital expenditure for growth levers business risk. I call this risk growth-leverage. Panel B of Figure 4.1 plots expected return versus  $ROE$ . Once profitability,  $ROE$ , crosses the growth threshold,  $ROE \geq \xi_e^* = 11.5\%$ , the manager grows the business. As  $ROE$  increases, expected return,  $\omega(ROE)$ , increases until  $ROE = 0.16$  (approximately). For  $0.115 \leq ROE \leq 0.16$ , profitability increases the likelihood of remaining in the growth state with continuing growth-leverage. This increasing likelihood of growth risk increases expected return,  $\omega$ . Because growth is limited (12% in Figure 4.1), when profitability is sufficiently high (about 16%  $ROE$ ), profitability “covers” the fixed capital costs of growth which decreases risk and return. In Chapter 2, I call this hill-shaped relation between returns and profitability the “limits-to-growth hypothesis” for equity returns. It is consistent with, but does not guarantee a value premium. High profitability growth firms, at the right-most section of Panel B have low returns. High profitability growth firms do

not need this profitability to fund growth, but instead it “covers” the ongoing costs of growth capital expenditures which decreases risk and return compared to value firms. Value firms with lower profitability (for example,  $ROE$  of around 16%), have returns near their local maximum in Panel B. In the study of profitable dividend paying companies, Chapter 2 reports evidence of this value premium.

My principal attention for equity returns in the current Chapter is for firms in financial distress with low profitability in the upper branch of Equation (4.5). Equity return is earnings yield (that is,  $ROE/\pi_e$ ), plus a term that depends upon earnings volatility,  $\sigma$ . This return,  $\omega$ , combines risk premiums for financial distress and for growth-leverage. As  $ROE$  deteriorates from the right in Panel B of Figure 4.1 to the call threshold,  $ROE = \psi_e^*$ , return,  $\omega$ , increases without bound because of extreme financial distress. At the same time, equity-value,  $\pi_e$ , approaches zero. On the other hand, as  $ROE$  increases towards the growth threshold,  $\xi_e^*$ , return increases because of increasing likelihood that the manager will commence business growth and incur growth-leverage. The relation between returns and profitability is U-shaped. At low profitability,  $ROE$  relieves financial distress which decreases equity returns. At high profitability (but still in the growth suspension state),  $ROE$  increases the likelihood of growth which increases risk and return.

In the following section, I test for a U-shaped relation between returns and profitability for firms in financial distress and investigate the connection of this curve with the value-premium.

## 4.3 Data, Portfolio Formation, and Portfolio Characteristics

### 4.3.1 Data

In this section, I test for a U-shaped relation between returns and profitability for firms in financial distress. I retrieve data from the *COMUSTAT*, *CRSP*, and Thomson *I/B/E/S* databases. *COMPUSTAT* is my source for book equity<sup>48</sup> (*BVE*), reported earnings (*EPS*), and other corporate financial data. I use *CRSP* for split factors, shares outstanding, daily share price, and daily returns. I use Thomson *I/B/E/S* for reported *EPS* and consensus analysts' *EPS* forecasts.<sup>49</sup> Finally, I use Ken French's website<sup>50</sup> to retrieve daily portfolio and risk-less rate data for benchmarking forward earnings yield, EPS/P, based portfolios.

### 4.3.2 Sample Selection and the Empirical Definition of Financial Distress

I constrain my study to publicly traded companies that have data from *COMPUSTAT*, *CRSP*, and Thomson *I/B/E/S*. These are US, foreign interlisted companies, and American Depositary Receipts (ADRs)<sup>51</sup> that trade on US exchanges. Because *ROE* requires division by book value of equity (*BVE*), I require positive *BVE* from the latest reported quarterly or annual financial statements immediately prior to portfolio inclusion.

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<sup>48</sup> Book equity (*BVE*) is Total Assets less Total Liabilities less Preferred Stock plus Deferred Taxes and Investment Tax Credits (from the *COMPUSTAT* quarterly file).

<sup>49</sup> 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 Research in Security Prices: Graduate School of Business, University of Chicago. The acronym *I/B/E/S* stands for Institutional Brokers Estimate System. I use the *I/B/E/S* summary statistics file and the actual data file, both of which are unadjusted for stock splits and stock dividends. I use *CRSP* daily cumulative stock factors to adjust for splits and stock dividends.

<sup>50</sup> [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data\\_Library](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library)

<sup>51</sup> If not in US dollars, I convert the accounting data (historical or forecast) of foreign interlisted companies and ADRs into US dollars.

I would like to define financial distress as those firms in the left-most section of Panel B of Figure 4.1 that have suspended growth. However, it is difficult to empirically identify firms that have suspended growth.

In my theoretical model of the previous section, return on equity is always positive because the call threshold is positive. The call threshold is positive because shareholders will not increase their investment in a business whose debt is about to be called. This feature of my model gives me financial distress for positive profitability, *ROE*. That is, equity value approaches zero at positive *ROE*. Of course, in actual financial markets, not all debt is callable. Managers have some discretion over optimal default for non-callable debt. For non-callable debt, the manager will optimally default only if *ROE* is negative. A manager never gives up on a business that covers its interest payments. Thus, for empirical purposes, I need a less restrictive definition of financial distress than I use in my theoretical model. I use negative trailing-twelve-month reported earnings at the time of portfolio formation as my definition of financial distress. Because Chapter 2 and Chapter 3 use positive trailing-twelve-month earnings for dividend paying and non-dividend paying firms as the primary selection criterion, respectively, the sample in this Chapter is entirely distinct from Chapter 2 and Chapter 3.

There are other measures of financial distress. For example, Katz, Lilien, and Nelson (1985), Dichev (1998), and Griffin and Lemmon (2002) use Z-scores and O-scores to investigate relations between stock returns and distress-risk.<sup>52</sup> Garlappi and Yan (2011) use *Moody's Expected Default Frequency*<sup>TM</sup> (*EDF*<sup>TM</sup>). However, a primary determinant of O-scores, Z-scores, and estimates of default probabilities is corporate

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<sup>52</sup> See Altman (1968) and Ohlson (1980) for the original development of Z-scores and O-scores as measures of financial distress, respectively.

profitability. For example, Griffen and Lemmon (2002) find that firms with high O-scores and Z-scores have negative earnings. Further, O-scores, Z-scores, and default probability estimates are focused measures of distress-risk. I investigate two types of risk in this Chapter: distress-risk and growth-leverage. In my testing, O-scores, Z-scores, or estimates of default probability would hamper my ability to jointly investigate these two risks. Finally, in my equity valuation model of section 4.2, equity returns depend on profitability. In particular, for firms in financial-distress, profitability impacts two risks in opposite ways. It decreases distress-risk but it increases growth-leverage. So, my theoretical model motivates the empirical investigation of returns and profitability.

Firms that have negative trailing-twelve-month earnings tend to be of two types. First, they are mature businesses whose operating profitability has deteriorated. Their financial distress is that profitability may continue to deteriorate. Alternatively, negative earnings firms are in the development stages of their life cycle: before, at the point of, or just after introducing new products and/or services. Their financial distress is that profitability in new product markets might not develop as anticipated at business formation.

### **4.3.3 Portfolios and Forward Earnings Yield**

I use trailing negative twelve month earnings as my primary sample selection criteria but I use forward earning yield with consensus analysts' earnings forecasts to form portfolios. Fama and French (2000) report evidence of mean reversion in earnings. Since I select firms with negative earnings, I expect an earnings improvement after this selection. Earnings forecasts incorporate analysts' awareness of this reversion which reported earnings do not anticipate.

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 December 2009 where the last Statistical Period date is 12/17/2009. My testing uses portfolios that I rebalance at closing prices on Statistical Period dates. I define a "statistical period month" as the interval between adjacent statistical period dates.

The first term on the right-hand-side of Equation (4.5) for expected return for firms in financial distress is earnings yield. Thus, I use forward earnings yield as my primary sort variable for portfolio formation. I use three different consensus *I/B/E/S* analysts' *EPS* forecasts at a Statistical Period date.<sup>53</sup> These *EPS* forecasts are for the first,<sup>54</sup> second, and third ( $J=1,2,3$ ) yet to be reported fiscal year-end in the future. I use annual *EPS* forecasts to avoid seasonality in quarterly earnings. The three forward earnings yields are  $EPS_J / P$  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), and  $P$  is the closing share price on that Statistical Period date.

For each Statistical Period date from 1/15/1976 to 12/17/2009 I calculate forward earnings yield,  $EPS_J / P$ , for firms with negative trailing-twelve-month reported earnings, and positive *BVE*. At each Statistical Period date, I sort firms into twenty  $EPS_J / P$  portfolios ( $b=1,2,\dots,20$ ) with an equal number of firms (approximately) in each

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<sup>53</sup> *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 my study.

<sup>54</sup> 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.

portfolio. This sorting leads to twenty portfolios that I rebalance at each Statistical Period date over the test period. In addition, because I sort firms in three ways, with  $EPS_J/P$ ,  $J=1,2,3$ , I investigate  $3 \times 20=60$  portfolios.

My test period for  $EPS_1/P$  and  $EPS_2/P$  is 34 years (1/15/1976 to 12/17/2009) which is 408 statistical period months. My test period is shorter for  $EPS_3/P$  because *I/B/E/S* only begins reporting  $EPS_3$ —forecast annual earnings three unreported fiscal year-ends hence—at the 9/20/1984 Statistical Period date. Thus, my test period for  $EPS_3/P$  is between 9/20/1984 and 12/17/2009 which is 25 years and 4 month (304 statistical period months). Over my test periods, the average numbers of stocks in the 20  $EPS_J/P$   $J=1,2,3$  portfolios is 30.1, 26.3, and 13.7, respectively.<sup>55</sup> The smaller number of stocks in  $EPS_3/P$  portfolios is because analyst annual *EPS* forecasts are sparser for three unreported fiscal years hence compared to one and two unreported fiscal years hence.

$EPS_{J,i,t,b}$ , is the median analysts' *EPS* forecast and  $EPS_{J,i,t,b}/P$  is forward earnings yield for firm  $i=1,2,\dots,N$ , at the beginning of statistical period month  $t=1,2,\dots,TP$  (where  $TP$  is the number of months in my test period),<sup>56</sup> in portfolio  $b=1,2,\dots,20$ , for  $J=1,2,3$ . The mean forward earnings yield,  $EPS_{J,b}/P$ , for portfolio  $b=1,2,\dots,20$  formed by ranking firms into 20 portfolios with  $EPS_{J,i,t,b}/P$ ,  $J=1,2,3$  is,

$$EPS_{J,b}/P = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N EPS_{J,i,t,b}/P \right) \quad J=1,2,3, \text{ and } b=1,2,\dots,20$$

Column A of Table 4.1 reports  $EPS_{J,b}/P$ , the mean portfolio forward earnings

<sup>55</sup> Total number of observations in my sample for  $EPS/P_1, EPS/P_2, EPS/P_3$  portfolio sets as 245,685, 214,685, and 83,236, respectively.

<sup>56</sup>  $TP$  is 408 for portfolio sets  $EPS/P_1$  and  $EPS/P_2$  and 304 for portfolio set  $EPS/P_3$ .

yield for portfolios formed by ranking firms into 20 portfolios with  $EPS_J / P$ ,  $J=1,2,3$ . Of course, because forward earnings yield is a sort variable,  $EPS_{J,b} / P$ , increases from portfolio  $b=1$  to  $b=20$ . Further, for each of  $J=1,2,3$ , mean portfolio earnings yield,  $EPS_{J,b} / P$ , increases from negative to positive. My sample selection criterion is for firms with negative trailing-twelve-month earnings, but the consensus analysts' earnings forecasts can be positive. These are firms for which analysts expect earnings improvement. For  $J=3$ , for the 20 portfolios, there are more positives than negatives. A conjecture for this phenomenon is that analysts forecast earnings more optimistically further in the future.<sup>57</sup>

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<sup>57</sup> Chapter 2 shows that analysts' earnings forecasts are quite accurate for one unreported fiscal year hence and then become overly optimistic for longer forecast periods..



**Table 4.1 Descriptive Statistics**

Portfolio Sorted by EPS/P	A. Forward Earnings Yield $EPS_{J,b} / P$			B. Realized Returns $\bar{R}_{J,b}$			C. Forward ROE $ROE_{J,b}$			D. Market/Book $M / B_{J,b}$			E. Market Capital $MVE_{J,b}$		
	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3	J=1	J=2	J=3
	Low 1	-1.389	-0.686	-0.539	0.020	0.019	0.019	-0.647	-0.474	-0.546	0.71	1.22	1.84	76	103
2	-0.436	-0.190	-0.147	0.010	0.007	0.006	-0.399	-0.297	-0.367	0.96	1.89	2.57	116	176	387
3	-0.263	-0.105	-0.080	0.007	0.005	0.009	-0.299	-0.241	-0.269	1.30	2.35	3.01	177	201	504
4	-0.181	-0.057	-0.039	0.006	-0.001	0.002	-0.259	-0.145	-0.125	1.51	2.36	3.09	202	254	507
5	-0.131	-0.028	-0.009	0.003	0.002	0.002	-0.209	-0.053	-0.015	1.55	2.44	3.20	217	339	756
6	-0.095	-0.003	0.014	0.005	0.004	0.003	-0.160	0.000	0.028	1.77	2.10	3.12	232	438	1120
7	-0.068	0.014	0.030	0.004	-0.001	0.002	-0.108	0.032	0.067	1.97	1.93	3.11	300	486	1112
8	-0.044	0.026	0.041	0.004	0.004	0.005	-0.071	0.050	0.089	1.86	1.84	2.87	343	572	1564
9	-0.025	0.039	0.051	0.007	0.006	0.004	-0.038	0.059	0.107	1.83	1.69	2.64	402	632	1555
10	-0.013	0.046	0.059	0.002	0.003	0.005	-0.017	0.070	0.117	1.90	1.71	2.48	495	778	2100
11	0.001	0.057	0.068	0.005	0.007	0.004	0.000	0.076	0.125	1.72	1.57	2.43	521	857	2157
12	0.012	0.064	0.076	0.007	0.005	0.009	0.016	0.082	0.133	1.62	1.54	2.27	557	851	2040
13	0.022	0.072	0.085	0.006	0.007	0.003	0.032	0.089	0.143	1.60	1.45	2.06	673	776	1916
14	0.033	0.081	0.094	0.006	0.006	0.012	0.042	0.097	0.151	1.49	1.43	2.00	735	803	1565
15	0.043	0.090	0.104	0.011	0.009	0.014	0.054	0.104	0.161	1.49	1.36	1.82	862	820	1658
16	0.055	0.101	0.117	0.007	0.015	0.005	0.064	0.109	0.183	1.46	1.25	1.79	842	831	1516
17	0.066	0.117	0.134	0.013	0.009	0.009	0.074	0.119	0.187	1.34	1.18	1.68	844	739	1190
18	0.082	0.133	0.160	0.012	0.012	0.015	0.085	0.128	0.215	1.20	1.07	1.53	899	650	1064
19	0.109	0.163	0.206	0.012	0.013	0.008	0.099	0.138	0.234	1.05	0.95	1.34	802	554	844
High 20	0.248	0.315	0.419	0.015	0.018	0.017	0.134	0.193	0.376	0.85	0.86	1.33	485	302	374

Notes: At each Statistical Period date ( $t=1,2,\dots,TP$ ), I sort firms into twenty portfolios ( $b=1,2,\dots,20$ ) with an equal number of firms, approximately, in each portfolio by  $EPS_{J,i,t,b} / P_{i,t,b}$ , where  $EPS_{J,i,t,b}$  is the consensus earnings forecast for  $J$  as-yet-unreported fiscal years, and  $P_{i,t,b}$  is the share price for firm  $i=1,2,\dots,N$ , at a Statistical Period date  $t=1,2,\dots,TP$ , in portfolio  $b=1,2,\dots,20$ .  $EPS_{J,b} / P = \sum_{t=1}^{TP} \left( \sum_{i=1}^N \left( \frac{EPS_{J,i,t,b} / P_{i,t,b}}{N} \right) \right) / TP = \sum_{t=1}^{TP} (EPS_{J,i,t,b} / P) / TP$  is the average forward earnings yield,  $\bar{R}_{J,b} = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N R_{J,i,t,b} \right)$  is the average portfolio returns,  $ROE_{J,b} = \text{median}_{t=1 \text{ to } TP} \left( \text{median}_{i=1 \text{ to } N} (ROE_{J,i,t,b}) \right)$  is the median ROE,  $MVE_{J,b} = \sum_{t=1}^{TP} \left( \sum_{i=1}^N \left( \frac{MVE_{J,i,t,b}}{N} \right) \right) / TP = \sum_{t=1}^{TP} (MVE_{J,i,t,b}) / TP$  is the average market value of equity, and  $M / B_{J,b} = \text{median}_{t=1 \text{ to } TP} \left( \text{median}_{i=1 \text{ to } N} (M / B_{J,i,t,b}) \right)$  is the median Market to Book ratio for the twenty portfolios ( $b=1,2,\dots,20$ ) over statistical period month  $t=1,2,\dots,TP$ , sorted by  $EPS/P$ ,  $J=1,2,3$ .

### 4.3.4 Forward Return on Equity, $ROE$

Forward return on equity is  $EPS_J/BPS$  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. I denote these  $ROE$  forecasts as  $ROE_J$   $J=1,2,3$ , respectively. Chapter 2 surveys the literature on accounting returns ( $ROE$ ) as proxies for economic returns.

Forward  $ROE$  for firm  $i=1,2,\dots,N$ , is the median analysts'  $EPS$  forecast,  $EPS_{J,i,t,b}$ , divided by book value per share,  $ROE_{J,i,t,b} = EPS_{J,i,t,b}/BPS$  at the beginning of statistical period month  $t=1,2,\dots,TP$  (where  $TP$  is the number of months in my test period),<sup>58</sup> for portfolio  $b=1,2,\dots,20$ . I construct these 20 portfolios by ranking firms by forward earnings yield,  $EPS_J/P$ ,  $J=1,2,3$ , at statistical period dates. If  $ROE_{J,t,b}$  is the median forward rate of return on equity<sup>59</sup> for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , at statistical month  $t$ , then,  $ROE_{J,t,b} = \underset{i=1 \text{ to } N}{\text{median}}(ROE_{J,i,t,b})$ . Median forward rate of return on equity,  $ROE_{J,b}$ , for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , across all statistical period months is,

$$ROE_{J,b} = \underset{t=1 \text{ to } TP}{\text{median}}(ROE_{J,t,b}) \quad J=1,2,3 \text{ and} \\ b=1,2,\dots,20$$

Column C of Table 4.1 reports median forward rate of return on equity,  $ROE_{J,b}$ , which increases monotonically with forward earnings yield,  $EPS_J/P$ , from portfolio

<sup>58</sup>  $TP$  is 404 for portfolio sets  $ROE_1$  and  $ROE_2$  and 301 for portfolio set  $ROE_3$ .

<sup>59</sup> Because  $ROE$  is forecast  $EPS$  divided by  $BPS$  (which can approach zero),  $ROE$  can have extreme values. To limit the impact of these extreme values on my analysis, I use median rather than mean  $ROE$ .

$b=1$  to  $b=20$  for each of the portfolio sets  $J=1,2,3$ . Because both earnings yield and  $ROE$  are profitability measures, they relate positively to one another.

### 4.3.5 Portfolio Returns

I measure portfolio returns from a Statistical Period date, where I form a portfolio, to the following Statistical Period date, which is approximately a month later. Because I use forward earnings yield,  $EPS/P$ , to rebalance portfolios at each Statistical Period date and measure portfolio realized returns for the following statistical period month, my empirical results are out-of-sample. Because Statistical Period dates are mid-month rather than month-end, I cannot use *CRSP* monthly returns. Instead, for firm  $i=1,2,\dots,N$ , sorted into portfolio  $b=1,2,\dots,20$ , with  $EPS_J / P$   $J=1,2,3$ , at the beginning of statistical period month  $t=1,2,\dots,TP$ , monthly return between Statistical Period dates is,

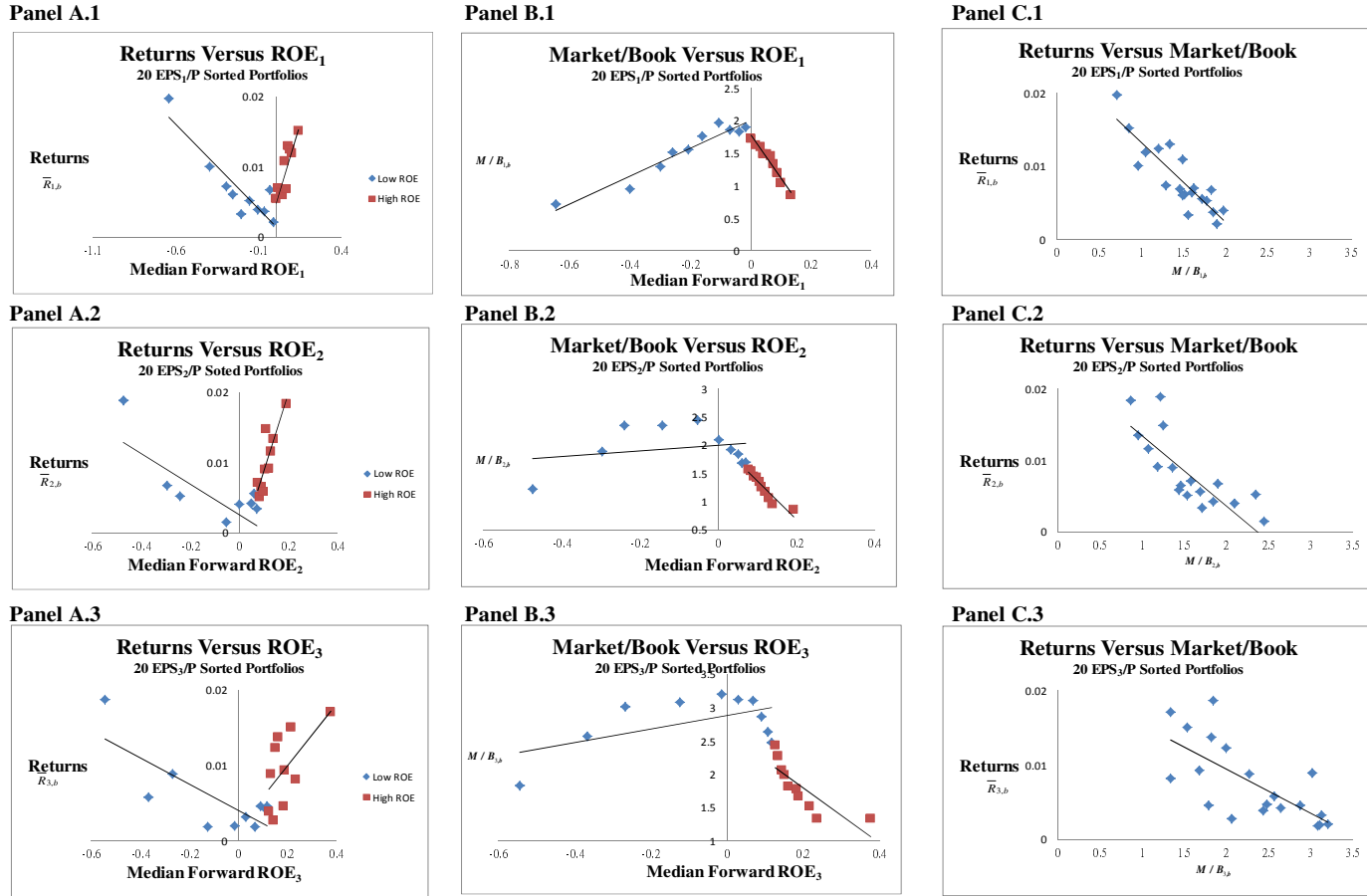
$$R_{J,i,t,b} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_{J,i,b}$$

where  $P_t$  and  $P_{t+1}$  are closing share prices<sup>60</sup> 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. I adjust both the dividend  $D_{t+1}$  and the end of month share price  $P_{t+1}$  for stock splits and stock dividends.

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<sup>60</sup> If a stock is delisted during statistical period month  $t$  or closing share price is missing on the Statistical Period date  $t+1$ , I 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  $t$ , I use the next opening price (if available from *CRSP*) or the first closing price in the statistical period month.

**Figure 4.2 Returns Versus ROE, Market/Book Versus ROE, and Returns Versus Market/Book**



Notes: Panels A.1, A.2, and A.3 plot  $\bar{R}_{J,b}$  versus  $ROE_{J,b}$  for the 20 portfolios formed by sorting  $EPS/P_j$ ,  $J=1,2,3$ , for  $b=1,2,\dots,20$ , respectively, Panel B.1, B.2, and B.3 plot median Market/Book ( $M/B_{J,b}$ ) versus  $ROE_{J,b}$  and Panel C.1, C.2, and C.3 plot average portfolio returns,  $\bar{R}_{J,b}$ , against the median Market/Book ( $M/B_{J,b}$ ), for  $b=1,2,\dots,20$ ,  $J=1,2,3$ , respectively, where  $\bar{R}_{J,b} = \frac{1}{TP} \sum_{i=1}^{TP} \left( \frac{1}{N} \sum_{j=1}^N R_{J,j,b} \right)$ ,  $M/B_{J,b} = \text{median}_{i=1 \text{ to } TP} \left( \text{median}_{i=1 \text{ to } N} (M/B_{J,j,b}) \right)$ , and  $ROE_{J,b} = \text{median}_{i=1 \text{ to } TP} \left( \text{median}_{i=1 \text{ to } N} (ROE_{J,j,b}) \right)$

The equally weighted portfolio return<sup>61</sup> in statistical period month  $t=1,2,\dots,TP$ , for portfolio  $b=1,2,\dots,20$ , is  $R_{J,t,b} = \frac{1}{N} \sum_{i=1}^N R_{J,i,t,b}$ . Average portfolio return over the entire test period is  $\bar{R}_{J,b} = \sum_{t=1}^{TP} \left( \frac{R_{J,t,b}}{TP} \right)$ ,  $J=1,2,3$ ,  $b=1,2,\dots,20$ .

Column B of Table 4.1 reports mean monthly portfolio returns  $\bar{R}_{J,b} = \sum_{t=1}^{TP} \left( \frac{R_{J,t,b}}{TP} \right)$ ,  $b=1,2,\dots,20$ , for the three portfolio sets  $J=1,2,3$ . Panels A1, A2, and A3 of Figure 4.2 plot these mean monthly portfolio returns  $\bar{R}_{J,b}$  versus forward portfolio  $ROE_{J,b}$ , for portfolios  $b=1,2,\dots,20$ , for each portfolio sets  $J=1,2,3$ , respectively. While I have yet to do any statistical testing (which I do in section 4.1 below), there is a clear U-shape in these plots of realized monthly portfolio returns versus forward  $ROE$  as predicted by my theoretical model of section 4.2.

### 4.3.6 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  $MVE_{J,i,t,b}$ , be the market capitalization (market cap) for firm  $i=1,2,\dots,N$ , sorted into portfolio  $b=1,2,\dots,20$ , with  $EPS_J / P$   $J=1,2,3$ , at the beginning of statistical period month  $t=1,2,\dots,TP$ . Market cap,  $MVE_{J,b}$ , for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , is,

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<sup>61</sup> Portfolio results in Table 4.1 and Figure 4.2 are qualitatively the same with value-weighted returns (results not reported). Of course, in the “market portfolio,” weights are value-weighted. Since individual investors need not and are unlikely to value weight their portfolios, I report portfolios results in this Chapter with equally weighted returns. In particular, value-weighted portfolios make little economic sense for a sample of firms in financial distress because these are primarily small stocks.

$$MVE_{J,b} = \sum_{t=1}^{TP} \left( \sum_{i=1}^N \left( \frac{MVE_{J,i,t,b}}{N} \right) \right) / TP = \sum_{t=1}^{TP} (MVE_{J,t,b}) / TP \quad J=1,2,3 \text{ and } b=1,2,\dots,20$$

Column E of Table 4.1 reports  $MVE_{J,b}$ , average portfolio market cap, for the twenty portfolios,  $b=1,2,\dots,20$ , for each portfolio set,  $J=1,2,3$ . For each of the portfolio sets  $J=1,2,3$ , market cap tends to increase with forward earnings yield,  $EPS/P$ , except for high earnings yield portfolios  $b=19$ , and 20 when market cap tends to be lower. Market cap tends to be greater for  $J=3$  compared to  $J=2$ , compared to  $J=1$  portfolio sets. Analysts are more likely to forecast earnings further in the future for larger rather than smaller firms.

### 4.3.7 Market/Book

Market/book (M/B) is  $MVE$ , divided by  $BVE$  from the most recently reported quarterly or annual financial statements prior to a Statistical Period date. Let  $M / B_{J,i,t,b}$ , be the market to book ratio for firm  $i=1,2,\dots,N$ , sorted into portfolio  $b=1,2,\dots,20$ , with  $EPS_J / P$   $J=1,2,3$ , at the beginning of statistical period month  $t=1,2,\dots,TP$ . If  $M / B_{J,t,b}$  is the median market/book ratio<sup>62</sup> for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , at statistical month  $t$ , then,  $M / B_{J,t,b} = \text{median}_{i=1 \text{ to } N} (M / B_{J,i,t,b})$ . Median market/book,  $M / B_{J,b}$ , for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , across all statistical period months is,

$$M / B_{J,b} = \text{median}_{t=1 \text{ to } TP} (M / B_{J,t,b}) \quad J=1,2,3 \text{ and } b=1,2,\dots,20$$

<sup>62</sup> Because  $M/B$  divides by  $BPS$  (which can approach zero),  $M/B$  can have extreme values. To limit the impact of these extreme values on my analysis, I use median rather than mean  $M/B$ . Further, I use  $M/B$  rather than  $B/M$  for my analysis to be consistent with Chapter 2. Chapter 2 uses  $M/B$  rather than  $B/M$  because  $M/B$  is an important component of the return proxy: forward  $ROE$  plus one minus the market/book ratio times dividend yield. This return proxy is the first two terms on the right hand side of the lower branch of Equation 4.5 in the current Chapter.

Column D of Table 4.1 reports  $M / B_{J,b}$ , the median portfolio equity market/book for the twenty portfolios,  $b=1,2,\dots,20$ , sorted by  $EPS_J / P$ ,  $J=1,2,3$ , respectively. Panels B1, B2, and B3 of Figure 4.2 plot these median portfolio equity market/book ratios,  $M / B_{J,b}$ , versus forward portfolio  $ROE_{J,b}$ , for portfolios  $b=1,2,\dots,20$ , for each portfolio sets  $J=1,2,3$ , respectively. While I have yet to do any statistical testing (which I do in section 4.2), there is a clear hill-shape in these plots of market/book versus forward  $ROE$ . Market/book initially increases with  $ROE$  and then decreases with  $ROE$ .

Any reasonable equity valuation model, including the one that I use, predicts a positive relation between market/book and profitability,  $ROE$ . Panel A of Figure 4.1 depicts this relation. So, before I began my testing, I did not expect this hill-shaped relation. A negative relation between  $ROE$  and market/book suggests that  $ROE$  changes an economic factor which I presume fixed in my theoretical model. I suspect that this economic factor might be volatility. In section 4.4, I discuss and investigate the relations between profitability, volatility, returns and market/book as important determinants of the value premium for firms in financial distress.

A U-shaped relation between returns and  $ROE$  in Panels A1, A2, and A3 of Figure 4.2 and a Hill shaped relation between market/book and  $ROE$  in Panels B1, B2, and B3, suggests a value-premium. Panels C1, C2, and C3 plots, for the portfolio sets  $J=1,2,3$ , respectively, average portfolio returns,  $\bar{R}_{J,b}$ , against portfolio market/book,  $M / B_{J,b}$ , for portfolios  $b=1,2,\dots,20$ . The relation between returns and market/book in Panels C1, C2, and C3 is clearly negative which suggests a value premium for firms in financial distress.

## 4.4 The Value-Premium for Firms in Financially Distress

The plots in Figure 4.2 of descriptive statistics from Table 4.1 are without formal statistical tests. They are, however, suggestive of a U-shaped relation between returns and *ROE*, a hill-shaped relation between market/book and *ROE*, and a negative relation between returns and market/book (the value premium). In this section, I present formal statistical tests.

### 4.4.1 A U-Shaped Relation Between Returns and Profitability, *ROE*

I estimate Fama-MacBeth (1973) regressions of monthly portfolio returns (for portfolios formed by sorting forward earnings yield) on portfolio profitability, *ROE*. Fama-MacBeth regressions are cross-sectional regressions (in my case across portfolios) that are averaged over time. In each statistical period month,  $t$ , I separate the 20 portfolios into two groups: portfolios  $b=1,2,\dots,10$  (stocks that have the lowest *EPS/P* rank) and  $b=11,12,\dots,20$  (stocks that have the highest *EPS/P* rank). For each statistical month  $t$ , I estimate two cross sectional regressions of monthly portfolio returns versus forward *ROE* for each of the portfolio sets,  $J=1,2,3$ ,

$$R_{J,t,b} = \delta_{0,J,t} + \delta_{1,J,t}ROE_{J,t,b} + u_{J,t}, \quad \text{for } b=1,2,\dots,10, \text{ and, for } b=11,12,\dots,20$$

For statistical period month  $t$ ,  $R_{J,t,b}$  is the monthly portfolio return and  $ROE_{J,t,b}$  is forward *ROE*,  $u_{J,t}$  is an error term,  $\delta_{0,J,t}$  and  $\delta_{1,J,t}$  are intercept and slope coefficients.

Panel A of Table 4.2 reports the average of cross-sectional estimated intercepts,  $\bar{\delta}_{0,J} = \sum_{t=1}^{TP} \left( \delta_{0,J,t} / TP \right)$ , and slope coefficients,  $\bar{\delta}_{1,J} = \sum_{t=1}^{TP} \left( \delta_{1,J,t} / TP \right)$  in the Fama-MacBeth (1973) regressions of return on *ROE* over the 408 statistical period months for *EPS<sub>t</sub>/P*



and  $EPS_2/P$  generated portfolios and 304 statistical period months for  $EPS_3/P$  generated portfolios. There are two sets of results in Panel A: for the 10 lowest  $EPS/P$  ranked portfolios and for the 10 highest  $EPS/P$  ranked portfolios ( $b=1,2,\dots,10$  and  $b=11,12,\dots,20$ , respectively).

The slopes,  $\bar{\delta}_{1,J}$ , for the 10 lowest  $EPS/P$  ranked portfolios ( $b=1,2,\dots,10$ ) are negative for each of the portfolio sets  $J=1,2,3$ , but only  $\bar{\delta}_{1,1}$ , for  $EPS/P_1$  generated portfolios is statistically significant. Results are strongest when the consensus analysts' forecast is closest. On the other hand, the slopes,  $\bar{\delta}_{1,J}$ , for the 10 highest  $EPS/P$  ranked portfolios ( $b=11,12,\dots,20$ ) are all positive for each of the portfolio sets  $J=1,2,3$ , and statistically significant for  $J=1,3$ . This evidence is consistent with a U-shaped relation between returns and profitability for financially distressed firms as predicted by my dynamic model as depicted in Panel B of Figure 4.1.

#### **4.4.2 A Hill-Shaped Relation Between Market/Book and Profitability, *ROE***

To test for a hill-shaped relation between market/book and *ROE*, I estimate Fama-MacBeth (1973) regressions of market/book (for portfolios formed by sorting forward earnings yield) on portfolio profitability, *ROE*. In each statistical period month,  $t$ , I separate the 20 portfolios into two groups: portfolios  $b=1,2,\dots,10$  (stocks that have the lowest  $EPS/P$  rank) and  $b=11,12,\dots,20$  (stocks that have the highest  $EPS/P$  rank). For each statistical month  $t$ , I estimate two cross sectional regressions of market/book versus forward *ROE* for each of the portfolio sets,  $J=1,2,3$ ,

$$M / B_{J,t,b} = \vartheta_{0,J,t} + \vartheta_{1,J,t} ROE_{J,t,b} + u_{J,t}, \quad \text{for } b=1,2,\dots,10, \text{ and, for } b=11,12,\dots,20$$

At the beginning of statistical period month  $t$ ,  $M / B_{J,t,b}$  is the market/book ratio and  $ROE_{J,t,b}$  is forward  $ROE$ , for portfolio  $b$ . The error term is  $u_{J,t}$ . The intercept and slope coefficients are  $\vartheta_{0,J,t}$  and  $\vartheta_{1,J,t}$ , respectively.

Panel A of Table 4.3 reports the average of cross-sectional estimated intercepts,  $\bar{\vartheta}_{0,J} = \sum_{t=1}^{TP} \left( \vartheta_{0,J,t} / TP \right)$ , and slope coefficients,  $\bar{\vartheta}_{1,J} = \sum_{t=1}^{TP} \vartheta_{1,J,t} / TP$  in the Fama-MacBeth regressions of market/book on forward  $ROE$  over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  generated portfolios and 304 statistical period months for  $EPS_3/P$  generated portfolios. There are two sets of results in Panel A: for the 10 lowest  $EPS/P$  ranked portfolios and for the 10 highest  $EPS/P$  ranked portfolios ( $b=1,2,\dots,10$  and  $b=11,12,\dots,20$ , respectively).

The slopes,  $\bar{\vartheta}_{1,J}$ , for the 10 lowest  $EPS/P$  ranked portfolios ( $b=1,2,\dots,10$ ) are positive and statistically significant for each of the portfolio sets  $J=1,2,3$ . On the other hand, the slopes,  $\bar{\vartheta}_{1,J}$ , for the 10 highest  $EPS/P$  ranked portfolios ( $b=11,12,\dots,20$ ) are negative and statistically significant for each of the portfolio sets  $J=1,2$ . This evidence is consistent with a hill-shaped relation between Market/Book and  $ROE$ .

**Table 4.2 Returns Versus ROE and Returns Versus Market/Book**

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

$$R_{J,t,b} = \delta_{0,J,t} + \delta_{1,J,t} ROE_{J,t,b} + u_{J,t}$$

Lowest EPS/P Ranked Portfolios (b=1 to 10)					Highest EPS/P Ranked Portfolios (b=11 to 20)				
Portfolios	Ranked by				Portfolios	Ranked by			
$EPS_J/P$	$\bar{\delta}_{0,J}$	$t(\bar{\delta}_{0,J})$	$\bar{\delta}_{1,J}$	$t(\bar{\delta}_{1,J})$	$EPS_J/P$	$\bar{\delta}_{0,J}$	$t(\bar{\delta}_{0,J})$	$\bar{\delta}_{1,J}$	$t(\bar{\delta}_{1,J})$
$EPS_1/P$	0.0014	0.33	-0.0468	-2.60	$EPS_1/P$	0.0057	1.30	0.0724	2.33
$EPS_2/P$	0.0027	0.59	-0.0131	-0.54	$EPS_2/P$	0.0036	0.69	0.0646	1.36
$EPS_3/P$	0.0039	0.71	-0.0140	-1.18	$EPS_3/P$	0.0032	0.58	0.0583	1.98

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

$$R_{J,t,b} = \rho_{0,J,t} + \rho_{1,J,t} \frac{M}{B}_{J,t,b} + u_{J,t}$$

Portfolios	Ranked by			
$EPS_J/P$	$\bar{\rho}_{0,J}$	$t(\bar{\rho}_{0,J})$	$\bar{\rho}_{1,J}$	$t(\bar{\rho}_{1,J})$
$EPS_1/P$	0.0188	3.43	-0.0092	-3.41
$EPS_2/P$	0.0184	3.55	-0.0088	-3.40
$EPS_3/P$	0.0169	2.81	-0.0052	-3.67

*Notes:* In Panel A, I test the U-shaped relation between returns and profitability. For each statistical period month,  $t$ , I estimate a cross sectional regression of monthly returns of 20  $EPS/P$  portfolios ( $R_{J,t,b}$ ) on forward  $ROE$  ( $ROE_{J,t,b}$ ) (separately for  $EPS_J/P$   $J=1,2,3$ ), where  $R_{J,t,b}$  is the monthly portfolio return and  $ROE_{J,t,b}$  is forward  $ROE$  for portfolio  $b=1,2,\dots,20$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  is an error term,  $\delta_{0,J,t}$  and  $\delta_{1,J,t}$  are intercept and slope coefficients. Panel A reports the average of cross-sectional estimated intercepts,  $\bar{\delta}_{0,J} = \sum_{t=1}^{TP} \delta_{0,J,t} / TP$ , and slope coefficients,  $\bar{\delta}_{1,J} = \sum_{t=1}^{TP} \delta_{1,J,t} / TP$  over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios and 304 statistical period months for  $EPS_3/P$  portfolios, separately for low earnings yield portfolios (portfolios 1 to 10) and high earnings yield portfolios (portfolios 11-20). In Panel B, for each statistical period month,  $t$ , I estimate a cross sectional regression of monthly returns of 20  $EPS/P$  portfolios ( $R_{J,t,b}$ ) on Market/Book ( $M/B_{J,t,b}$ ) (separately for  $EPS_J/P$ ,  $J=1,2,3$ ), where  $R_{J,t,b}$  is the monthly portfolio return and  $M/B_{J,t,b}$  is median Market/Book for portfolio  $b=1,2,\dots,20$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  is an error term,  $\rho_{0,J,t}$  and  $\rho_{1,J,t}$  are intercept and slope coefficients. Panel B reports the average of cross-sectional estimated intercepts,  $\bar{\rho}_{0,J} = \sum_{t=1}^{TP} \rho_{0,J,t} / TP$ , and slope coefficients,  $\bar{\rho}_{1,J} = \sum_{t=1}^{TP} \rho_{1,J,t} / TP$  over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios and 304 statistical period months for  $EPS_3/P$  portfolios.

### 4.4.3 The Value-Premium

In this section, I test for a value-premium for firms in financial distress. I estimate Fama-MacBeth (1973) regressions of monthly portfolio returns (for portfolios formed by sorting forward earnings yield) on portfolio market/book. For each statistical month  $t$ , I estimate a cross sectional regressions of monthly portfolio returns versus market/book for each of the portfolio sets,  $J=1,2,3$ ,

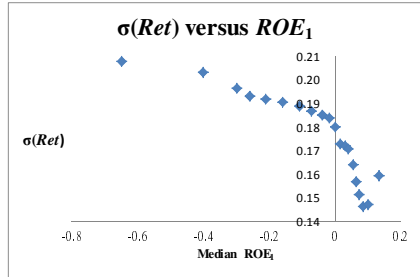
$$R_{J,t,b} = \rho_{0,J,t} + \rho_{1,J,t} M / B_{J,t,b} + u_{J,t}, \quad \text{for } b=1,2,\dots,20$$

For statistical period month  $t$ ,  $R_{J,t,b}$  is the monthly return and  $M / B_{J,t,b}$  is the market/book ratio for portfolio  $b$ . The error term is  $u_{J,t}$ . The intercept and slope coefficients are  $\rho_{0,J,t}$  and  $\rho_{1,J,t}$ , respectively.

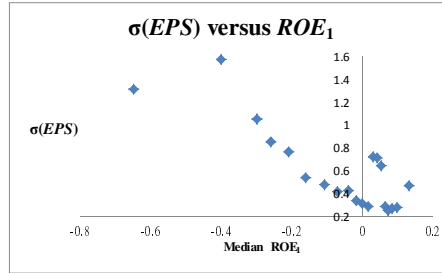
Panel B of Table 4.2 reports the average of cross-sectional estimated intercepts,  $\bar{\rho}_{0,J} = \sum_{t=1}^{TP} \left( \rho_{0,J,t} / TP \right)$ , and slope coefficients,  $\bar{\rho}_{1,J} = \sum_{t=1}^{TP} \left( \rho_{1,J,t} / TP \right)$ , in the Fama-MacBeth (1973) regressions of return on Market/Book over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios and 304 statistical period months for  $EPS_3/P$  portfolios. Each of the slopes,  $\bar{\rho}_{1,J}$ ,  $J=1,2,3$  is negative and statistically significant. These relations are evidence of a value-premium for firms in financial distress.

**Figure 4.3 Volatility Versus ROE**

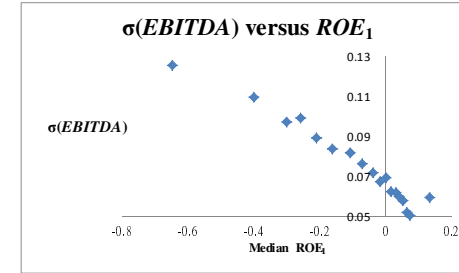
**Panel A.1**



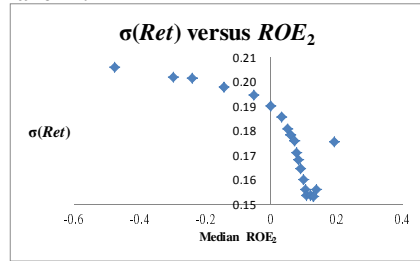
**Panel B.1**



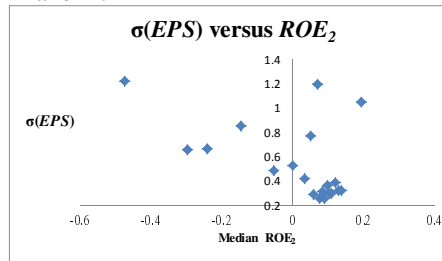
**Panel C.1**



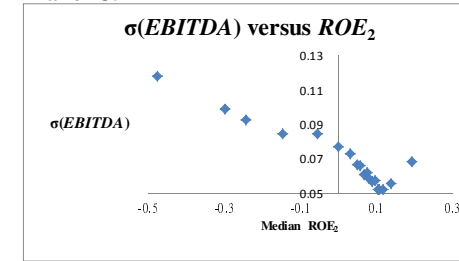
**Panel A.2**



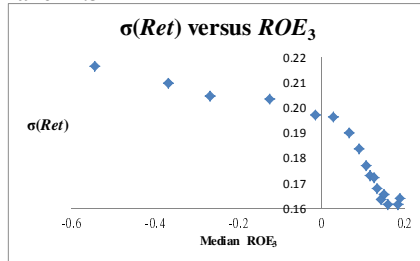
**Panel B.2**



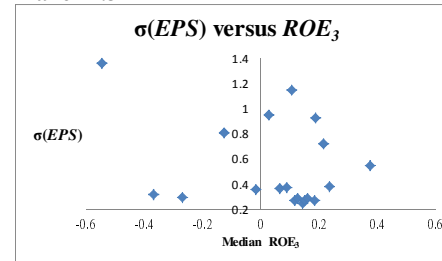
**Panel C.2**



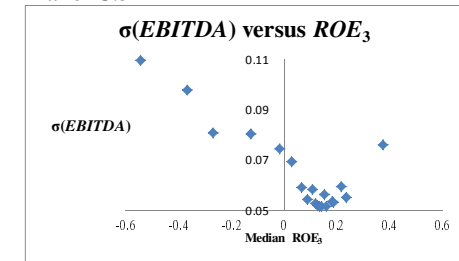
**Panel A.3**



**Panel B.3**



**Panel C.3**



Notes: Panels A.1, A.2, and A.3 plot return volatility,  $\sigma(Ret)_{J,b}$ , versus  $ROE_{J,b}$ , Panel B.1, B.2, and B.3 plot earnings volatility,  $\sigma(EPS)_{J,b}$ , versus  $ROE_{J,b}$ , and Panel C.1, C.2, and C.3 plot volatility of operating profit,  $\sigma(EBITDA)_{J,b}$ , versus  $ROE_{J,b}$ , for the 20 portfolios formed sorting by forward earnings yield,  $EPS/P_J$ , for  $J=1,2,3$ , respectively.

**Table 4.3 Market/Book Versus ROE and EBITDA Volatility Versus ROE**

**Panel A: Fama-MacBeth Regression of Market/Book on ROE**

$$M / B_{J,t,b} = \vartheta_{0,J,t} + \vartheta_{1,J,t} ROE_{J,t,b} + u_{J,t}$$

<b>Lowest EPS/P Ranked Portfolios (b=1 to 10)</b>					<b>Highest EPS/P Ranked Portfolios (b=11 to 20)</b>				
Portfolios	Ranked by				Portfolios	Ranked by			
$EPS_J/P$	$\bar{\vartheta}_{0,J}$	$t(\bar{\vartheta}_{0,J})$	$\bar{\vartheta}_{1,J}$	$t(\bar{\vartheta}_{1,J})$	$EPS_J/P$	$\bar{\vartheta}_{0,J}$	$t(\bar{\vartheta}_{0,J})$	$\bar{\vartheta}_{1,J}$	$t(\bar{\vartheta}_{1,J})$
$EPS_1/P$	2.1985	28.33	1.7059	8.95	$EPS_1/P$	1.7388	28.41	-4.7288	-8.70
$EPS_2/P$	2.3731	22.57	2.2210	8.80	$EPS_2/P$	1.7967	20.63	-4.6023	-5.52
$EPS_3/P$	3.4988	22.56	2.4163	6.16	$EPS_3/P$	1.7814	21.93	0.5555	1.66

**Panel B: Fama-MacBeth Regression of EBITDA Volatility on ROE**

$$\sigma(EBITDA)_{J,t,b} = \phi_{0,J,t} + \phi_{1,J,t} ROE_{J,t,b} + u_{J,t}$$

Portfolios	Ranked by			
$EPS_J/P$	$\bar{\phi}_{0,J}$	$t(\bar{\phi}_{0,J})$	$\bar{\phi}_{1,J}$	$t(\bar{\phi}_{1,J})$
$EPS_1/P$	0.0635	101.55	-0.0936	-18.58
$EPS_2/P$	0.0656	62.71	-0.0639	-6.37
$EPS_3/P$	0.0636	65.90	-0.0404	-9.97

Notes: In Panel A, I test the hill-shaped relation between Market/Book and profitability. For each statistical period month,  $t$ , I estimate a cross sectional regression of Market/Book ( $M/B_{J,t,b}$ ) of 20  $EPS/P$  portfolios on forward  $ROE$  ( $ROE_{J,t,b}$ ) (separately for  $EPS/P_J$   $J=1,2,3$ ), where  $M/B_{J,t,b}$  is the Market/Book and  $ROE_{J,t,b}$  is forward  $ROE$  for portfolio  $b=1,2,\dots,20$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  is an error term,  $\vartheta_{0,J,t}$  and  $\vartheta_{1,J,t}$  are intercept and slope coefficients. Panel A reports the average of cross-sectional estimated intercepts,  $\bar{\vartheta}_{0,J} = \sum_{t=1}^{TP} \vartheta_{0,J,t} / TP$ , and slope coefficients,  $\bar{\vartheta}_{1,J} = \sum_{t=1}^{TP} \vartheta_{1,J,t} / TP$  over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios and 304 statistical period months for  $EPS_3/P$  portfolios, separately for low earnings yield portfolios (portfolios 1 to 10) and high earnings yield portfolios (portfolios 11-20). In Panel B, in each statistical period month,  $t$ , I estimate a cross sectional regression of  $\sigma(EBITDA)_{J,t,b}$  on profitability,  $ROE_{J,t,b}$ . (separately for  $EPS/P_J$ ,  $J=1,2,3$ ), where  $\sigma(EBITDA)_{J,t,b}$  is EBITDA volatility and  $ROE_{J,t,b}$  is profitability, for portfolio  $b=1,2,\dots,20$ , in statistical period month  $t=1,2,\dots,TP$ ,  $u_{J,t}$  is an error term,  $\phi_{0,J,t}$  and  $\phi_{1,J,t}$  are intercept and slope coefficients. Table 4.3 reports the average of cross-sectional estimated intercepts,  $\bar{\phi}_{0,J} = \sum_{t=1}^{TP} (\phi_{0,J,t} / TP)$ , and slope coefficients,  $\bar{\phi}_{1,J} = \sum_{t=1}^{TP} (\phi_{1,J,t} / TP)$ , in the Fama-MacBeth (1973) regressions of volatility of operating profit on profitability over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios and 304 statistical period months for  $EPS_3/P$  portfolios.

#### 4.4.4 Volatility Versus Profitability, *ROE*

One would not expect a value premium from a U-shaped relation between returns and profitability. My equity valuation model predicts a positive relation between market/book and *ROE* for all levels of profitability. Panel A of Figure 4.1 depicts this relation. Thus, depending upon where firms in a particular sample fall along this U-shaped curve, returns and market/book might relate positively or negatively, but this relation is unlikely to be strong or persistent. Contrary to this prediction, evidence I report in section 4.2 indicates that for high *ROE* firms (within the class of firms in financial distress), the relation between market/book and *ROE* is negative. A principal reason for the value premium that I report in section 4.3 is this negative relation between market/book and *ROE* for high *ROE* firms.

A negative relation between market/book and *ROE* suggests that *ROE* changes an economic factor that I presume fixed in my theoretical model. A likely candidate for this economic factor is volatility. In this section, I investigate the relations between profitability, volatility, returns and market/book as important determinants of the value premium for firms in financial distress. I consider three different volatility measures: past return volatility, earnings volatility, and operating profit<sup>63</sup> (EBITDA) volatility.

Let  $\sigma(RET)_{J,i,t,b}$  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 forward earnings yield,  $EPS_J/P$ ,  $J=1,2,3$  into 20 portfolios. The return volatility for portfolio  $b$  at month  $t$  is

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<sup>63</sup> The acronym EBITDA stands for earnings before interest, tax, depreciation, and amortization.

$\sigma(RET)_{J,t,b} = \sum_{i=1}^N \left( \frac{\sigma(RET)_{J,i,t,b}}{N} \right)$ . The average return volatility, for portfolio  $b=1,2,\dots,20$ ,

$J=1,2,3$ , is,

$$\sigma(RET)_{J,b} = \sum_{t=1}^{TP} \left[ \sum_{i=1}^N \left( \frac{\sigma(RET)_{J,i,t,b}}{N} \right) \right] / TP \quad J=1,2,3 \text{ and } b=1,2,\dots,20$$

I refer to  $\sigma(RET)_{J,b}$  as return volatility.

Let  $\sigma(EPS)_{J,i,t,b}$  be the standard deviation of annual *EPS* reported in the sixty month window<sup>64</sup> 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 forward earnings yield,  $EPS_J/P$ ,  $J=1,2,3$ , into 20 portfolios. Earnings volatility

for portfolio  $b$  at month  $t$  is  $\sigma(EPS)_{J,t,b} = \sum_{i=1}^N \left( \frac{\sigma(EPS)_{J,i,t,b}}{N} \right)$ . Average earnings volatility

for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , is,

$$\sigma(EPS)_{J,b} = \sum_{t=1}^{TP} \left[ \sum_{i=1}^N \left( \frac{\sigma(EPS)_{J,i,t,b}}{N} \right) \right] / TP \quad J=1,2,3 \text{ and } b=1,2,\dots,20$$

I refer to  $\sigma(EPS)_{J,b}$  as earnings volatility.

Let  $\sigma(EBITDA)_{J,i,t,b}$  be the standard deviation of annual operating profit, *EBITDA*, reported in the sixty month window<sup>65</sup> prior to the beginning of statistical period month  $t$ , scaled by the most recently reported book value of assets for firm  $i$ , sorted into portfolio  $b$ , by ranking forward earnings yield,  $EPS_J/P$ ,  $J=1,2,3$ , into 20 portfolios.

<sup>64</sup> In order to calculate the standard deviation of *EPS*, firms must have reported earnings at least twice in this sixty month window.

<sup>65</sup> In order to calculate the standard deviation of *EBITDA*, firms must have reported operating profit at least twice in this sixty month window.



EBITDA volatility for portfolio  $b$  at month  $t$  is  $\sigma(EBITDA)_{J,t,b} = \sum_{i=1}^N \left( \frac{\sigma(EBITDA)_{J,i,t,b}}{N} \right)$ .

Average *EBITDA* volatility for portfolio  $b=1,2,\dots,20$ ,  $J=1,2,3$ , is,

$$\sigma(EBITDA)_{J,b} = \sum_{t=1}^{TP} \left[ \sum_{i=1}^N \left( \frac{\sigma(EBITDA)_{J,i,t,b}}{N} \right) \right] / TP \quad J=1,2,3 \text{ and } b=1,2,\dots,20$$

I refer to  $\sigma(EBITDA)_{J,b}$  as *EBITDA* volatility.

Figure 4.3 plots volatility versus *ROE* for the three volatility measures: past return volatility,  $\sigma(RET)_{J,b}$ , earnings volatility,  $\sigma(EPS)_{J,b}$ , and *EBITDA* volatility,

$\sigma(EBITDA)_{J,b}$ . Panels A.1, A.2, and A.3 plot return volatility,  $\sigma(RET)_{J,b}$ , Panel B.1,

B.2, and B.3 plot earnings volatility,  $\sigma(EPS)_{J,b}$ , and Panel C.1, C.2, and C.3 plot

*EBITDA* volatility,  $\sigma(EBITDA)_{J,b}$  (for the 20 portfolios formed sorting by forward

earnings yield,  $EPS_J/P$ ,  $J=1,2,3$ , respectively). For all three volatility measures,

volatility decreases with profitability, *ROE*. The fall in *EBITDA* volatility with *ROE* is

particularly interesting because *EBITDA* is an operating measure of profitability before interest and is, thus, independent of financial structure. An increase in operating profit

volatility as profitability deteriorates is consistent with the argument that managers are

distracted from operations by financial distress with the result that volatility increases.

Alternatively, Jensen and Meckling (1976) argue that that managers “risk-shift” into

higher risk business investments with financial distress because they increasingly put

creditors’ capital at risk rather than shareholders’ capital as default or debt-call becomes

imminent.

The plots in Figure 4.3 are suggestive of a negative relation between volatility and *ROE*. They are, however, without statistical tests. Below I present a formal test for the relation between *EBITDA* volatility<sup>66</sup> and *ROE*.

To test for a negative relation between *EBITDA* volatility and *ROE*, I estimate Fama-MacBeth (1973) regressions of *EBITDA* volatility (for portfolios formed by sorting forward earnings yield) on portfolio profitability, *ROE*. For each statistical month *t*, I estimate a cross sectional regression of *EBITDA* volatility versus forward *ROE* for each of the portfolio sets, *J*=1,2,3,

$$\sigma(EBITDA)_{J,t,b} = \phi_{0,J,t} + \phi_{1,J,t}ROE_{J,t,b} + u_{J,t}, \text{ for } b=1,2,\dots,20$$

At the beginning of statistical period month *t*,  $\sigma(EBITDA)_{J,b}$  is *EBITDA* volatility and  $ROE_{J,t,b}$  is forward *ROE*, for portfolio *b*. The error term is  $u_{J,t}$ . The intercept and slope coefficients are  $\phi_{0,J,t}$  and  $\phi_{1,J,t}$ , respectively.

Panel B of Table 4.3 reports the average of cross-sectional estimated intercepts,  $\bar{\phi}_{0,J} = \sum_{t=1}^{TP} \left( \phi_{0,J,t} / TP \right)$ , and slope coefficients,  $\bar{\phi}_{1,J} = \sum_{t=1}^{TP} \left( \phi_{1,J,t} / TP \right)$ , in the Fama-MacBeth (1973) regressions of *EBITDA* volatility on profitability over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios and 304 statistical period months for  $EPS_3/P$  portfolios. Each of the slopes,  $\bar{\phi}_{1,J}$ , *J*=1,2,3 is negative and statistically significant.

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<sup>66</sup> Results are similar for return volatility and for EPS volatility.

#### **4.4.5 The Financial-Distress/Growth Hypothesis of the Value Premium**

In section 4.4.2 I present evidence that market/book initially increases but then decreases with *ROE*. A negative relation between *ROE* and market/book suggests that *ROE* changes an economic factor that I presume fixed in my theoretical model. I present evidence in section 4.4.4 that volatility decreases with *ROE*. I know from option theory that low volatility means low value and, thus, low market/book. So, firms in financial distress, but with relatively great *ROE*, have low volatility, low market/book and high returns. A principal reason for the value premium that I report in section 4.4.3 is this negative relation between market/book and *ROE* for high *ROE* firms. At *ROE* extremes, high or low, returns are high and market/book is low.

#### **4.5 Do Investors Recognize the U-Shaped Relation between Returns and Profitability?**

In this section, I investigate whether investors recognize the U-shaped relation between returns and profitability for firms in financial distress. If I find evidence of non-zero abnormal returns, then either investors or my asset-pricing model do not recognize the U-shaped relation between returns and profitability.

The upper branch of Equation (4.5) indicates that the two determinants of expected return for firms in financial distress are earnings yield and volatility. Thus, to test for abnormal returns I double sort firms, first by earnings yield and then by volatility, to form portfolios.

At each statistical period date, I sort firms into five *EPS/P* quintiles ( $k=1,2,3,4,5$ ) by  $EPS_{J,i,t} / P$ , and then for each *EPS/P* quintile into five volatility<sup>67</sup> portfolios

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<sup>67</sup> I do this analysis for return volatility and *EBITDA* volatility. Results are similar for *EPS* volatility, but not as strong.

( $v=1,2,3,4,5$ ). This double sorting leads to twenty-five portfolios that I rebalance at each Statistical Period date over the 408 statistical period months for  $EPS_1/P$  and  $EPS_2/P$  portfolios (as the primary sorting key) and 304 statistical period months for  $EPS_3/P$  portfolios. Because I sort firms by  $EPS/P$  in three ways, with  $EPS_1/P$ ,  $EPS_2/P$ , and  $EPS_3/P$ , I investigate  $3 \times 25 = 75$  portfolios.

For firm  $i=1,2,\dots,N$ , sorted into portfolio  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ , with  $EPS_J/P$ ,  $J=1,2,3$ , at the beginning of statistical period month  $t=1,2,\dots,TP$ , monthly return between Statistical Period dates is,

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

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  $t+1$ . I 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 for statistical period month  $t=1,2,\dots,TP$ , for portfolio  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ ,  $J=1,2,3$ , is  $R_{J,t,k,v} = \frac{1}{N} \sum_{i=1}^N R_{J,i,t,k,v}$ .

### 4.5.1 Normal Returns

I use a conditional four factor asset pricing model to represent normal returns.<sup>68</sup> The four factor model explains expected returns with a Book/Market factor, a size factor,

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<sup>68</sup> I also estimate alpha with Chen, Novy-Marx, and Zhang's (2010) three factor model that has a market factor, historical profitability factor and an investment factor. Alpha estimates tend to be consistently positive which suggests a missing factor. Because low market capitalization is a characteristic of firms in financial distress, because small firms tend to have greater returns than large firms, and because

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 I 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), I 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 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

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evidence in Chen, Novy-Marx, and Zhang (2010) suggests that their model does not explain the small firm effect, it appears that this missing factor is firm size. Because of this bias, I do not report results. It is beyond the scope of my paper to search for new and better asset-pricing models that might include, for example, firm size.

to capture these dynamic patterns in returns. Since my sample period is over 33 years for  $EPS_1/P$  and  $EPS_2/P_2$ , and 25 years for  $EPS_3/P$ , I 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, I 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). I 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, I create monthly *SMB*, *HML*, *MOM*, and market risk factors (for statistical period months rather than calendar months) that I use to benchmark portfolios formed by a double sort of forward earnings yield,  $EPS/P$ , and volatility.

I risk-adjust the 25  $EPS/P$  and volatility sorted portfolios with four risk factors in the regression model:

$$R_{J,t,k,v} - R_{f,t} = \alpha_{J,k,v} + s_{J,k,v}SMB_t + h_{J,k,v}HML_t + m_{J,k,v}MOM_t + \beta_{J,k,v} (R_{M,t} - R_{f,t}) + \varepsilon_{J,k,v} \quad (4.6)$$

$$\begin{aligned} s_{J,k,v} &= s_{0,J,k,v} + s_{1,J,k,v}DY_{t-1} + s_{2,J,k,v}R_{f,t} \\ h_{J,k,v} &= h_{0,J,k,v} + h_{1,J,k,v}DY_{t-1} + h_{2,J,k,v}R_{f,t} \quad k=1,2,3,4,5, v=1,2,3,4,5, t=1,2,\dots, TP \\ m_{J,k,v} &= m_{0,J,k,v} + m_{1,J,k,v}DY_{t-1} + m_{2,J,k,v}R_{f,t} \\ \beta_{J,k,v} &= \beta_{0,J,k,v} + \beta_{1,J,k,v}DY_{t-1} + \beta_{2,J,k,v}R_{f,t} \end{aligned} \quad (4.7)$$

where  $R_{J,t,k,v}$  denotes the return on portfolio  $J=1,2,3$ ,  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ , in month  $t = 1,2,\dots,TP$ ,  $R_{f,t}$  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 (4.7) into (4.6) 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. I test my 25 *ROE* and volatility sorted portfolios ( $J=1,2,3$ ,  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ ,) on the conditional four-factor model. Table 4.4 reports abnormal returns,  $\hat{\alpha}$ s, of regression (4.6) and (4.7) for portfolios formed with *ROE* and volatility.

**Table 4.4 Abnormal Returns**  
**Conditional Fama-French-Carhart Four-Factor Asset Pricing Model**

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

$$s_{J,k,v} = s_{0,J,k,v} + s_{1,J,k,v}DY_{t-1} + s_{2,J,k,v}R_{f,t} \quad h_{J,k,v} = h_{0,J,k,v} + h_{1,J,k,v}DY_{t-1} + h_{2,J,k,v}R_{f,t} \quad m_{J,k,v} = m_{0,J,k,v} + m_{1,J,k,v}DY_{t-1} + m_{2,J,k,v}R_{f,t} \quad \beta_{J,k,v} = \beta_{0,J,k,v} + \beta_{1,J,k,v}DY_{t-1} + \beta_{2,J,k,v}R_{f,t}$$

$$k=1,2,3,4,5, \quad v=1,2,3,4,5, \quad t=1,2,\dots, TP, J=1,2,3$$

**Panel A: 5x5 EPS/P and Return Volatility Sorted Portfolios**

EPS/P Quintile	Ret-Vol Quintile	EPS <sub>1</sub> /P		Hansen's J	GRS	EPS <sub>2</sub> /P		Hansen's J	GRS	EPS <sub>3</sub> /P		Hansen's J	GRS
		α	t(α)	(p-value)	(p-value)	α	t(α)	(p-value)	(p-value)	α	t(α)	(p-value)	(p-value)
Lowest EPS/P k=1	Lowest Ret-Vol v=1	-0.0024	-0.55	3.53	0.63	0.0012	0.27	2.31	0.44	0.0058	0.88	3.58	1.09
	v=2	-0.0019	-0.48	(0.4738)	(0.6791)	-0.0034	-0.74	(0.6798)	(0.8211)	0.0134	1.84	(0.4651)	(0.3645)
	v=3	-0.0022	-0.48			-0.0040	-0.86			0.0024	0.40		
	v=4	0.0014	0.29			0.0006	0.13			-0.0020	-0.29		
	Highest Ret-Vol v=5	0.0073	1.17			0.0032	0.50			0.0069	0.93		
k=2	Lowest Ret-Vol v=1	<b>-0.0107</b>	<b>-3.74</b>	<b>8.42</b>	<b>4.49</b>	<b>-0.0094</b>	<b>-3.44</b>	4.73	<b>3.78</b>	<b>-0.0090</b>	<b>-2.48</b>	3.57	1.74
	v=2	-0.0051	-1.56	<b>(0.0774)</b>	<b>(0.0006)</b>	-0.0044	-1.28	(0.3162)	<b>(0.0024)</b>	-0.0089	-1.92	(0.4667)	(0.1248)
	v=3	-0.0033	-1.00			-0.0065	-1.55			-0.0014	-0.28		
	v=4	<b>-0.0098</b>	<b>-2.85</b>			<b>-0.0079</b>	<b>-2.16</b>			-0.0007	-0.14		
	Highest Ret-Vol v=5	<b>-0.0117</b>	<b>-3.06</b>			-0.0021	-0.47			-0.0004	-0.07		
k=3	Lowest Ret-Vol v=1	<b>-0.0079</b>	<b>-3.26</b>	3.96	<b>2.88</b>	<b>-0.0073</b>	<b>-3.00</b>	0.72	<b>3.19</b>	-0.0024	-0.72	0.99	0.17
	v=2	-0.0040	-1.33	(0.4113)	<b>(0.0144)</b>	<b>-0.0059</b>	<b>-2.13</b>	(0.9484)	<b>(0.0079)</b>	-0.0008	-0.23	(0.9109)	(0.9723)
	v=3	-0.0032	-0.94			<b>-0.0092</b>	<b>-2.86</b>			0.0019	0.42		
	v=4	<b>-0.0078</b>	<b>-2.27</b>			-0.0069	-1.73			-0.0006	-0.13		
	Highest Ret-Vol v=5	-0.0059	-1.57			-0.0071	-1.69			-0.0003	-0.06		
k=4	Lowest Ret-Vol v=1	<b>-0.0068</b>	<b>-4.04</b>	<b>8.44</b>	<b>3.76</b>	-0.0015	-0.77	4.58	1.54	-0.0031	-0.85	4.79	1.55
	v=2	<b>-0.0091</b>	<b>-4.21</b>	<b>(0.0767)</b>	<b>(0.0025)</b>	<b>-0.0084</b>	<b>-3.38</b>	(0.3332)	(0.1771)	<b>-0.0083</b>	<b>-2.06</b>	(0.3092)	(0.1733)
	v=3	-0.0008	-0.29			-0.0046	-1.64			-0.0034	-0.79		
	v=4	-0.0025	-0.78			-0.0019	-0.58			0.0013	0.24		
	Highest Ret-Vol v=5	-0.0028	-0.81			-0.0031	-0.86			0.0084	1.34		
Highest EPS/P k=5	Lowest Ret-Vol v=1	<b>-0.0053</b>	<b>-2.67</b>	5.56	1.77	-0.0046	-1.80	4.20	0.92	-0.0038	-0.83	4.23	0.76
	v=2	-0.0032	-1.30	(0.2341)	(0.1191)	-0.0031	-0.92	(0.3793)	(0.4687)	-0.0017	-0.30	(0.3758)	(0.5768)
	v=3	-0.0021	-0.76			-0.0046	-1.42			-0.0024	-0.48		
	v=4	0.0013	0.42			0.0003	0.08			0.0074	1.16		
	Highest Ret-Vol v=5	0.0008	0.23			0.0041	0.90			0.0117	1.54		

Notes:  $R_{J,t,k,v}$  denotes the return on portfolio  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ , in month  $t=1,2,\dots, TP$ , for portfolio sets  $EPS_J/P$ ,  $J=1,2,3$ .  $R_{f,t}$ , the riskless rate, is the yield on a US Government 1-month Treasury bill,  $R_{M,t}$ , the return on the market portfolio, is the return on the CRSP value weighted index of common stocks in month  $t$ ,  $SMB_t$  and  $HML_t$  are the small-minus-big and high-minus-low Fama-French factors,  $MOM_t$  is the momentum factor in month  $t$ , and  $DY_{t-1}$  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.



**Panel B: 5x5 EPS/P and EBITDA Volatility sorted Portfolios**

EPS/P Quintile	EBITDA-Vol Quintile	EPS <sub>1</sub> /P				EPS <sub>2</sub> /P				EPS <sub>3</sub> /P			
		$\alpha$	t( $\alpha$ )	Hansen's J (p-value)	GRS (p-value)	$\alpha$	t( $\alpha$ )	Hansen's J (p-value)	GRS (p-value)	$\alpha$	t( $\alpha$ )	Hansen's J (p-value)	GRS (p-value)
Lowest EPS/P k=1	Lowest EBITDA-Vol v=1	-0.0106	-1.80	<b>9.04</b>	1.82	-0.0106	-1.80	7.49	1.51	-0.0037	-0.44	4.76	1.12
	v=2	-0.0048	-1.07	<b>(0.0602)</b>	(0.1084)	-0.0048	-1.07	(0.1123)	(0.1865)	-0.0026	-0.32	(0.3129)	(0.3501)
	v=3	0.0004	0.08			0.0004	0.08			0.0099	1.25		
	v=4	0.0093	1.28			0.0093	1.28			0.0194	1.87		
	Highest EBITDA-Vol v=5	0.0091	1.67			0.0091	1.67			0.0023	0.27		
k=2	Lowest EBITDA-Vol v=1	<b>-0.0141</b>	<b>-3.41</b>	4.90	<b>3.43</b>	<b>-0.0141</b>	<b>-3.41</b>	6.96	<b>2.50</b>	<b>-0.0140</b>	<b>-2.33</b>	5.62	1.40
	v=2	-0.0059	-1.60	(0.2980)	<b>(0.0049)</b>	<b>-0.0059</b>	<b>-1.60</b>	(0.1378)	<b>(0.0304)</b>	0.0034	0.59	(0.2297)	(0.2254)
	v=3	<b>-0.0091</b>	<b>-2.46</b>			<b>-0.0091</b>	<b>-2.46</b>			0.0000	-0.01		
	v=4	-0.0079	-1.80			-0.0079	-1.80			0.0003	0.05		
	Highest EBITDA-Vol v=5	-0.0044	-1.11			<b>-0.0044</b>	<b>-1.11</b>			-0.0057	-0.85		
k=3	Lowest EBITDA-Vol v=1	<b>-0.0088</b>	<b>-2.23</b>	2.70	<b>1.87</b>	<b>-0.0088</b>	<b>-2.23</b>	<b>9.41</b>	<b>4.44</b>	0.0018	0.31	1.47	0.33
	v=2	<b>-0.0069</b>	<b>-1.97</b>	(0.6096)	<b>(0.0989)</b>	<b>-0.0069</b>	<b>-1.97</b>	<b>(0.0517)</b>	<b>(0.0006)</b>	-0.0001	-0.01	(0.8318)	(0.8971)
	v=3	<b>-0.0061</b>	<b>-2.27</b>			<b>-0.0061</b>	<b>-2.27</b>			-0.0048	-1.18		
	v=4	-0.0022	-0.56			-0.0022	-0.56			-0.0014	-0.31		
	Highest EBITDA-Vol v=5	-0.0030	-0.71			-0.0030	-0.71			0.0013	0.20		
k=4	Lowest EBITDA-Vol v=1	<b>-0.0132</b>	<b>-3.66</b>	<b>17.41</b>	<b>5.18</b>	<b>-0.0132</b>	<b>-3.66</b>	<b>16.37</b>	<b>4.85</b>	-0.0023	-0.42	2.04	0.60
	v=2	-0.0041	-1.34	<b>(0.0016)</b>	<b>(0.0001)</b>	<b>-0.0041</b>	<b>-1.34</b>	<b>(0.0026)</b>	<b>(0.0003)</b>	-0.0002	-0.04	(0.7283)	(0.6985)
	v=3	<b>-0.0066</b>	<b>-2.31</b>			<b>-0.0066</b>	<b>-2.31</b>			-0.0092	-1.81		
	v=4	0.0017	0.54			0.0017	0.54			-0.0001	-0.01		
	Highest EBITDA-Vol v=5	0.0032	0.81			0.0032	0.81			0.0017	0.26		
Highest EPS/P k=5	Lowest EBITDA-Vol v=1	<b>-0.0085</b>	<b>-2.77</b>	<b>14.78</b>	<b>4.25</b>	<b>-0.0085</b>	<b>-2.77</b>	<b>17.11</b>	<b>2.97</b>	-0.0069	-1.07	<b>8.68</b>	1.83
	v=2	-0.0050	-1.75	<b>(0.0052)</b>	<b>(0.0009)</b>	-0.0050	-1.75	<b>(0.0018)</b>	<b>(0.0122)</b>	-0.0055	-0.75	<b>(0.0696)</b>	(0.1069)
	v=3	-0.0047	-1.61			-0.0047	-1.61			-0.0015	-0.25		
	v=4	0.0031	0.90			0.0031	0.90			0.0088	1.37		
	Highest EBITDA-Vol v=5	0.0072	1.94			0.0072	1.94			<b>0.0187</b>	<b>2.29</b>		

Notes:  $R_{J,t,k,v}$  denotes the return on portfolio  $k=1,2,3,4,5$ ,  $v=1,2,3,4,5$ , in month  $t = 1,2,\dots, TP$ , for portfolio sets  $EPS_J/P$ ,  $J=1,2,3$ .  $R_{ft}$ , the riskless rate, is the yield on a US Government 1-month Treasury bill,  $R_{M,t}$ , the return on the market portfolio, is the return on the CRSP value weighted index of common stocks in month  $t$ ,  $SMB_t$  and  $HML_t$  are the small-minus-big and high-minus-low Fama-French factors,  $MOM_t$  is the momentum factor in month  $t$ , and  $DY_{t-1}$  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.

### 4.5.2 Null Hypothesis

In this section, I discuss multivariate tests of abnormal returns, the  $\hat{\alpha}$  s, of equation (4.6) and (4.7). The purpose of the Gibbons, Ross, and Shanken (1989) (GRS) test is to search for pricing errors in an asset pricing model. I 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<sup>69</sup>,  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha$ , 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 my case, Hansen's J statistic is  $\chi^2$  distributed with degree of freedom equal to 4 (number of restrictions minus one) for  $EPS_1/P$ ,  $EPS_2/P$ , and  $EPS_3/P$  portfolios.

### 4.5.3 Abnormal Returns

I now turn to abnormal return evidence for portfolios formed with forward earnings yield and volatility when benchmarked against the conditional Fama-French-Carhart four factor asset pricing model. Panel A reports results for portfolios formed with return volatility,  $\sigma(RET)$ . Panel B reports results for portfolios formed with  $EBITDA$

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<sup>69</sup> 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.

volatility. Because I estimate many parameters in the conditional Fama-French-Carhart model, this table reports results only for the alpha estimates.

In Panel A of Table 4.4, within the middle  $EPS/P$  quintiles  $k=2,3,4$ , alpha ( $\hat{\alpha}$ ) is always negative and often statistically significant (with the t-statistics). In addition, within these  $EPS/P$  quintiles  $k=2,3,4$ , the GRS statistics rejects the hypothesis that the alphas jointly equal zero,  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ . Since middle  $EPS/P$  portfolios are low-risk (neither high nor low profitability), this is evidence of negative abnormal returns for low-risk stocks. On the other hand, within the extreme  $EPS/P$  quintiles  $k=1,5$ , alpha ( $\hat{\alpha}$ ) is sometime positive and sometimes negative but generally not statistically significant (with the t-statistics). In addition, within these  $EPS/P$  quintiles  $k=1,5$ , the GRS statistic fails to reject the hypothesis that the alphas jointly equal zero,  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ . Since extreme  $EPS/P$  portfolios,  $k=1,5$ , are high-risk (high and low profitability), I uncover no evidence of abnormal returns for the highest-risk stocks in financial distress.

At the 10% significance level, for the  $EPS/P$  quintiles  $k=2$ , and 4, Hansen's J statistic rejects the hypothesis that the alphas equal one another (but, the joint value is not necessarily zero),  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha$ . This is weak evidence that not only does the Fama-French-Carhart four factor model over price low risk stocks, but also, that in some instances, investors might be about to use volatility to form profitable investment strategies.

Panel B of Table 4.4 reports results for alpha estimates for portfolios sorted by forward earnings yield and  $EBITDA$  volatility. These results are qualitatively similar to those for  $EPS/P$  and  $\sigma(RET)$  generated portfolios. I find negative abnormal returns for

middle *EPS/P* quintiles ( $k=2,3,4$ ) where returns and risk are relatively low and profitability is intermediate. In each of these quintiles, the GRS statistic is statistically significant. In addition, for both the *EPS/P* quintiles  $k=4$  and  $k=5$  (high profitability companies), both the GRS statistic and Hansen's J statistic is statistically significant. Alpha estimates tend to increase monotonically from negative and statistically significant (with the t-statistic) to positive and statistically significant (at least for the highest earning yield quintile,  $k=5$ ) as  $v$  increases from 1 to 5 (low volatility to high volatility). This evidence suggests that *EBITDA* volatility is a missing factor in the Fama-French-Carhart model for high profitability non-dividend paying companies.

#### **4.6 Conclusion for Chapter 4**

My research is based on the guiding principle that the value premium arises from an underlying relation between returns and profitability for companies. Because this relation is quite complex and differs for different types of companies, some classes of firms have, and others do not have, a value premium. In Chapter 2, I find a value premium for profitable dividend paying companies. The current Chapter finds a value premium for firms in financial distress. On the other hand, in Chapter 3, I find a negative value premium for profitable non-dividend paying firms. Further, even when the value premium exists, the reason for it is quite distinct between the profitable dividend paying firms that Chapter 2 investigates and the firms in financial distress that I investigate in the current Chapter.

Chapter 2 argues that limits on growth restrict managers from using high profitability for further business investment and, instead, this profitability "covers" ongoing growth capital expenditures. This coverage reduces risk. Consequently, high

profitability growth-firms, with great market/book, have lower risk and lower return than value-firms. I report supporting evidence for profitable dividend paying companies. In the current Chapter, I find a hill-shaped relation between market/book and *ROE* and a U-shaped relation between returns and *ROE*. The combination of these two relations means that there is a value-premium for firms in financial distress. At *ROE* extremes, high or low, returns for firms in financial distress are high and market/book is low. I argue that low market/book for high *ROE* firms (that are nonetheless in financial distress) arises from low volatility. Last, Chapter 3 argues that the decision by managers not to pay dividends is evidence of financing constraints that impede the development of unbounded (or at least less limited) growth opportunities. Profitability allows firms to finance internally when they cannot finance externally which increases growth, growth-leverage, expected return, and market/book. In Chapter 3, I report evidence of this negative value premium for profitable non-dividend paying firms.

I call all of these explanations for the value premium (or a negative value premium) the financial-distress/limits-to-growth hypothesis. Since existing explanations of the value premium (financial-distress, investment irreversibility, and growth-option exercise), are, in my view, rather unidimensional, I do not believe that they are adequate to explain the range of return phenomenon that I report and investigate.

Across Chapter 2 to Chapter 4, I report evidence of abnormal returns. The principal commonality in these results is negative abnormal returns for low risk companies. However, what constitutes a low risk company differs across these three papers. Within each of the book/market quintile portfolios (that is from growth to value), Chapter 2 finds negative abnormal returns for portfolios of firms with low values of a

return proxy (forward *ROE* plus one minus the market/book ratio times dividend yield, which is the first two terms on the right hand side of the lower branch of Equation 4.5 in the current Chapter). Since this return proxy relates positively with realized returns, low values indicate low risk. While I find negative abnormal returns for these low risk stocks, I do not find negative abnormal returns for all low risk stocks. Across book/market quintile portfolios (value versus growth) I find evidence of the value premium, low returns for growth stocks. However, I find no evidence of negative abnormal returns for low risk growth stocks compared to value stocks. Second, in Chapter 3, within the set of profitable non-dividend paying firms, those with the lowest profitability have the lowest risk because they are least inclined to grow. I find negative abnormal returns for these firms. Last, in the current Chapter, I find negative abnormal returns for portfolios of stocks with intermediate profitability (neither low nor high). These companies have low risk amongst the class of firms in financial distress. They are neither in extreme financial distress nor is their profitability sufficiently great to make investors believe that growth risk is imminent. The commonality of these results across my three papers gives me comfort that my analysis, both theoretically and empirically, is without significant error.

While rational financial-economic analysis guides my empirical investigation, I cannot dismiss market-inefficiency as an explanation for abnormal returns. To do so would impede rather than promote unbiased future scientific inquiry that my research might inspire. Either equity-markets over-price low-risk stocks or current asset-pricing models are not adequate for low risk stocks. While I cannot dismiss capital market inefficiency as an explanation for abnormal returns, my inclination is to believe that, in many instances, current asset-pricing models are not adequate for low risk stocks. These

models presume linearity in the relation between returns and risk factors. Linearity does not capture complex non-linearities in the relation between returns and profitability that, for example, Panel B of Figure 4.1 depicts. At a minimum, I believe that financial researchers must develop and use different linear factor models to capture risk for different types of companies: profitable dividend paying, profitable non-dividend paying, and firms in financial distress.

### Appendix 4A

This appendix describes Blazenko and Pavlov's (2009) model of a dynamically expanding business where profit growth at the rate,  $g\%$  per annum, requires capital growth, at the rate  $g\%$  per annum. Because these rates are the same, when a manager grows his/her business or suspends growth, the return on capital,  $ROC \equiv Y$ , which is operating earnings divided by capital, follows a non-growing<sup>70</sup> geometric Brownian motion with a volatility parameter  $\sigma$ .

The manager's expansion decision depends on profitability,  $ROC=Y$ . When  $ROC$  exceeds a value maximizing expansion threshold,  $\xi_c^*$ , which Equation (A4.3) below describes, the manager expands operating earnings at the rate  $g$  with capital growth at the rate  $g$ . When  $ROC$  is less than the expansion boundary,  $\xi_c^*$ , the manager suspends growth ( $g=0$ ) until profitability improves. Blazenko and Pavlov (2009) show that the market/book ratio for capital,  $\pi_c(ROC)$ , for  $0 \leq g < r^*$ ,  $r^* \equiv r + \theta\sigma_{x,c}$ , is,

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<sup>70</sup> If growth of operating earnings at the rate  $g$  requires capital growth at the rate  $g$ , then  $ROC$  does not grow. Further, despite growth, the corporate return on business investment is  $ROC$  and not  $ROC$  plus growth. A static environment illustrates the point. Let  $X$  be operating earnings and  $B$  be capital, then, the IRR satisfies  $(X-g*B)/(IRR-g)-B=0$ , and,  $IRR=X/B=ROC$  without the growth factor  $g$ . For spontaneous profit growth (without capital investment), which is not the nature of the investment I study, the IRR satisfies  $X/(IRR-g)-B=0$ , and  $IRR=ROC+g$ .

$$\pi_c(Y) = \begin{cases} \frac{Y}{r^*} + \frac{g\xi_c^*}{r^*(r^*-g)} \frac{(1-\lambda)}{(\alpha-\lambda)} \left(\frac{Y}{\xi_c^*}\right)^\alpha - \frac{g}{(r-g)} \frac{\lambda}{(\lambda-\alpha)} \left(\frac{Y}{\xi_c^*}\right)^\alpha, & \text{suspend growth, } Y < \xi_c^*, \\ \frac{Y}{r^*-g} + \frac{g\xi_c^*}{r^*(r^*-g)} \frac{(1-\alpha)}{(\alpha-\lambda)} \left(\frac{Y}{\xi_c^*}\right)^\lambda - \frac{g}{(r-g)} \left(1 - \frac{\alpha}{(\alpha-\lambda)} \left(\frac{Y}{\xi_c^*}\right)^\lambda\right), & \text{grow, } Y \geq \xi_c^* \end{cases} \quad (\text{A4.1})$$

$$\text{where, } \alpha \equiv \frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2} + \sqrt{\frac{2r}{\sigma^2} + \left(\frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2}\right)^2}, \quad (\text{A4.2})$$

$$\lambda \equiv \frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2} - \sqrt{\frac{2(r-g)}{\sigma^2} + \left(\frac{1}{2} + \frac{\theta\sigma_{x,c}}{\sigma^2}\right)^2},$$

$$\xi_c^* = r^* \times \left[\frac{r^*-g}{r-g}\right] \times \left[\frac{\alpha}{(\alpha-1)}\right] \times \left[\frac{\lambda}{(\lambda-1)}\right]. \quad (\text{A4.3})$$

The parameter,  $\theta$ , is constant relative risk aversion for a representative investor.

The parameter  $\sigma_{x,c}$  measures business risk of the common share and equals covariance of the log of  $ROC$  with the log of aggregate consumption in the economy. For expositional simplicity, I presume,  $\theta\sigma_{x,c} > 0$ , which means that risk premiums for equity ownership are positive. The parameter,  $r$ , is risk free rate. The risk adjusted rate for a hypothetical firm that permanently does not growth,  $r^* \equiv r + \theta\sigma_{x,c}$ , is risk free rate,  $r$ , plus the risk premium  $\theta\sigma_{x,c}$ .

Panel A of Figure 4.1 plots market/book for capital,  $\pi_c$ , with respect to  $ROE$  ( $ROE$  is a transformation of  $ROC=Y$  given in Equation 4.2). Blazenko and Pavlov (2009) show that market/book for capital equals one at the expansion boundary,  $\pi_c(\xi_c^*) = 1$ . The manager grows the business when market/book exceeds one,  $\pi_c(ROC) \geq 1$ , and suspends



business growth when market/book is less than one,  $\pi_c(ROC) < 1$ . This representation of corporate investment is the dynamic equivalent of Tobin's  $q$  theory (Tobin, 1969).

On the branch of Equation (A4.1) with suspended growth, the first term is the value of a firm that permanently does not grow. The second term (positive) is the expected incremental profit in the option to incur growth investment. The third term (negative) is the expected expansion cost if the manager expands the business sometime in the future when profitability exceeds the expansion boundary,  $ROC \geq \xi_c^*$ . On the growth branch of Equation (A4.1), the first term is the value of a permanently growing firm. The second term (negative), is the expected profit foregone if profitability falls below expansion boundary,  $ROC < \xi_c^*$ , and the manager suspends growth. The third term (negative) is the expected cost of growth expenditures recognizing that the manager avoids these costs upon possible suspension of growth at times in the future. Equation (A4.3) is the value maximizing expansion boundary,  $\xi_c^*$ . The first two terms,

$r^* \times \left[ \frac{r^* - g}{r - g} \right]$ , are the expansion boundary for a hypothetical permanently growing firm.

The third term,  $\left[ \frac{\alpha}{(\alpha - 1)} \right] > 1$ , measures the delaying force of irreversible growth

investments for firms that have suspended growth (see, Dixit and Pindyck 1994). The

fourth term,  $\left[ \frac{\lambda}{(\lambda - 1)} \right] < 1$ , measure a force that accelerates growth investment. With

limits on investment, current investment increases the size and value of future growth

investments upon stochastically improved profitability (see, Blazenko and Pavlov 2009).

The product of the last two term,  $\left[ \frac{\alpha}{(\alpha-1)} \right] \times \left[ \frac{\lambda}{(\lambda-1)} \right]$ , is less than one. Because the manager has the indefinite option to grow or suspend business growth, the dynamic expansion threshold is lower than in the static setting.

# CHAPTER 5: DYNAMIC GROWTH EXPECTED RETURN

## Abstract

Within book/market quintiles, expected return from constant growth equity valuation (static growth expected return, *SGER*) relates positively with realized returns. However, *SGER* overstates realized returns for growth stocks and understates realized returns for value stocks. I investigate whether reversion in *ROE*, which is a *SGER* input, reconciles these biases. I compare several *ROE* forecasts using both historical and analysts' earnings estimates but *SGER* continues to overstate (understate) returns for growth (value) stocks. On the other hand, the regression of return on *ROE* for value versus growth stocks is a conditional reduced-form version of a dynamic equity valuation model that recognizes the value-premium. I call return forecasts from these regressions dynamic growth expected returns, *DGER*, which in large part eliminate the value-versus-growth bias.

## 5.1 Introduction

The discount rate in an equity valuation model that best represents share price is an “implicit” expected return. See, for example, Easton (2004, 2006), Easton, Taylor, Shroff, and Sougannis (2002), Gebhardt, Lee, Swaminathan (2001), Gode and Mohanram (2003). The purpose of these expected returns is for the Weighted Average Cost of Capital and business investment analysis or corporate performance evaluation with financial measures like Residual Income and Economic Value Added<sup>71</sup> that require a return

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<sup>71</sup> Residual income is accounting earnings less book equity times the required equity return. Economic Value Added is Net Operating Income less the dollar cost of capital which is book assets multiplied by the cost of capital.

benchmark for employed capital. These uses impose some rather demanding statistical requirements on an implicit-return measure, including, at a minimum, unbiasedness. However, in a study of seven implicit-returns, Easton and Monahan (2005) find that in the entire cross-section of firms, these proxies are unreliable and none has a positive association with realized returns. In Chapter 2, I argue that this literature runs afoul of the value-premium which is the empirical observation that low market/book “value” stocks have higher returns than high market/book “growth” stocks (see, for example, Fama and French, 1992, 1998; Chan, Hamao, and Lakonishok, 1991).

Because implicit-returns “discount” a profitability-related measure to best match share price, they relate positively with profitability. One might argue that implicit-returns need not relate positively with profitability because high profitability generates high share prices. This argument would be valid if the financial model used for determination of implicit-return was “the” model that investors used for share price determination. However, any model is at best a weak representation of economic activity. In particular, the models in this literature are static rather than dynamic and, thus, do not capture the value-premium. With this specification error, implicit-returns and profitability relate positively. Further, high profitability firms are growth firms with low returns. Thus, implicit expected returns and realized returns relate negatively.

Alternatively, in Chapter 2, I first sort firms into portfolios by market/book. For value and growth stocks separately, that is, within each market/book sorting of firms, I find that the implicit-return measure, expected return from the constant growth version of the discounted dividend model (static growth expected return, *SGER*), relates positively with realized returns. This “conditional” implicit-return is an improvement over the

unconditional implicit-returns that Easton and Monahan (2005) find unreliable. However, I find that *SGER* overstates realized returns for high-profitability growth stocks and understates realized returns for low-profitability value stocks. This bias needs to be corrected for conditional implicit-returns to be useful for corporate financial purposes.

A possible reason for this bias is that the profitability forecast for *ROE* that I use in my implicit-return measure, *SGER*, does not recognize the reversion in profitability that Fama and French (2000) empirically document. The first task of this paper is to determine whether I can reduce or eliminate the value-versus-growth bias in *SGER* as a conditional expected return measure by recognizing earnings-reversion prior to inputting *ROE* into *SGER*. In other words, high profitability for growth firms is unsustainably high and is not a good forecast of future profitability for the purpose of expected return determination (and vice versa for value stocks). I compare several *ROE* forecasts using both historical and analysts' earnings estimates. Nonetheless, *SGER* continues to overstate realized returns for growth stocks and understates realized returns for value stocks.

Second, the fact that earnings reversion does not eliminate the value-versus-growth bias for *SGER* as a conditional expected return measure suggests that this bias will never be removed with implicit-returns from static models of equity valuation. Rather, only expected returns from a dynamic model of equity valuation that recognize the value-premium will eliminate this bias. In Chapter 2, I propose a new explanation for the value-premium: the "limits-to-growth hypothesis." With organizational limits on growth expenditure, profitability decreases risk for high profitability growth firms but increases risk for low profitability value firms in anticipation of future growth-leverage.

Consistent with a modified version of the limits-to-growth hypothesis, I find that returns and profitability relate positively for both value and growth stocks but that the relation is stronger for value stocks than it is for growth stocks. The estimated regressions of realized returns on profitability, *ROE*, that lead to these results are effectively a conditional reduced-form version of my dynamic equity valuation model that recognizes the value-premium. I investigate *ROE* with historical earnings and consensus analysts' earnings forecasts as input in these regressions to produce an expected return. I call return forecasts from these regressions "dynamic growth expected returns," *DGER*. *DGERs* effectively eliminate the value-versus-growth bias.

In section 5.2, I review my implicit equity return measure *SGER*. I compare several *ROE* forecasts using both historical and analysts' earnings estimates. I report evidence that a reversion adjustment to historical *ROE* leads to the best *SGER* representation of realized returns. Nonetheless, *SGER* continues to overstate realized returns for growth stocks and understates realized returns for value stocks. In section 5.3, I review the dynamic equity valuation model I develop in Chapter 2. I develop estimated regressions of realized returns on profitability, *ROE*, as a conditional reduced-form version of the dynamic equity valuation model. I investigate *ROE* with historical earnings and consensus analysts' earnings forecasts as input in these regressions for an expected return measure. I show that these conditional expected returns effectively eliminate the value-versus-growth bias. Section 5.4 summarizes and concludes the paper.

## 5.2 Static Growth Expected Return, *SGER*

### 5.2.1 Preliminaries

In Chapter 2, I show that expected return from the constant growth discounted dividend model (Williams, 1938) is,

$$SGER \equiv ROE + (1 - \pi)dy \quad (5.1)$$

where *ROE* is the forward rate of return on equity,  $\pi$  is the market/book ratio, and *dy* is the forward dividend yield. The component terms of *SGER* are either readily available ( $\pi$  and *dy*) or relatively easy to forecast, *ROE*. Growth “g” does not appear in Equation (5.1) other than indirectly through its impact on share price which determines market/book,  $\pi$ , and dividend yield, *dy*. *SGER* has the attractive feature that it does not require statistical estimation of unknown parameters.

It is common in the implicit-return literature to use a forecast-period/terminal-value approach for modeling equity value. See, for example, Easton (2004, 2006), Easton, Taylor, Shroff, and Sougannis (2002), Gebhardt, Lee, Swaminathan (2001), and Gode and Mohanram (2003). The length of the explicit forecast period is arbitrary and is unlikely appropriate for all firms. Further, results are not sensitive to the length of explicit forecast period that these authors use. This observation suggests that in static modeling the assumption of constant growth is sufficient. Alternatively, Blazenko and Pavlov’s (2009) dynamic equity valuation model that I use in section 5.3 as the basis for empirical measures of conditional expected returns is a dynamic two stage growth model rather than a static model. *SGER* in Equation (5.1) is not appropriate for firms in financial distress and, thus, empirically, I do not use it for these firms. See Chapter 4 for an investigation of firms in financial distress and the value-premium.

Because in Chapter 2 I recognize the negative impact of the value-premium on implicit-returns, I first sort firms into portfolios by market/book. For value and growth stocks separately, that is, within each market/book sorting of firms, I find that *SGER* relates positively with realized returns. This “conditional” implicit-return is an improvement over the unconditional implicit-returns that Easton and Monahan (2005) find unreliable. However, I find that *SGER* overstates realized returns for high-profitability growth stocks and understates realized returns for low-profitability value stocks. In the following sub-section I investigate whether I can reduce or eliminate the value-versus-growth bias in *SGER* as a conditional expected return measure by recognizing earnings-reversion prior to inputting *ROE* into *SGER* in Equation (5.1).

### **5.2.2 Data, Portfolio Formation, and Portfolio Characteristics**

I require that firms have data from each of the *COMPUSTAT*, *CRSP*, and Thomson *I/B/E/S* databases. These are US domestic companies but also include foreign inter-listed companies and American Depositary Receipts (ADRs).<sup>72</sup> Second, because both market/book and *ROE* for *SGER* in Equation (5.1) entail division by *BVE*, I require that firms have positive *BVE* from the latest reported quarterly or annual financial statements immediately prior to portfolio formation. Third, in the constant growth version of the discounted dividend model from which Equation (5.1) is derived, it makes little sense for a firm to grow with negative forecast *ROE* indefinitely. Further, in section 5.3, in my application of Blazenko and Pavlov’s (2009) dynamic equity valuation model, I presume that *ROE* follows a geometric Brownian motion, which mean that *ROE* is always positive. These modeling restrictions direct my analysis away from firms in

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<sup>72</sup> If not in US dollars, I convert accounting data (forecast or historical) into US dollars.



financial distress and, therefore, I require positive trailing-twelve-month earnings. Fourth, Chapter 3 reports evidence that the profitability motivated risk/return dynamics of non-dividend paying firms is distinct from dividend paying firms. In particular, I find evidence of a negative value-premium for non-dividend paying firms. Because in this chapter my statistical handling of firms that do and do not have a value-premium should be distinct and because *SGER* in Equation (5.1) requires dividend yield, I impose the requirement that firms have positive trailing-twelve-month dividends at the time of portfolio formation. Last, to avoid bias in *ROE* arising from extremely small book equity, I require BVE greater than five million dollars and book value per share greater than one.

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* they refer to as a "Statistical Period" date. My testing rebalances portfolios at closing prices on Statistical Period dates. Thomson *I/B/E/S* is my source for reported EPS and consensus analysts' EPS forecasts.<sup>73</sup> *COMPUSTAT* is my source for book equity (BVE), and other corporate financial data. I measure BVE as Total Assets less Total Liabilities less Preferred Stock plus Deferred Taxes and Investment Tax Credits. *CRSP* is my source for dividends, split factors, shares outstanding, daily share price, and daily returns.

The first Statistical Period date, which begins the *I/B/E/S* database, is 1/15/1976. Common database coverage (that is, for *I/B/E/S*, *COMPUSTAT*, and *CRSP*) is up to September 2009 where the last Statistical Period date is 9/17/2009. For each Statistical

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<sup>73</sup> I use the *COMPUSTAT* Merged Primary, Supplementary, Tertiary & Full Coverage Research Quarterly and Annual files that include both active and inactive companies, which do not suffer from survivor bias. *CRSP* stands for Center for Research in Security Prices: Graduate School of Business, University of Chicago. Thomson *I/B/E/S* is a financial information product of Thomson Reuters. The acronym *I/B/E/S* stands for Institutional Brokers Estimate System. I use the *I/B/E/S* summary statistics file and the actual data file, both of which are unadjusted for stock splits and stock dividends. I use *CRSP* daily cumulative stock factors to adjust for splits and stock dividends.

Period date from 1/15/1976 to 9/17/2009, I sort firms into five book/market quintiles (b=1,2,3,4,5) which leads to five portfolios that I rebalance at each statistical period date over the test period.

I forecast *ROE* in several ways before I input into *SGER* in Equation (5.1). I use trailing-twelve-month (TTM) EPS divided by divided by Book Value Per Share (BPS) which is Book Value of Equity (BVE) from the most recently reported quarterly or annual financial statements prior to a Statistical Period date divided by the number of outstanding shares at a Statistical Period Date. Second, I use the median *I/B/E/S* analysts' EPS forecast for the upcoming unreported fiscal year at a Statistical Period date divided by BPS. I use annual rather than quarterly EPS forecasts to avoid seasonality. Chapter 2 reports evidence that analysts' consensus EPS forecasts for one unreported fiscal year hence are quite accurate. On the other hand, for longer term forecasts, that is, two and three unreported fiscal years hence, I report evidence that analysts overly optimistically forecast earnings. Because I use only analysts' forecasts for the upcoming unreported fiscal year hence, I avoid this analyst-optimism-bias. In addition to these two *ROE* forecasts I use *ROE* forecasts that are adjusted with estimates of earnings-reversion. I describe these earnings-reversion estimates in the following subsections.

### **5.2.3 Fama-French Earnings-Reversion**

In Chapter 2, I find that *SGER* overstates realized returns for high-profitability growth stocks and understates realized returns for low-profitability value stocks. A possible reason for this bias is that the *ROE* forecasts that I use in the implicit-return measure, *SGER*, do not recognize the profitability-reversion that Fama and French (2000) empirically document. Fama and French (2000) argue that in a competitive economy

profitability reverts to a long-run mean that is established in an equilibrium process. They use a non-linear partial adjustment model to investigate profitability changes (earnings before interest to total book assets) and find strong evidence of mean-reverting in profitability. In particular, extreme profitability (either higher or lower than mean) reverts to its mean with a higher reversion rate. Because Equation (5.1) and my application of Blazenko and Pavlov's (2009) dynamic equity valuation model uses *ROE* rather than the return on capital (*ROC*), I apply Fama and French's (2000) methodology to *ROE* rather than *ROC*. I investigate mean reversion in *ROE* using Fama and French's (2000) two-step non-linear partial adjustment model.

In step one, on each Statistical Period date  $t=1 \dots TP$ , I estimate Fama-MacBeth (1973) cross-sectional regressions of *ROE* (trailing-twelve-month earnings/book equity) on two variables: M/B (market/book), and D/B (trailing-twelve-months dividends/book equity)<sup>74</sup> separately for each of my book/market portfolios,  $b=1,2,\dots,5$ ,

$$ROE_{i,t} = d_{0,t} + d_{1,t} \frac{M_{i,t}}{B_{i,t}} + d_{2,t} \frac{D_{i,t}}{B_{i,t}} + \varepsilon_{i,t} \quad \text{for } i=1 \dots N \quad (5.2)$$

where  $N$  is the number of firms satisfying my sample selection criteria for Statistical Period date  $t$ . Fama and French (2000) argue that M/B and D/B are determinants of expected profitability. M/B is market value of equity divided by most recently reported book equity and D/B is trailing-twelve-months dividends scaled by most recently reported book equity per share at Statistical Period date  $t$ . Panel A of Table 5.1 reports the means and standard deviations of the regression variables and the temporal average of cross-sectional estimated coefficients,  $\bar{d}_0$ ,  $\bar{d}_1$ ,  $\bar{d}_2$  in the Fama-MacBeth (1973)

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<sup>74</sup> Fama and French (2000) include an additional dummy variable for dividend versus non-dividend payers to capture the relation between dividends and profitability. I do not include this dummy variable because I restrict my sample to firms with positive trailing-twelve-month dividends.

regressions of Equation (5.2). Consistent with Fama and French (2000), both M/B and D/B relate positively with profitability *ROE*.

### 5.2.3.1 Fama-French Long-Term ROE Forecast

Fama and French (2000) argue that in a competitive economy, profitability reverts to a long-run mean that is established in an equilibrium process. Above normal profitability from, for example, innovation and technology reverts downward as other firms enter the product market. On the other hand, restructuring by low profitability firms to avoid liquidation or take-over improves profitability.

With most recent M/B and D/B for firm *i*, in market/book quintile *b*, at statistical month *t*, I can use regression estimates from Equation (5.2) to forecast the ergodic (long-run) *ROE* towards which *ROE* reverts. On each Statistical Period date  $t=1 \dots TP$ , for each book/market portfolio, I average the estimated coefficients from the regressions of Equation (5.2) for at least 12 months and up to 60 months prior to Statistical Period month *t*. Ergodic *ROE*, which I denote as  $FF\_LT\_R\hat{O}E_{i,t}$ , is,

$$FF\_LT\_R\hat{O}E_{i,t} = \bar{d}_{0,t} + \bar{d}_{1,t} \frac{M_{i,t}}{B_{i,t}} + \bar{d}_{2,t} \frac{D_{i,t}}{B_{i,t}} \quad \text{for } i=1 \dots N \quad (5.3)$$

Column A in Panel A of Table 5.4 reports the median ergodic *ROE*,  $FF\_LT\_R\hat{O}E$  (see Appendix 5A Equation A.5.22 for definition) for each book/market quintile  $b=1,2,3,4,5$ . Note that  $FF\_LT\_R\hat{O}E$  is higher than the current trailing-twelve-month *ROE*, (that is,  $ROE\_TTM$ ) from column A of Panel A in Table 5.2. So, Fama and French's (2000) ergodic *ROE* has the disconcerting property that it forecasts a long-run *ROE* improvement for both value and growth firms.

### 5.2.3.2 Fama-French Reversion Adjustment To Current Profitability as an ROE Forecast

The purpose of Fama and French's (2000) second step is to estimate the speed at which *ROE* reverts to its ergodic value. In step two, I use the deviation of *ROE* from its estimated ergodic value in Equation (5.3) and lagged changes in *ROE* to explain current changes in *ROE*. On each Statistical Period date  $t=1 \dots TP$ , I estimate Fama-MacBeth (1973) cross-sectional regressions of changes in *ROE*,  $CP_{i,t+1}$ , separately for each of my book/market portfolios<sup>75</sup>,  $b=1,2,3,4,5$ ,

$$CP_{i,t+1} = a + b_1 DFE_{i,t} + b_2 NDFE_{i,t} + b_3 SNDFE_{i,t} + b_4 SPDFE_{i,t} \\ + c_1 CP_{i,t} + c_2 NCP_{i,t} + c_3 SNCP_{i,t} + c_4 SPCP_{i,t} + e_{t+1}$$

where,

$$\begin{aligned} DFE_{i,t} &= ROE_{\text{fiscal year end prior to } t} - E(ROE_t) \\ NDFE_{i,t} &= NDFED_{i,t} * DFE_{i,t} \\ SNDFE_{i,t} &= NDFED_{i,t} * DFE_{i,t} * DFE_{i,t} \\ SPDFE_{i,t} &= PDFED_{i,t} * DFE_{i,t} * DFE_{i,t} \\ CP_{i,t+1} &= \text{Change in } ROE \text{ between the fiscal year end prior to and after month } t \\ CP_{i,t} &= \text{Change in } ROE \text{ between two fiscal year ends prior to month } t \\ NCP_{i,t} &= NCPD_{i,t} * CP_{i,t} \\ SNCP_{i,t} &= NCPD_{i,t} * CP_{i,t} * CP_{i,t} \\ SPCP_{i,t} &= PCPD_{i,t} * CP_{i,t} * CP_{i,t} \end{aligned} \tag{5.4}$$

$DFE_{i,t}$  is the deviation of *ROE* from its expected value  $E(ROE_t)$ . The empirical

counterpart of  $E(ROE_t)$  from Equation (5.2) is  $FF\_LT\_R\hat{O}E_{i,t}$  in Equation (5.3).

$NDFED_{i,t}$  is a dummy variable which takes the value 1 when  $DFE_{i,t}$  is negative.  $PDFED_{i,t}$

is a dummy variable which takes the value 1 when  $DFE_{i,t}$  is positive.  $NDFE_{i,t}$  measures

the negative deviation from expected *ROE*,  $SNDFE_{i,t}$  measures the squared negative

<sup>75</sup> Because Fama and French's (2000) non-linear partial adjustment model for profitability is sensitive to extreme values of profitability change, CP, I exclude observations with absolute values of  $CP_{i,t}$ , or  $CP_{i,t+1}$  greater than 5 when estimating regressions of Equation (5.4).

deviation from expected  $ROE$ , and  $SPDFE_{i,t}$  measures the squared positive deviation from expected  $ROE$ .  $CP_{i,t}$  is the change of  $ROE$  between two fiscal year ends prior to Statistical Period Date  $t$ .  $NCPD_{i,t}$  is a dummy variable which takes the value 1 when  $CP_{i,t}$  is negative.  $PCPD_{i,t}$  is a dummy variable which takes the value 1 when  $CP_{i,t}$  is positive.  $NCP_{i,t}$  measures the negative lagged changes in  $ROE$ ,  $SNCP_{i,t}$  measures the squared negative lagged changes in  $ROE$ , and  $SPCP_{i,t}$  measures the squared positive lagged changes in  $ROE$ .

Panel B of Table 5.1 reports the means and standard deviations of the regression variables and the temporal average of cross-sectional estimated coefficients, in the Fama-MacBeth (1973) regressions of Equation (5.4).

With most recent variables ( $DFE_{i,t}$ ,  $NDFE_{i,t}$ ,  $SNDFE_{i,t}$ ,  $SPDFE_{i,t}$ ,  $CP_{i,t}$ ,  $NCP_{i,t}$ ,  $SNCP_{i,t}$ , and  $SPCP_{i,t}$ ) for firm  $i$ , in market/book quintile  $b$ , at statistical month  $t$ , I can use regression Equation (5.4) to forecast  $ROE$  changes. Denote this forecast as  $\hat{CP}_{i,t+1}$ . On each Statistical Period date  $t=1 \dots TP$ , for each book/market portfolio, I average the estimated coefficients from the regressions of Equation (5.4) for at least 12 months and up to 60 months prior to Statistical Period month  $t$ . An  $ROE$  forecast, which I denote as,  $\hat{ROE}_{i,t+1}$ , is the historical  $ROE$  calculated with trailing-twelve-month earnings (TTM), adjusted by the predicted changes in  $ROE$  (which is  $\hat{CP}_{i,t+1}$ ), for firm  $i$ , at Statistical Period month  $t$ , is,

$$\hat{ROE}_{i,t+1} = ROE_{TTM_{i,t}} + \hat{CP}_{i,t+1} \quad (5.5)$$

For growth to value firms,  $b=1,2,3,4,5$ , column C of Panel A of Table 5.2 reports median reversion-adjusted trailing-twelve-month *ROE*,  $\hat{ROE}_{CP}$  (see Appendix 5A Equation A.5.2 for definition).

For comparison purposes, column A of Panel A in Table 5.2 for growth to value firms,  $b=1,2,3,4,5$ , reports median trailing-twelve-month *ROE*,  $ROE_{TTM}$  (see Appendix 5A Equation A.5.4 for definition). Median trailing-twelve-month *ROE* decreases across quintiles from growth to value firms,  $b=1,2,3,4,5$ . Growth firms are more profitable than are value firms.

In addition, for comparison purposes, column B of Panel A in Table 5.2 for growth to value firms,  $b=1,2,3,4,5$ , reports median analysts' *ROE* forecasts,  $ROE_{AN}$  (see Appendix 5A Equation A.5.6 for definition). Analysts' *ROE* forecasts decreases across quintiles from growth to value firms,  $b=1,2,3,4,5$ .

**Table 5.1 Regression to Explain the Level and Changes in ROE**

Panel A

**Regressions to Explain the Level of ROE**

1. Means and t Statistics for the Means of the Month-by-Month  
Regression Coefficients

Book/Market Portfolio	Intercept (t-stat)	$M_{i,t}/B_{i,t}$ (t-stat)	$D_{i,t}/B_{i,t}$ (t-stat)
b=1 Growth	0.067 (30.564)	0.027 (50.658)	0.519 (43.997)
2	0.055 (28.292)	0.040 (41.672)	0.236 (21.304)
3	0.047 (20.805)	0.050 (32.380)	0.083 (7.896)
4	0.032 (17.636)	0.066 (34.463)	0.005 (0.376)
b=5 Value	0.047 (40.160)	0.050 (19.477)	0.050 (3.088)
All Firms	0.051 (53.961)	0.034 (82.593)	0.398 (44.722)

2. Means and Standard Deviation for the Regression Variables

Book/Market Portfolio	ROE (S.D)	$M_{i,t}/B_{i,t}$ (S.D)	$D_{i,t}/B_{i,t}$ (S.D)
b=1 Growth	0.229 (0.037)	4.328 (1.268)	0.084 (0.021)
2	0.147 (0.010)	2.071 (0.479)	0.050 (0.005)
3	0.123 (0.010)	1.504 (0.361)	0.045 (0.004)
4	0.104 (0.009)	1.148 (0.279)	0.042 (0.004)
b=5 Value	0.082 (0.008)	0.772 (0.179)	0.035 (0.005)
All Firms	0.137 (0.009)	1.964 (0.492)	0.051 (0.006)



## Panel B

### Regressions to Explain the Change in ROE

#### 1. Means and t Statistics for the Means of the Month-by-Month Regression Coefficients

Book/Market Portfolio	Intercept (t-stat)	ROE <sub>i,t</sub> (t-stat)	E(ROE <sub>i,t</sub> ) (t-stat)	NDFE <sub>i,t</sub> (t-stat)	SNDFE <sub>i,t</sub> (t-stat)	SPDFE <sub>i,t</sub> (t-stat)	CP <sub>i,t</sub> (t-stat)	NCP <sub>i,t</sub> (t-stat)	SNCP <sub>i,t</sub> (t-stat)	SPCP <sub>i,t</sub> (t-stat)
b=1 Growth	-0.004 (-1.401)	-0.351 (-9.645)	0.356 (8.536)	0.127 (2.120)	0.626 (3.865)	-0.450 (-2.482)	0.110 (4.619)	-0.236 (-5.657)	0.179 (1.141)	-0.432 (-3.114)
2	0.002 (0.499)	-0.481 (-13.948)	0.413 (9.159)	0.292 (6.029)	2.472 (10.946)	-0.319 (-0.736)	0.123 (6.218)	-0.080 (-2.489)	0.369 (2.479)	-0.269 (-2.434)
3	-0.014 (-2.262)	-0.389 (-8.243)	0.431 (6.413)	0.196 (3.243)	3.206 (9.790)	-0.702 (-1.298)	0.087 (4.174)	-0.066 (-1.626)	-0.154 (-0.657)	-0.617 (-3.506)
4	-0.021 (-3.652)	-0.419 (-9.106)	0.562 (7.871)	0.265 (3.794)	4.971 (9.102)	-1.830 (-4.394)	0.002 (0.043)	0.151 (2.553)	0.399 (1.676)	-0.289 (-1.533)
b=5 Value	-0.188 (-6.397)	-0.508 (-8.842)	2.566 (7.502)	0.271 (3.036)	3.710 (6.215)	-0.059 (-0.120)	-0.098 (-2.745)	0.451 (6.265)	1.911 (4.560)	-0.031 (-0.212)
All Firms	-0.022 (-13.343)	-0.384 (-21.935)	0.462 (21.728)	0.060 (2.521)	0.648 (7.588)	-0.488 (-5.860)	0.013 (1.019)	-0.031 (-1.750)	0.104 (2.192)	-0.123 (-3.805)

#### 2. Means and Standard Deviation for the Regression Variables

Book/Market Portfolio	CP <sub>i,t+1</sub> (S.D.)	ROE <sub>i,t</sub> (S.D.)	E(ROE <sub>i,t</sub> ) (S.D.)	NDFE <sub>i,t</sub> (S.D.)	SNDFE <sub>i,t</sub> (S.D.)	SPDFE <sub>i,t</sub> (S.D.)	CP <sub>i,t</sub> (S.D.)	NCP <sub>i,t</sub> (S.D.)	SNCP <sub>i,t</sub> (S.D.)	SPCP <sub>i,t</sub> (S.D.)
b=1 Growth	-0.004 (0.026)	0.229 (0.053)	0.229 (0.030)	-0.039 (0.029)	0.123 (1.191)	0.201 (1.083)	0.012 (0.022)	-0.027 (0.016)	0.022 (0.033)	0.033 (0.055)
2	-0.006 (0.014)	0.146 (0.011)	0.151 (0.012)	-0.024 (0.009)	0.003 (0.010)	0.003 (0.005)	0.003 (0.011)	-0.018 (0.007)	0.004 (0.010)	0.005 (0.008)
3	-0.009 (0.014)	0.122 (0.010)	0.126 (0.013)	-0.021 (0.008)	0.002 (0.002)	0.002 (0.004)	0.002 (0.009)	-0.017 (0.006)	0.003 (0.005)	0.003 (0.004)
4	-0.011 (0.018)	0.104 (0.009)	0.108 (0.014)	-0.020 (0.010)	0.002 (0.002)	0.001 (0.001)	0.000 (0.010)	-0.017 (0.007)	0.003 (0.006)	0.003 (0.002)
b=5 Value	-0.028 (0.035)	0.085 (0.008)	0.085 (0.009)	-0.018 (0.007)	0.001 (0.001)	0.002 (0.002)	-0.002 (0.009)	-0.019 (0.006)	0.002 (0.002)	0.003 (0.003)
All Firms	-0.011 (0.017)	0.137 (0.012)	0.140 (0.009)	-0.024 (0.010)	0.026 (0.240)	0.042 (0.215)	0.003 (0.009)	-0.020 (0.007)	0.007 (0.008)	0.009 (0.012)

Notes: Panel A reports the temporal average of cross-sectional estimated coefficients,  $\bar{\hat{a}}_0$ ,  $\bar{\hat{a}}_1$ ,  $\bar{\hat{a}}_2$ , and the means and standard deviations of the regression variables in the Fama-MacBeth (1973) regressions of Equation (5.2) that regress ROE (trailing-twelve-month earnings/book equity) on two variables: M/B (market/book), and D/B (trailing-twelve-months dividends/book equity) separately for each of my book/market portfolios,  $b=1,2,\dots,5$ . Panel B reports the temporal average of cross-sectional estimated coefficients and the means and standard deviations of the regression variables in the Fama-MacBeth (1973) regressions of Equation (5.4).  $E(ROE_{i,t})$  is the expected ROE forecasted from regression estimates from Equation (5.2) using the most recent M/B and D/B for firm  $i$  at statistical month  $t$ .  $DVE_{i,t}$  is the deviation of ROE from its expected value  $E(ROE_{i,t})$ .  $NDFE_{i,t}$  measures the negative deviation from expected ROE,  $SNDFE_{i,t}$  measures the squared negative deviation from expected ROE, and  $SPDFE_{i,t}$  measures the squared positive deviation from expected ROE.  $CP_{i,t}$  is the change of ROE between two fiscal year ends prior to Statistical Period Date  $t$ .  $NCP_{i,t}$  measures the negative lagged changes in ROE,  $SNCP_{i,t}$  measures the squared negative lagged changes in ROE, and  $SPCP_{i,t}$  measures the squared positive lagged changes in ROE.

I can make a number of comments on  $\hat{ROE}_{CP}$  forecasts. First,  $\hat{ROE}_{CP}$  forecasts are uniformly less than analysts'  $ROE$  forecasts across quintiles of firms from growth to value. That is, comparing column C to column B of Panel A in Table 5.2,  $ROE_{CP} < ROE_{AN}$ ,  $b=1,2,\dots,5$ . Even though I have used only analysts' EPS forecasts for one unreported fiscal year hence, this difference suggests overly optimistic analysts' forecasts. Second, a comparison of column C with column A of Panel A in of Table 5.2 indicates that, on average,  $\hat{ROE}_{CP}$  forecasts increased profitability for growth firms. That is,  $\hat{ROE}_{CP} > ROE_{TTM}$  for quintile  $b=1$ . On the other hand,  $\hat{ROE}_{CP}$  forecasts, on average, decreased in profitability for value firms. That is,  $\hat{ROE}_{CP} < ROE_{TTM}$  for quintile  $b=2,3,4,5$ . Increased profitability for growth firms and decreased profitability for value firms is hardly the reversion that one would expect from an equilibrium process in a competitive economy. Thus, before I compare realized return versus expected returns based on  $\hat{ROE}_{CP}$  as a profitability forecast I investigate an alternative method for empirically recognizing profit reversion.

#### **5.2.4 Marginal $ROE$**

One of the reasons that profitability reverts is that “marginal” profitability differs from “average” profitability for firms. Average profitability is the  $ROE$  on a firm's existing assets. Marginal profitability is the rate of return on new investments. If existing assets are very profitable, then new investments might be less profitable. On the other hand, if existing assets are not very profitable, then, when firms apply demanding standards for expansion analysis, new investments should be more profitable. Forecasts

should recognize that future profitability arises from a combination of existing assets and new investments. New investments differ in profitability from existing investments.

To investigate the relation between average and marginal profitability, I represent the relation between earnings,  $E$ , and book equity,  $B$ , with a Cobb-Douglas production function,

$$E = \alpha_0 B^{\alpha_1} \quad (5.6)$$

Take natural logarithm on both sides of Equation (5.6) to transform it to a linear function:

$$\ln E = \ln \alpha_0 + \alpha_1 \ln B \quad (5.7)$$

The derivative of Equation (5.7) is:

$$\frac{dE}{E} = \alpha_1 \frac{dB}{B} \quad (5.8)$$

Rearranging Equation (5.8) yields,

$$dROE \equiv \frac{dE}{E} = \alpha_1 ROE \quad (5.9)$$

Equation (5.9) shows that marginal  $ROE$  (that is,  $dROE$ ) equals average  $ROE$  when  $\alpha_1=1$ . If  $\alpha_1>1$  marginal investment is more profitable than existing assets and average  $ROE$  increases over time. If  $\alpha_1<1$ , marginal investment is less profitable than existing assets and average  $ROE$  decreases over time.

I estimate the  $ROE$  mean-reversion rate,  $\alpha_1$ , in a cross-sectional study of Equation (5.7),

$$\ln TTM_{i,t} = \alpha_{0,t} + \alpha_{1,t} \ln B_{i,t} + e_{i,t} \quad i=1, \dots, N \quad (5.10)$$

On each Statistical Period date  $t$ , I estimate Fama-MacBeth (1973) regressions of  $\ln(TTM)$  on  $\ln(BVE)$ , separately for book/market quintile  $b=1,2,3,4,5$ . On each Statistical

Period date  $t=1 \dots TP$ , for each book/market portfolio, I average the estimated coefficients,  $\bar{\hat{\alpha}}_{1,t,b}$ , from the regressions of Equation (5.10) for at least 12 months and up to 60 months prior to Statistical Period month  $t$ , separately for book/market quintile  $b=1,2,3,4,5$ .  $\bar{\hat{\alpha}}_{1,t,b}$  is the *ROE* reversion rate for book/market quintile  $b$  on Statistical Period date  $t$ .

Table 5.3 reports the average estimated coefficients,  $\bar{\hat{\alpha}}_{1,b} = \sum_{t=1}^{TP} \bar{\hat{\alpha}}_{1,t,b}$ , from the Fama-MacBeth regressions of Equation (5.10) for each book/market quintile  $b=1,2,3,4,5$ . The *ROE* mean reversion rate  $\bar{\hat{\alpha}}_{1,b}$  is 1.01 for value firms ( $b=5$ ), and 0.97 for growth firms ( $b=1$ ). Marginal *ROE* improves by 1% per annum for value firms and deteriorates by 3% per annum for growth firms.

I can use the estimated reversion rate,  $\bar{\hat{\alpha}}_{1,t,b}$ , to forecast future profitability in a way that recognizes that marginal profitability can differ from average profitability. Further, I can apply this adjustment to both TTM earnings and analysts' earnings forecasts.

Denote a forecast of future *ROE* as average TTM *ROE* with a marginal adjustment as,  $m\hat{ROE}_{TTM_{i,t}}$ ,

$$m\hat{ROE}_{TTM_{i,t}} = \bar{\hat{\alpha}}_{1,t,b} \times ROE_{TTM_{i,t}} \quad (5.11)$$

**Table 5.2 ROE Forecasts, SGER, MSE and QMSE**

**Panel A: ROE Forecasts**

Book/Market Portfolio	A. $ROE\_TTM$	B. $ROE\_AN$	C. $R\hat{O}E\_CP$	D. $mR\hat{O}E\_TTM$	E. $mR\hat{O}E\_AN$
b=1 Growth	0.195	0.214	0.196	0.189	0.207
2	0.146	0.156	0.140	0.145	0.154
3	0.121	0.129	0.113	0.121	0.129
4	0.100	0.104	0.091	0.100	0.105
b=5 Value	0.076	0.074	0.057	0.077	0.075

**Panel B:  $SGER = ROE + (1-MB)dy$  calculated with ROE Forecasts**

Book/Market Portfolio	A. $SGER\_TTM$	B. $SGER\_AN$	C. $S\hat{G}ER\_CP$	D. $mS\hat{G}ER\_TTM$	E. $mS\hat{G}ER\_AN$	F. Realized Returns, $\bar{R}$
b=1 Growth	0.158	0.177	0.164	0.151	0.170	0.128
2	0.121	0.131	0.119	0.119	0.128	0.137
3	0.109	0.115	0.100	0.108	0.114	0.157
4	0.101	0.104	0.094	0.101	0.104	0.167
b=5 Value	0.096	0.091	0.077	0.098	0.091	0.199

**Panel C: Mean Squared Errors  $MSE_{SGER}$**

Book/Market Portfolio	A. $SGER\_TTM$	B. $SGER\_AN$	C. $S\hat{G}ER\_CP$	D. $mS\hat{G}ER\_TTM$	E. $mS\hat{G}ER\_AN$
b=1 Growth	1.385	1.391	1.674	1.384	1.390
2	1.326	1.325	1.517	1.326	1.325
3	1.251	1.250	1.259	1.252	1.251
4	1.218	1.217	1.227	1.219	1.218
b=5 Value	1.579	1.578	1.592	1.578	1.578
Average MSE	1.352	1.353	1.454	1.352	1.352

**Panel D: Quintile Mean Squared Errors  $QMSE_{SGER}$**

Book/Market Portfolio	A. $SGER\_TTM$	B. $SGER\_AN$	C. $S\hat{G}ER\_CP$	D. $mS\hat{G}ER\_TTM$	E. $mS\hat{G}ER\_AN$
b=1 Growth	0.0009	0.0024	0.0013	0.0005	0.0018
2	0.0003	0.0000	0.0003	0.0003	0.0001
3	0.0023	0.0017	0.0033	0.0024	0.0018
4	0.0044	0.0040	0.0054	0.0044	0.0040
b=5 Value	0.0106	0.0119	0.0150	0.0104	0.0118
Average QMSE	0.0037	0.0040	0.0051	0.0036	0.0039

Notes: Panel A reports median values for  $ROE\_TTM$ ,  $ROE\_AN$ ,  $R\hat{O}E\_CP$ ,  $mR\hat{O}E\_TTM$ , and  $mR\hat{O}E\_AN$  (see Appendix 5A Equations A.5.4, A.5.6, A.5.2, A.5.8, and A.5.10 for definitions). Panel B reports mean values for  $SGER\_TTM$ ,  $SGER\_AN$ ,  $SGER\_CP$ ,  $mS\hat{G}ER\_TTM$ , and  $mS\hat{G}ER\_AN$  (see Appendix 5A Equations A.5.18, A.5.20, A.5.12, A.5.14, and A.5.16, respectively for definitions). Column F of Panel B reports average annualized realized returns,  $\bar{R}$  (see Appendix 5B Equation B5.3 for the exact definition of  $\bar{R}$ ). Panel C reports mean values of  $MSE_{SGER}$  (see Appendix 5A Equations A.5.50 for definition) for  $SGER\_TTM$ ,  $SGER\_AN$ ,  $SGER\_CP$ ,  $mS\hat{G}ER\_TTM$ , and  $mS\hat{G}ER\_AN$ . Panel D reports mean values of  $QMSE_{SGER}$  (see Appendix 5A Equations A.5.51 for definition) for  $SGER\_TTM$ ,  $SGER\_AN$ ,  $SGER\_CP$ ,  $mS\hat{G}ER\_TTM$ , and  $mS\hat{G}ER\_AN$ .

**Table 5.3 ROE Mean-Reversion Rate****ROE mean-reversion rate**

Means and t Statistics for the Means of the Month-by-Month Regression Coefficients

Book/Market Portfolio	<i>Intercept</i>	(t-stat)	$\bar{\hat{\alpha}}_{1,b}$ , <i>ROE mean-reversion rate</i>	(t-stat)
b=1 Growth	-1.44	-165.02	0.97	969.34
2	-1.91	-219.61	0.98	720.25
3	-2.14	-222.64	0.99	701.48
4	-2.39	-259.06	1.00	752.69
b=5 Value	-2.75	-218.58	1.01	528.87

Notes: Table 5.3 reports the average estimated intercept coefficients, and average slope coefficients,  $\bar{\hat{\alpha}}_{1,b}$ ,

from the Fama-MacBeth regressions of Equation (5.10) for each book/market quintile  $b=1,2,3,4,5$ .

In addition, denote a forecast of future *ROE* average based on analysts' earnings forecasts *ROE* with a marginal adjustment as,  $m\hat{ROE}_{AN_{i,t}}$ ,

$$m\hat{ROE}_{AN_{i,t}} = \bar{\alpha}_{1,t,b} \times ROE_{AN_{i,t}} \quad (5.12)$$

where  $ROE_{AN_{i,t}}$  is an *ROE* forecast for firm *i* at statistical period *t* with the consensus analysts' earnings forecast.

Columns D and E in Panel A of Table 5.2 report median values of reversion-adjusted *ROE\_TTM* and reversion-adjusted *ROE\_AN* (*ROE* based on analysts' EPS forecasts),  $m\hat{ROE}_{TTM}$ , and  $m\hat{ROE}_{AN}$  (see Appendix 5A Equation A.5.8 and A.5.10 for definitions), respectively.

These marginal adjustments increase *ROE* forecasts for value firms ( $b=5$ ) and decrease *ROE* forecasts for growth firms ( $b=1$ ). That is, in Table 5.2,  $m\hat{ROE}_{TTM} > ROE_{TTM}$  and  $m\hat{ROE}_{AN} > ROE_{TTM}$  for quintile  $b=5$ . On the other hand,  $m\hat{ROE}_{TTM} < ROE_{TTM}$  and  $m\hat{ROE}_{AN} < ROE_{TTM}$  for quintile  $b=1$ .

### 5.2.5 Realized Returns Versus *SGER* With Different *ROE* Forecasts

In Chapter 2, I find that *SGER* overstates realized returns for high-profitability growth stocks and understates realized returns for low-profitability value stocks. A possible reason for this bias is that the profitability forecast for *ROE* that I use in the implicit-return measure, *SGER*, does not recognize the reversion in profitability that Fama and French (2000) empirically document. In this section I investigate whether I can reduce or eliminate the value-versus-growth bias in *SGER* as a conditional expected

return measure by recognizing earnings-reversion prior to inputting  $ROE$  into  $SGER$  in Equation (5.1).

Denote  $SGER$  in Equation (5.1) for firm  $i$  at statistical month  $t$  calculated with  $R\hat{O}E\_TTM_{i,t}$ ,  $R\hat{O}E\_AN_{i,t}$ ,  $R\hat{O}E\_CP_{i,t}$ ,  $mR\hat{O}E\_TTM_{i,t}$ , and  $mR\hat{O}E\_AN_{i,t}$ , as  $SGER\_TTM_{i,t}$ ,  $SGER\_AN_{i,t}$ ,  $SGER\_CP_{i,t}$ ,  $mSGER\_TTM_{i,t}$ , and  $mSGER\_AN_{i,t}$ , respectively. I denote average values of these expected return measures respectively for growth to value quintiles  $b=1,2,3,4,5$  as  $SGER\_TTM$ ,  $SGER\_AN$ ,  $SGER\_CP$ ,  $mSGER\_TTM$ , and  $mSGER\_AN$  (see Appendix 5A Equations A.5.18, A.5.20, A.5.12, A.5.14, and A.5.16, respectively for definitions). Panel B of Table 5.2 reports these expected return measures for growth to value quintiles  $b=1,2,3,4,5$  in columns A to E respectively. Finally, for comparison purposes, column F of Panel B in Table 5.2 reports for growth to value firms,  $b=1,2,3,4,5$ , average annualized realized returns,  $\bar{R}$ , for the period following a statistical period month. (see Appendix 5B Equation B5.3 for definition).

I now make some summary observations on the results in Panel B of Table 5.2. Each of the expected return measures,  $SGER\_TTM$ ,  $SGER\_AN$ ,  $SGER\_CP$ ,  $mSGER\_TTM$ , and  $mSGER\_AN$  decreases from growth ( $b=1$ ) to value ( $b=5$ ) firms. On the other hand, realized returns,  $\bar{R}$ , increase from growth ( $b=1$ ) to value ( $b=5$ ) firms (which is the value-premium). Thus, while some of these expected return measures reduce the value versus growth bias, none of them eliminates it and, in fact, none of them reduce the value versus growth bias very much.

Possibly the expected return measures,  $SGER$ , in Panel B of Table 5.2 do not reduce significantly or eliminate the value versus growth bias because they are forecasts



of long-term profitability based on current profitability or a minor adjustment to current profitability. Current profitability or a minor adjustment to current profitability is a good forecast of long-term profitability only if the stochastic process that generates profitability is close to a random walk. The results in Panel B of Table 5.2 suggest that that is not the case. Rather the results in Panel B of Table 5.2 suggest that I should not forecast long-run profitability as adjustment to current profitability but, rather, I should forecast long-run profitability directly.

In the following subsection, I develop a number of forecasts of long-run profitability to use in *SGER* as expected return measures to reduce or eliminate the value versus growth bias.

## 5.2.6 Long Run *ROE* Forecasts

In this subsection, I develop a number of forecasts of long-run profitability to use in *SGER*.

### 5.2.6.1 Fama-French Long-Term *ROE* Forecast

Equation (5.3) is Fama and French's (2000) long-run *ROE* forecast,

$$FF\_LT\_R\hat{O}E_{i,t}. \text{ Denote } FF\_LT\_R\hat{O}E \text{ as the median value of } FF\_LT\_R\hat{O}E_{i,t}$$

(see Appendix 5A Equation A.5.22 for the exact definition of this median). Column A of Panel A of Table 5.4 reports this *ROE* forecast for growth to value firms  $b=1,2,3,4,5$ .

### 5.2.6.2 Trailing-twelve-month *ROE* with Multiple Marginal Adjustments

In section 5.2.4, I estimate a reversion rate,  $\bar{\alpha}_{1,t,b}$ , that recognizes the movement of *ROE* towards its mean. I compound this adjustment for  $j$  years and then adjust  $ROE\_TTM_{i,t}$  as an forecast of long-run *ROE*,

$$LTm\hat{ROE}_{TTM}_{i,t} = \left(\bar{\hat{\alpha}}_{1,t,b}\right)^j \times ROE_{TTM}_{i,t} \quad (5.13)$$

where  $j$  is the number of marginal adjustments applied. I arbitrarily use  $j=5$ . Thus, my forecast is for  $ROE$  five years hence. Denote  $LTm\hat{ROE}_{TTM}$  as the median value of  $LTm\hat{ROE}_{TTM}_{i,t}$  (see Appendix 5A Equation A.5.24 for the exact definition of this median). Column B of Panel A of Table 5.4 reports this  $ROE$  forecast for growth to value firms  $b=1,2,3,4,5$ .

### 5.2.6.3 Analysts' Earnings Forecast $ROE$ with Multiple Marginal Adjustments

Denote a forecast of future  $ROE$  based on  $ROE_{AN}$  with multiple marginal adjustments as,

$$LTm\hat{ROE}_{AN}_{i,t} = \left(\bar{\hat{\alpha}}_{1,t,b}\right)^j \times ROE_{AN}_{i,t} \quad (5.14)$$

where  $ROE_{AN}_{i,t}$  is an  $ROE$  forecast for firm  $i$  at statistical period  $t$  with the consensus analysts' earnings forecast, and  $j$  is the number of marginal adjustments. I arbitrarily use  $j=5$ . Thus, my forecast is for  $ROE$  five years hence. Denote  $LTm\hat{ROE}_{AN}$  as the median value of  $LTm\hat{ROE}_{AN}_{i,t}$  (see Appendix 5A Equation A.5.26 for the exact definition of this median). Column C of Panel A of Table 5.4 reports this  $ROE$  forecast for growth to value firms  $b=1,2,3,4,5$ .

### 5.2.6.4 $ROE$ Changes with Multiple Marginal Adjustments

A long-run  $ROE$  forecast is the CP forecast in Equation (5.5) with multiple marginal adjustments,

$$LTm\hat{ROE}_{CP}_{i,t} = \left(\bar{\hat{\alpha}}_{1,t,b}\right)^j \times \hat{ROE}_{CP}_{i,t} \quad (5.15)$$

where  $ROE\_CP_{i,t}$  is the historical  $ROE$  calculated with trailing-twelve-month earnings (TTM), adjusted by predicted changes in  $ROE$  (Equation 4) and  $j$  is the number of marginal adjustments. I arbitrarily use  $j=5$ . Thus, my forecast is for  $ROE$  five years hence. Denote  $LTm\hat{ROE}\_CP$  as the median value of  $LTm\hat{ROE}\_CP_{i,t}$  (see Appendix 5A Equation A.5.28 for the exact definition of this median). Column D of Panel A of Table 5.4 reports this  $ROE$  forecast for growth to value firms  $b=1,2,3,4,5$ .

### 5.2.6.5 Quintile Median $ROE$

High market/book growth firms tend to have high profitability compared to low market/book value firms. Profitability may remain high (low) for growth (value) firms but revert to a mean level within the group of growth (value) firms. Thus, I use the quintile median  $ROE$  as a long-run  $ROE$  forecast. Denote the quintile median  $ROE$  as  $ROE\_QMED$  (see Appendix 5A Equation A.5.30 for the exact definition). Column E in Panel A of Table 5.4 reports  $ROE\_QMED$  from growth ( $b=1$ ) to value ( $b=5$ ) firms.

### 5.2.6.6 A Combination of $ROE\_TTM$ , Quintile Median $ROE$ , and Grand Median $ROE$

I use a combination of  $ROE\_TTM$ , the Quintile Median  $ROE$  ( $ROE\_QMED$ ) and the Grand Median  $ROE$  (the definition of the Grand Median  $ROE$  is given in Equation A.5.31 in Appendix 5A) as a final  $ROE$  forecast.  $ROE\_TTM$  represents profitability factors unique to an individual company. The Quintile Median  $ROE$  ( $ROE\_QMED$ ) represents profitability factors associated with value versus growth firms. Finally, the Grand Median  $ROE$  represents profitability factors associated with all firms.

Denote this  $ROE$  forecast for firm  $i$  on Statistical Period month  $t$  as  $ROE\_TQG_{i,t}$ ,

$$ROE\_TQG_{i,t} = \frac{1}{3}ROE\_TTE_{i,t} + \frac{1}{3}ROE\_QMED_t + \frac{1}{3}ROE\_Grand_t \quad (5.16)$$

Denote  $ROE\_TQG$  as the median value of  $ROE\_TQG_{i,t}$  (see Appendix 5A Equation A.5.33 for the exact definition of this median). Column F of Panel A of Table 5.4 reports this  $ROE$  forecast for growth to value firms  $b=1,2,3,4,5$ .

### 5.2.6.7 Summary of Long-run $ROE$ Forecasts

Panel A of Table 5.4 reports all six of the long-run  $ROE$  forecasts that I develop in this section from growth to value firms  $b=1,2,3,4,5$ . The principal common feature of these long-run  $ROE$  forecasts is that they increase monotonically from value to growth firms  $b=1,2,3,4,5$ .

In the following section, I input long-run  $ROE$  forecasts for firm  $i$  at statistical period  $t$  that I develop in this section into  $SGER$  in Equation (5.1). I then compare these expected returns with realized returns.

### 5.2.7 Realized Returns Versus $SGER$ With Long-Run $ROE$ Forecasts

In section 5.2.5, I find that the expected return measures,  $SGER$ , calculated with current profitability do not significantly reduce or eliminate the value versus growth bias. In this subsection, I investigate whether I can reduce or eliminate the value versus growth bias with forecasts of long-run  $ROE$  in  $SGER$  as expected return measures.

Denote  $SGER$  in Equation (5.1) for firm  $i$  at statistical month  $t$  calculated with

$FF\_LT\_R\hat{O}E_{i,t}$ ,  $LTmR\hat{O}E\_TTM_{i,t}$ ,  $LTmR\hat{O}E\_AN_{i,t}$ ,  $LTmR\hat{O}E\_CP_{i,t}$ ,  
 $ROE\_QMED_t$ , and  $ROE\_TQG_{i,t}$  as  $FF\_LT\_S\hat{G}ER_{i,t}$ ,  $LTmS\hat{G}ER\_TTM_{i,t}$ ,  
 $LTmS\hat{G}ER\_AN_{i,t}$ ,  $LTmS\hat{G}ER\_CP_{i,t}$ ,  $SGER\_QMED_t$ , and  $SGER\_TQG_{i,t}$ ,

respectively. I denote average values of these expected return measures respectively for growth to value quintiles  $b=1,2,3,4,5$  as  $FF\_LT\_S\hat{G}ER$ ,  $LTmS\hat{G}ER\_TTM$ ,

$LTm\hat{S}GER\_AN$ ,  $LTm\hat{S}GER\_CP$ ,  $SGER\_QMED$ , and  $SGER\_TQG$  (see Appendix 5A Equations A.5.35, A.5.37, A.5.39, A.5.41, A.5.43, and A.5.45, respectively for definitions). Panel B of Table 5.4 reports these expected return measures for growth to value quintiles  $b=1,2,3,4,5$  in columns A to F respectively. Finally, for comparison purposes, column G of Panel B in Table 5.2 reports for growth to value firms,  $b=1,2,3,4,5$ , average annualized realized returns,  $\bar{R}$ , for the period following a statistical period month. (see Appendix 5B Equation B5.3 for the exact definition of  $\bar{R}$ ).

I now make some summary observations on the results in Panel B of Table 5.4. Except for  $FF\_LT\_S\hat{G}ER$ , all of these expected return measures reduce the value versus growth bias that I identified in Panel B of Table 5.2. They do this primarily by reducing the expected return for growth stocks. However, none of these expected return measures increases the expected return for value stocks much ( $b=5$ ) and, therefore, these expected return measures retain a value bias. Expected returns are remarkably low compared to realized returns for value firms ( $b=5$ ). Each of the expected returns in Panel B of Table 5.4 decreases from growth to value firms ( $b=1$  to  $b=5$ ). Thus, the value bias arises because these expected return measures fail to recognize the value-premium—higher returns for value stocks compared to growth stocks.

I believe that the combination of my results in Tables 2 and 4 illustrate that the problem with application of  $SGER$  in Equation (5.1) is not so much the profitability forecast  $ROE$  that one might use, but rather that  $SGER$  arises from a static equity valuation model that does not recognize the value-premium. Thus, I believe that any difficulty that  $SGER$  has in application is general for any implicit expected return measure from a static equity valuation model (for example, Easton 2004, 2006; Easton et

al, 2002; Gebhardt et al., 2001; Gode and Mohanram 2003). I believe that all of these implicit returns will have the property that *SGER* has: for either value or growth firms separately, implicit returns increase with profitability. On the other hand, for realized returns, the value-premium means that high profitability growth firms have lower returns than low profitability value firms. Thus, even in an analysis that conditions on value versus growth (that is, investigates value and growth firms separately), there will always be a value or a growth bias or both.

Based on these observations, I believe that the way forward in the implicit expected return literature is to develop implicit expected returns based on dynamic models of equity valuation that recognize the value-premium rather than static equity valuation model that do not. I begin this initiative in the following section. I develop regressions of realized returns on profitability, *ROE*, for value versus growth stocks as a conditional reduced-form version of a dynamic equity valuation model that recognizes the value-premium. I call return forecasts from these regressions “dynamic growth expected returns,” *DGER*. In large part, *DGER* eliminates the value-versus-growth bias.

**Table 5.4 Long Term ROE, SGER, MSE, and QMSE**

**Panel A: Long Term ROE Forecasts**

Book/Market Portfolio	A. <i>FF_LT_ROE</i>	B. <i>LTmRÔE_TTM</i>	C. <i>LTmRÔE_AN</i>	D. <i>LTmRÔE_CP</i>	E. <i>ROE_QMED</i>	F. <i>ROE_TQG</i>
b=1 Growth	0.197	0.169	0.186	0.170	0.194	0.170
2	0.150	0.138	0.146	0.131	0.146	0.138
3	0.125	0.118	0.124	0.110	0.122	0.122
4	0.106	0.104	0.107	0.095	0.100	0.107
b=5 Value	0.084	0.086	0.080	0.061	0.079	0.091

**Panel B:  $SGER = ROE + (I-MB)dy$  calculated with ROE Forecasts**

Book/Market Portfolio	A. <i>FF_LT_SGER</i>	B. <i>LTmSĜER_TTM</i>	C. <i>LTmSĜER_AN</i>	D. <i>LTmSĜER_CP</i>	E. <i>SGER_QMED</i>	F. <i>SGER_TQG</i>	G. Realized Returns, $\bar{R}$
b=1 Growth	0.158	0.126	0.143	0.131	0.131	0.118	0.128
2	0.124	0.111	0.121	0.111	0.119	0.113	0.137
3	0.112	0.106	0.112	0.097	0.109	0.109	0.157
4	0.105	0.103	0.106	0.096	0.100	0.107	0.167
b=5 Value	0.099	0.103	0.096	0.083	0.094	0.110	0.199

**Panel C: Mean Squared Errors  $MSE_{SGER}$**

Book/Market Portfolio	A. <i>FF_LT_SGER</i>	B. <i>LTmSĜER_TTM</i>	C. <i>LTmSĜER_AN</i>	D. <i>LTmSĜER_CP</i>	E. <i>SGER_QMED</i>	F. <i>SGER_TQG</i>
b=1 Growth	1.383	1.382	1.386	1.571	1.365	1.362
2	1.327	1.326	1.326	1.561	1.317	1.316
3	1.253	1.252	1.251	1.262	1.250	1.249
4	1.220	1.219	1.218	1.233	1.219	1.217
b=5 Value	1.578	1.578	1.577	1.593	1.573	1.569
Average MSE	1.352	1.351	1.352	1.444	1.345	1.343

**Panel D: Quintile Mean Squared Errors  $QMSE_{SGER}$**

Book/Market Portfolio	A. <i>FF_LT_SGER</i>	B. <i>LTmSĜER_TTM</i>	C. <i>LTmSĜER_AN</i>	D. <i>LTmSĜER_CP</i>	E. <i>SGER_QMED</i>	F. <i>SGER_TQG</i>
b=1 Growth	0.0009	0.0000	0.0002	0.0000	0.0000	0.0001
2	0.0002	0.0007	0.0003	0.0007	0.0003	0.0006
3	0.0020	0.0026	0.0020	0.0035	0.0023	0.0022
4	0.0039	0.0041	0.0037	0.0050	0.0044	0.0036
b=5 Value	0.0100	0.0092	0.0106	0.0136	0.0111	0.0080
Average QMSE	0.0034	0.0033	0.0034	0.0046	0.0036	0.0029

Notes: Panel A reports median values for  $FF\_LT\_R\hat{O}E$ ,  $LTmR\hat{O}E\_TTM$ ,  $LTmR\hat{O}E\_AN$ ,  $LTmR\hat{O}E\_CP$ ,  $ROE\_QMED$ , and  $ROE\_TQG$  (see Appendix 5A Equations A.5.22, A.5.24, A.5.26, A.5.28, A.5.30 and A.5.33 for definitions). Panel B reports mean values  $FF\_LT\_S\hat{G}ER$ ,  $LTmS\hat{G}ER\_TTM$ ,  $LTmS\hat{G}ER\_AN$ ,  $LTmS\hat{G}ER\_CP$ ,  $SGER\_QMED$ , and  $SGER\_TQG$  (see Appendix 5A Equations A.5.35, A.5.37, A.5.39, A.5.41, A.5.43, and A.5.45, respectively for definitions). Column G of Panel B reports average annualized realized returns,  $\bar{R}$ , (see Appendix 5B Equation B5.3 for the exact definition of  $\bar{R}$ ). Panel C reports mean values of  $MSE_{SGER}$  (see Appendix 5A Equations A.5.50 for definition) for  $FF\_LT\_S\hat{G}ER$ ,  $LTmS\hat{G}ER\_TTM$ ,  $LTmS\hat{G}ER\_AN$ ,  $LTmS\hat{G}ER\_CP$ ,  $SGER\_QMED$ , and  $SGER\_TQG$ . Panel D reports mean values of  $QMSE_{SGER}$  (see Appendix 5A Equations A.5.51 for definition) for  $FF\_LT\_S\hat{G}ER$ ,  $LTmS\hat{G}ER\_TTM$ ,  $LTmS\hat{G}ER\_AN$ ,  $LTmS\hat{G}ER\_CP$ ,  $SGER\_QMED$ , and  $SGER\_TQG$ .

## 5.3 A Dynamic Model of Equity Valuation

### 5.3.1 Preliminaries

When capital growth generates earnings growth, Blazenko and Pavlov (2009) value a business whose manager has a dynamic option to suspend and recommence growth indefinitely. The manager suspends growth when the return on capital (*ROC*) falls below a value-maximizing return-threshold and recommences growth at a fixed rate,  $g > 0$ , when *ROC* rises above this threshold. Blazenko and Pavlov use this model to show that the cost of capital is an unduly conservative growth benchmark because it exceeds the value maximizing return-threshold. An important assumption for this result is limited growth: when a firm grows, it grows at a maximum rate  $g$ .

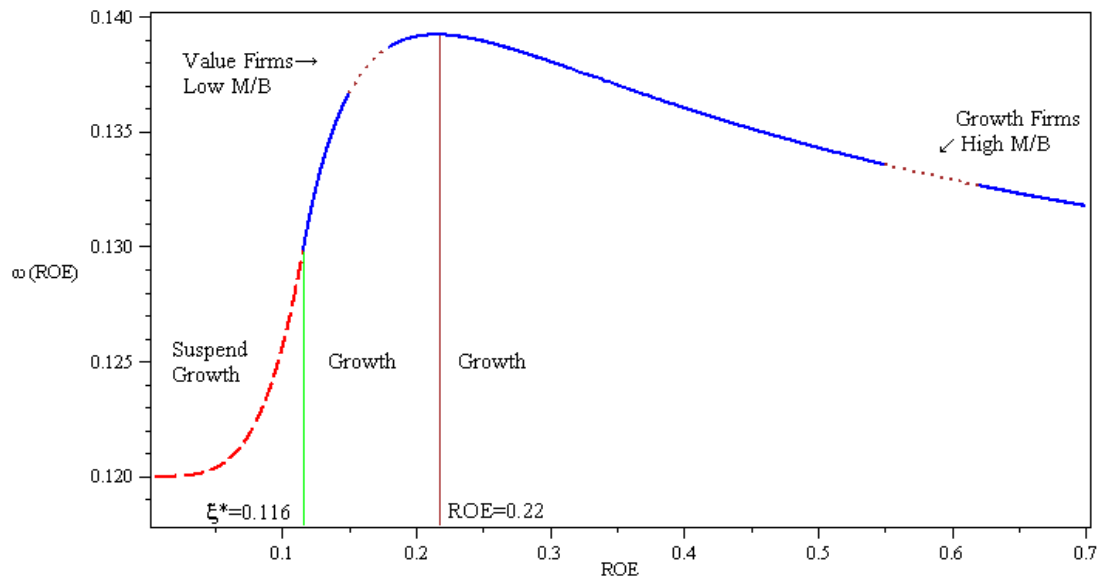
Chapter 2 presumes that a business manager maintains a target financial structure by increasing debt at the rate  $g\%$  per annum to finance growth investments. Alternatively the manager uses operating cash flow to repay debt (de-levers) at the rate  $g\%$  per annum when he/she suspends growth. Because the manager de-levers upon poor profitability, equity-holders never default and the firm is never in financial distress. Thus, I presume that *ROE* follows a geometric Brownian motion which means that earnings can never be negative. Since I restrict the empirical investigation to firms that are not in financial distress, this modeling is appropriate. See Chapter 4 for a theoretical and empirical investigation of firms in financial distress. Figure 5.1 plots expected equity return,  $\alpha(ROE)$ , versus profitability, *ROE* for a numerical example of Blazenko and Pavlov's (2009) dynamic equity valuation model as applied by Chapter 2.

As profitability, *ROE*, approaches zero from the right, the firm suspends growth (the left-most section of Figure 5.1). In this case, growth-leverage disappears and



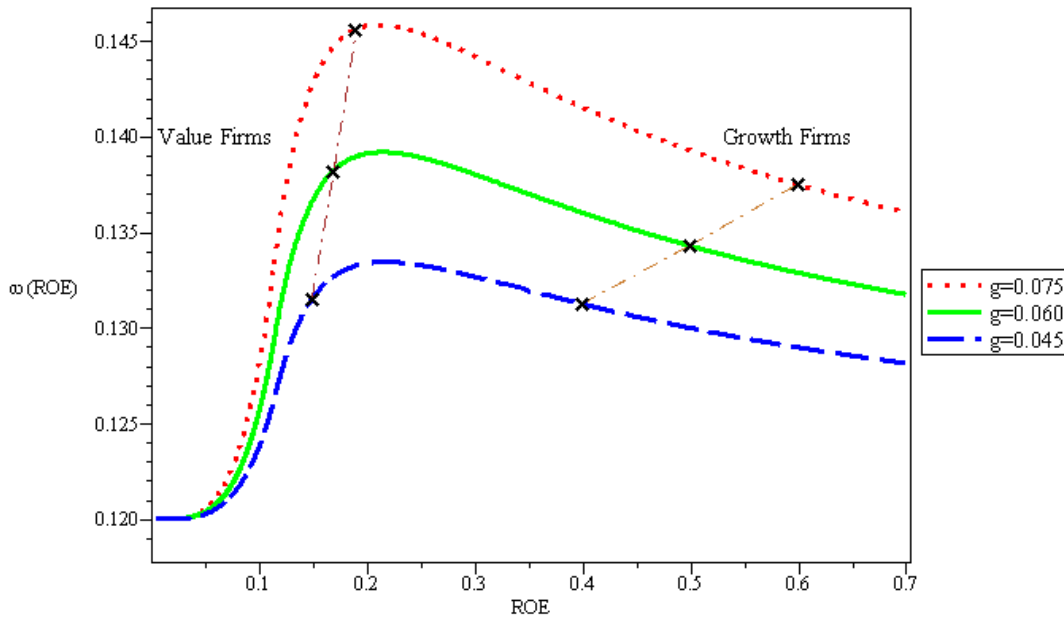
expected return falls because the likelihood of returning to the growth state diminishes. With no possibility of growth there is no growth-leverage and return equals that of a hypothetical business that permanently commits to no-growth. That is,  $\omega(ROE) = r^* = 0.12$  in Figure 5.1. When  $ROE$  increases in the left-most section of Figure 5.1, risk increases because there is increasing likelihood that at some future time  $ROE$  will cross the expansion boundary,  $\xi^* = 0.116$ . In this case, the firm begins to grow which creates growth-leverage. Expected return  $\omega(ROE)$  increases in anticipation of this risk.

**Figure 5.1** Expected Return,  $\omega(ROE)$ , versus Profitability,  $ROE$



*Notes:* Figure 5.1 plots expected return,  $\omega(ROE)$ , versus profitability,  $ROE$  (with earnings volatility  $\sigma=0.2$ , earnings growth  $g=0.06$ , and a risk adjusted expected return for a hypothetical business that permanently does not grow  $r^*=0.12$ ). The value maximizing return threshold for business expansion is  $\xi^* = 0.116$  in this numerical example.

**Figure 5.2 Profitability, Growth, and the Value Premium**



*Notes:* Figure 5.2 plots expected return,  $\omega(ROE)$ , versus profitability,  $ROE$ , for different earnings growth rates,  $g=0.075$ ,  $g=0.06$ ,  $g=0.045$  (with earnings volatility  $\sigma=0.2$  and expected return for a hypothetical firm that permanently does not grow  $r^*=0.12$ ).

Once  $ROE$  crosses the expansion boundary,  $ROE \geq \xi^* = 11.6\%$ , in Figure 5.1 the manager grows the business. As  $ROE$  increases, expected return increases until  $ROE=0.22$  in Figure 5.1. For  $0.116 \leq ROE \leq 0.22$ , profitability increases the likelihood of remaining in the growth state which incurs growth-leverage for the business. This increasing likelihood of growth-leverage increases risk, which increases expected return,  $\omega(ROE)$ . Thus, in Figure 5.1, for  $0 \leq ROE \leq 0.22$ ,  $ROE$  increases risk and expected return,  $\omega(ROE)$ . Expected return,  $\omega(ROE)$ , is at a maximum in Figure 5.1 when  $ROE$  is approximately 22%. When  $ROE \geq 0.22$ , the likelihood suspending growth becomes remote. Rather, increasing  $ROE$  increases the firm's ability to "cover" growth capital expenditures which decreases risk. Thus, for  $ROE > 0.22$ ,  $ROE$  decreases risk and expected return. Blazenko and Pavlov's (2009) dynamic equity valuation model is

consistent with but does not guarantee a value-premium. For example, Figure 5.1 depicts value firms (low profitability and low market/book) with expected returns greater than 13.5% and growth firms (high profitability and high market/book) with expected returns less than 13.5%.

The discussion above indicates  $ROE$  can either increase or decrease risk. It increases risk for value stocks (the left most section of Figure 5.1) but it decreases risk for growth stocks (the right most section of Figure 5.1). However, inconsistent with this latter prediction, Chapter 2 finds that for value and growth stocks separately (that is, within a book/market quintile), profitability increases returns. I propose a modified version of the “limits to growth” hypothesis as an explanation of the relation between returns and profitability “in the large,” that is, the value premium, and “in the small,” that is, for value and growth stocks separately.

Holding book/market constant, there are two forces that impact returns as  $ROE$  increases with the result that returns increase with profitability. First, holding maximum growth,  $g$ , constant,  $ROE$  can either increase or decrease risk as represented in Figure 5.1.  $ROE$  increases risk for value stocks but it decreases risk for growth stocks. Second, if firms are financially constrained (Froot, Scharfstein, and Stein, 1993), increasing profitability increases the ability of the firm to finance growth internally when they cannot finance externally which increases the maximum growth rate,  $g$ .

Figure 5.2 plots expected return,  $\omega(ROE)$ , with respect to  $ROE$  for different growth rates,  $g$ . For value firms (low market to book and low profitability)  $ROE$  increases risk and expected return,  $\omega(ROE)$ , holding growth,  $g$ , constant (that is, on any one of the curves,  $g=0.045$ ,  $g=0.06$ , or  $g=0.07$ ). On the other hand, profitability increases growth,

which Figure 5.2 depicts as shifting upward to a higher growth curve. Higher growth,  $g$ , increases growth-leverage risk for any level of  $ROE$  which increases expected return,  $\omega(ROE)$ . For value firms, these two forces work together to increase expected return,  $\omega(ROE)$ . Because these two forces work together to increase return with profitability, the relationship depicted for value firms at the left most section of Figure 5.2 between expected return,  $\omega(ROE)$ , and  $ROE$  is steep compared to growth firms at the right most section.

For growth firms (high market to book and high profitability),  $ROE$  decreases risk and expected return,  $\omega(ROE)$ , holding growth,  $g$ , constant (that is, on any one of the curves,  $g=0.045$ ,  $g=0.06$ , or  $g=0.075$ ) in Figure 5.2. On the other hand, profitability increases growth, which Figure 5.2 depicts as shifting upward to a higher growth curve, which increases expected return,  $\omega(ROE)$ . For growth firms, these two forces work in opposite directions and therefore, either effect might dominate.  $ROE$  might either increase or decrease returns,  $\omega(ROE)$ , for growth firms. However, because these two forces work in opposite directions, regardless of whether it is positive or negative, I expect the relation between returns and profitability to be lesser for growth stocks compared to value stocks.

The positive relation between expected return,  $\omega(ROE)$ , and  $ROE$  for both value and growth stocks is a conditional reduced-form version of the modified dynamic equity valuation model that recognizes the value-premium. In the next section, I estimate conditional regressions, for value and growth stocks separately, to use as the basis of expected return forecasts. I call return forecasts from these regressions “dynamic growth expected returns,” *DGER*.

### 5.3.2 Dynamic Growth Expected Returns, *DGER*

On each Statistical Period date  $t$ , for each book/market quintile,  $b=1,2,3,4,5$ , I estimate Fama-MacBeth (1973) cross sectional regressions of annualized stock returns on *ROE* (separately for *ROE\_TTM* and *ROE\_AN*) for stocks in each book/market quintile,<sup>76</sup>  $b=1,2,3,4,5$ .

$$\begin{aligned} R_{i,t}^A &= \gamma_{0,t}^{TTE} + \gamma_{1,t}^{TTE} ROE\_TTM_{i,t} + u_t, \\ R_{i,t}^A &= \gamma_{0,t}^{AN} + \gamma_{1,t}^{AN} ROE\_AN_{i,t} + u_t \end{aligned}, \quad i=1,2,\dots,N \quad (5.17)$$

The dependent variable,  $R_{i,t}^A$ , is the annualized monthly return for firm  $i$  for Statistical Period month  $t$  (see Appendix 5B Equation B5.2 for definition of  $R_{i,t}^A$ ). The independent variable  $ROE\_TTM_{i,t}$  and  $ROE\_AN_{i,t}$  is *ROE* for firm  $i=1,2,\dots,N$ , on Statistical Period date  $t$ . The terms  $\gamma_{0,t}^{TTE}$  and  $\gamma_{0,t}^{AN}$  are intercepts, and  $\gamma_{1,t}^{TTE}$  and  $\gamma_{1,t}^{AN}$  are slope coefficients.

For each book/market quintile ( $b=1,2,3,4,5$ ), Panel A of Table 5.5 reports the temporal average (over the *TP* Statistical Period months) of cross-sectional estimated intercepts  $\bar{\gamma}_0^{-TTE}$  and  $\bar{\gamma}_0^{-AN}$ , and slope coefficients  $\bar{\gamma}_1^{-TTE}$  and  $\bar{\gamma}_1^{-AN}$  in the Fama-MacBeth (1973) regression of return on *ROE* separately for both *ROE\_TTM* and *ROE\_AN*. Both average slopes,  $\bar{\gamma}_1^{-TTE}$  and  $\bar{\gamma}_1^{-AN}$ , are all positive which indicates that returns increase with profitability within each book/market quintile  $b=1,2,3,4,5$ . Slopes are higher for value

<sup>76</sup> Rather than Fama-MacBeth regressions, results are qualitatively similar (not reported) using panel regression with standard errors clustered by statistical period. Analysis suggests a stronger time effect than a firm effect. When panel data have only a time effect, Petersen (2008) concludes that Fama-MacBeth regressions produce unbiased test statistics. Thus, I report results in Table 5.5 only for Fama-MacBeth regressions. In addition, rather than estimate the linear cross-sectional relation between profitability, *ROE*, and return,  $R$ , individually for each of the market/book quintiles  $b=1,2,3,4,5$  at statistical month  $t$ , I also jointly estimated these linear relations at statistical month  $t$  with dummy variables for the intercept and slope coefficients. Results are essentially the same (not reported).

firms ( $b=5$ ) compared to growth firms ( $b=1$ ). Consistent with Chapter 2, the relation between returns and profitability is stronger for value firms compared to growth firms.

I estimate  $DGER$  from the regressions of Equation (5.17). On each Statistical Period date  $t$ , I average the estimated coefficients,  $\bar{\gamma}_{0,t}^{TTE}$ ,  $\bar{\gamma}_{0,t}^{AN}$ ,  $\bar{\gamma}_{1,t}^{TTE}$  and  $\bar{\gamma}_{1,t}^{AN}$ , from the regressions of Equation (5.17) for at least 12 months and up to 60 months prior to Statistical Period month  $t$ , separately for book/market quintile  $b=1,2,3,4,5$ . The dynamic growth expected return calculated with the most recent trailing-twelve-month  $ROE$ ,  $ROE\_TTM_{i,t}$ , which I denote as  $D\hat{G}ER\_TTM_{i,t}$ , is,

$$D\hat{G}ER\_TTM_{i,t} = \bar{\gamma}_{0,t}^{TTE} + \bar{\gamma}_{1,t}^{AN} ROE\_TTM_{i,t} \quad \text{for } i=1 \dots N \quad (5.18)$$

The dynamic growth expected return calculated with the most recent analyst earnings forecast  $ROE$ ,  $ROE\_AN_{i,t}$ , which I denote as  $D\hat{G}ER\_AN_{i,t}$ , is,

$$D\hat{G}ER\_AN_{i,t} = \bar{\gamma}_{0,t}^{AN} + \bar{\gamma}_{1,t}^{AN} ROE\_AN_{i,t} \quad \text{for } i=1 \dots N \quad (5.19)$$

Panel B of Table 5.5 reports the mean  $D\hat{G}ER\_TTM$ , the mean  $D\hat{G}ER\_AN$  (see Appendix 5A Equation A.5.47 and A.5.49 for exact definitions) and the mean annualized monthly realized returns  $\bar{R}$  for each book/market quintile  $b=1,2,3,4,5$ . Both

$D\hat{G}ER\_TTM$  and  $D\hat{G}ER\_AN$  increase from growth firms ( $b=1$ ) to value firms ( $b=5$ ) which means that  $DGER$  recognizes the value-premium.  $DGER$  effectively eliminates the value-versus-growth bias. For either,  $D\hat{G}ER\_TTM$  or  $D\hat{G}ER\_AN$ , expected returns are remarkably close to realized returns for growth to value firms ( $b=1,2,3,4,5$ ).

**Table 5.5 DGER, MSE, and QMSE****Panel A: Regressions to Returns on ROE**

1. Means and t Statistics for the Means of the Month-by-Month Regression Coefficients

Book/Market Portfolio	$\gamma_0^{-TTE}$ (t-stat)	$\gamma_1^{-TTE}$ (t-stat)	$\gamma_0^{-AN}$ (t-stat)	$\gamma_1^{-AN}$ (t-stat)
b=1 Growth	0.082 (17.081)	0.222 (15.985)	0.083 (14.011)	0.239 (12.021)
2	0.006 (1.754)	0.926 (50.386)	0.042 (8.626)	0.729 (28.304)
3	0.019 (3.717)	1.217 (63.228)	0.065 (14.428)	0.906 (44.538)
4	0.009 (1.441)	1.638 (57.022)	0.088 (12.889)	0.944 (33.272)
b=5 Value	0.136 (15.277)	1.101 (27.048)	0.177 (21.477)	0.524 (17.803)

**Panel B: DGER**

Book/Market Portfolio	A. $\hat{DGER}_{TTM}$	B. $\hat{DGER}_{AN}$	C. Realized Returns, $\bar{R}$
b=1 Growth	0.132	0.132	0.128
2	0.147	0.148	0.137
3	0.170	0.170	0.157
4	0.178	0.177	0.167
b=5 Value	0.208	0.206	0.199

**Panel C: Mean Squared Errors :  $MSE_{DGER}$**

Book/Market Portfolio	A.	B.
	$D\hat{G}ER\_TMM$	$D\hat{G}ER\_AN$
b=1 Growth	1.387	1.388
2	1.334	1.334
3	1.258	1.258
4	1.224	1.223
b=5 Value	1.585	1.585
Average MSE	1.358	1.358

**Panel D: Quintile Mean Squared Errors :**

**$QMSE_{DGER}$**

Book/Market Portfolio	A.	B.
	$D\hat{G}ER\_TMM$	$D\hat{G}ER\_AN$
b=1 Growth	0.00002	0.00002
2	0.00009	0.00011
3	0.00017	0.00018
4	0.00012	0.00009
b=5 Value	0.00007	0.00004
Average QMSE	0.00010	0.00009

Notes: Panel A reports the temporal average (over the  $TP$  Statistical Period months) of cross-sectional estimated intercepts  $\bar{\gamma}_0^{-TTE}$  and  $\bar{\gamma}_0^{-AN}$ , and slope coefficients  $\bar{\gamma}_1^{-TTE}$  and  $\bar{\gamma}_1^{-AN}$  in the Fama-MacBeth (1973) regression of return on  $ROE$  separately for both  $ROE\_TMM$  and  $ROE\_AN$ . Panel B reports the mean  $D\hat{G}ER\_TMM$ , the mean  $D\hat{G}ER\_AN$  (see Appendix 5A Equation A.5.47 and A.5.49 for exact definitions) and the mean annualized monthly realized returns  $\bar{R}$  (see Appendix 5B Equation B5.3 for the exact definition of  $\bar{R}$ ). Panel C reports MSE for  $DGER$  (that is,  $MSE_{DGER}$ , see Equation A.5.52 in Appendix 5A for the exact definition of  $MSE_{DGER}$ ). Panel D reports  $QMSE$  for  $DGER$  (that is,  $QMSE_{DGER}$ , see Equation A.5.53 in Appendix 5A for the exact definition of  $QMSE_{DGER}$ ).



Unbiasedness is an important statistical property that an expected return measure should have. While *DGER* appears to have this feature, it has the unattractive feature that it is calculated from an estimated regression equation. *SGER*, on the other hand, requires no statistical estimation. Thus, based on other statistical criterion, like, for example, mean squared error (MSE), *DGER* may not be preferred over *SGER*. In the following subsection, I compare *DGER* and *SGER* with MSE.

### 5.3.3 Mean Squared Errors

To compare the accuracy of *SGER* and *DGER* as the expected returns representations, I use mean squared error (MSE) as a guide. MSE measures the average squared difference between an expected return estimator and annualized realized returns  $R_{i,t}^A$  (see Appendix 5B Equation B5.2 for the exact definition of  $R_{i,t}^A$ ). Panel C of Table 5.2 and Panel C of Table 5.4 give MSE for *SGER* (that is,  $MSE_{SGER}$ , see Equation A.5.50 in Appendix 5A for the exact definition of  $MSE_{SGER}$ ). In Panel C of Table 5.2 *SGER* arises from adjustments to current profitability, *ROE\_TTM* and *ROE\_AN*. In Panel C of Table 5.4 *SGER* arises from long-term *ROE* forecasts. Panel C of Table 5.5 reports MSE for *DGER* (that is,  $MSE_{DGER}$ , see Equation A.5.52 in Appendix 5A for the exact definition of  $MSE_{DGER}$ ).

While *DGER\_TTM* and *DGER\_AN* are remarkably accurate representations of realized returns on average for growth and value stocks in Panel B of Table 5.5 ( $b=1,2,3,\dots,5$ ), they do not have the lowest MSE amongst all expected return measures. The expected return measure with the lowest MSE is *SGER\_TQG* which is *SGER* based on an *ROE* forecast that is an equal weighting of *ROE\_TTM*, the quintile median *ROE* (across growth to value stocks,  $b=1,2,\dots,5$ ), and the Grand Median *ROE* (across all

firms).  $DGER\_TTM$  and  $DGER\_AN$  are accurate representations of realized returns for value versus growth firms on average ( $b=1,2,\dots,5$ ) but they depend on statistical estimation of regression parameters. This estimation induces a randomness in return forecasts that  $SGER$  does not have because it requires no statistical estimation but only a forecast of future profitability,  $ROE$ .  $SGER$ , however, has a value-versus-growth bias or, at a minimum, a value bias. It appears that the first force is rather more disadvantageous in MSE and, therefore, even though  $SGER\_TQG$  has a value bias (see Panel B of Table 5.4) it has a lower MSE than does either  $DGER\_TTM$  or  $DGER\_AN$ .

My analysis suggests that the “best” return measure depends on the intended use of that return measure. If the purpose of a return measure is for the Weighted Average Cost of Capital, then the best return measure is the one with the lowest MSE even if it has a bias. In this case, the best return measure that I identify is  $SGER\_TQG$ . On the other hand, if one’s purpose is to forecast the return on a portfolio of stocks (for example, in portfolio analysis), then, because estimation risk will tend to “average out,” the best return measure is probably  $DGER\_TTM$  or  $DGER\_AN$ . I can support the last claim with a little analysis.

In Panel D of Tables 5.2, 5.4 and 5.5 I report a MSE measure that I call Quintile Mean Squared Error (that is,  $QMSE$ ). Average  $QMSE$  is the sum across market/book quintiles of stocks of the squared differences between quintile average of  $SGER$  or  $DGER$  from Table 5.2, 5.4, or 5.5 and average quintile realized returns  $\bar{R}$  (see Equations A.5.51 and A.5.53 in Appendix 5A for exact definitions of Quintile MSE applied to  $SGER$  and  $DGER$ , respectively). Because the  $QMSE$  calculation is applied on average expected returns that have estimation errors “averaged out,” it can be interpreted as a measure of

“best fit” for portfolio expected returns versus portfolio realized returns. The expected return measure with the lowest *QMSE* is *DGER\_AN* in Panel D of Table 5.5. Possibly *DGER\_AN* is a slightly better measure of portfolio returns than is *DGER\_TTM* because analysts anticipate reversion in corporate profitability that TTM earnings cannot capture.

## 5.4 Conclusion for Chapter 5

With unadjusted forward rate of return on equity, *ROE*, expected return from the constant growth discounted dividend model (static growth expected return, *SGER*) overstates realized returns for growth stocks and understates realized returns for value stocks. I investigate whether reversion in profitability reconciles these biases. I compare several *ROE* forecasts using both historical and analysts’ earnings estimates. I find that a reversion-adjustment to historical *ROE* leads to the best *SGER* representation of realized returns to be used for an individual company in the Weighted Average Cost of Capital. In particular, it is a better representation of realized returns than *SGER* based on forward *ROE* with either adjusted or unadjusted analysts’ earnings forecasts. Nonetheless, *SGER* continues to overstate realized returns for growth stocks and understates realized returns for value stocks. On the other hand, regressions of realized returns on profitability, *ROE*, for value versus growth stocks are a conditional reduced-form version of a dynamic equity valuation model that recognizes the value-premium. I call return forecasts from these regressions “dynamic growth expected returns,” *DGER*. In large part, *DGER* eliminates the value-versus-growth bias. I conclude that *DGER* is the best expected return representation for portfolio returns.

Like any good empirical analysis, my study suggests avenues for future research. First, this paper investigates dividend-paying companies. Fama and French (2000) show

that dividend paying behavior impacts the expected value toward which the profitability reverts. Further, in Chapter 3 and Chapter 4, I document that the return-profitability relationship is distinct for dividend paying, non-dividend paying, and financially distressed companies. A reversion-adjustment to profitability or *DGER* may improve expected return measures for non-dividend and financially distressed companies.

Second, for individual companies, for the purposes of WACC, based on a MSE criterion of best-fit, I conclude that an implicit return measure, *SGER*, from a static equity valuation model is a better representation of realized returns than is estimated expected return *DGER* from a dynamic equity valuation model. I come to this conclusion even though *DGER* effectively eliminates the value-versus-growth bias for portfolios of companies. However, I did not evaluate *SGER* against all possible other implicit expected return measures that are available in the financial literature (for example, Easton 2004, 2006; Easton et al, 2002; Gebhardt et al., 2001; Gode and Mohanram 2003). One of these implicit expected return measures might be a better representation of realized return for individual companies for WACC purposes than is *SGER*. Future research will make this determination.

## **Appendix 5A**

### ***ROE* Forecasts**

**A.5.1**  $\hat{ROE}_{CP_{i,t+1}}$  is the historical *ROE* calculated with trailing-twelve-month earnings (TTM), adjusted by the predicted changes in *ROE* (which is  $\hat{CP}_{i,t+1}$ ), for firm *i*, at Statistical Period month *t*.

$$\hat{ROE}_{CP_{i,t+1}} = ROE_{TTM_{i,t}} + \hat{CP}_{i,t+1}$$

**A.5.2**  $\hat{ROE}_{CP}$  is median value of  $\hat{ROE}_{CP_{i,t+1}}$ .

$$\hat{ROE}_{CP} = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}\hat{ROE}_{CP_{i,t+1}})$$

**A.5.3**  $ROE_{TTM_{i,t}}$  is the historical  $ROE$  calculated with trailing-twelve-month earnings (TTM) for firm  $i$ , at Statistical Period month  $t$ .

**A.5.4**  $ROE_{TTM}$  is median value of  $ROE_{TTM_{i,t}}$ .

$$ROE_{TTM} = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}\text{ROE}_{TTM_{i,t}})$$

**A.5.5**  $ROE_{AN_{i,t}}$  is the  $ROE$  calculated with analysts' earnings forecasts for firm  $i$ , at Statistical Period month  $t$ .

**A.5.6**  $ROE_{AN}$  is median analysts'  $ROE$  forecast.

$$ROE_{AN} = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}\text{ROE}_{AN_{i,t}})$$

**A.5.7**  $m\hat{ROE}_{TTM_{i,t}}$  is  $\hat{ROE}_{TTM_{i,t}}$  with a marginal adjustment for firm  $i$ , at Statistical Period month  $t$ .

$$m\hat{ROE}_{TTM_{i,t}} = \bar{\alpha}_{1,t,b} \times \text{ROE}_{TTM_{i,t}}$$

**A.5.8**  $m\hat{ROE}_{TTM}$  is median value of  $m\hat{ROE}_{TTM_{i,t}}$ .

$$m\hat{ROE}_{TTM} = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(m\hat{ROE}_{TTM_{i,t}}))$$

**A.5.9**  $m\hat{ROE}_{AN_{i,t}}$  is  $\hat{ROE}_{AN_{i,t}}$  with a marginal adjustment for firm  $i$ , at Statistical Period month  $t$ .

$$m\hat{R}OE\_AN_{i,t} = \bar{\hat{\alpha}}_{1,t,b} \times ROE\_AN_{i,t}$$

**A.5.10**  $m\hat{R}OE\_AN$  is median value of  $m\hat{R}OE\_AN_{i,t}$ .

$$m\hat{R}OE\_AN = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(m\hat{R}OE\_AN_{i,t}))$$

### **SGER**

**A.5.11**  $\hat{S}GER\_CP_{i,t}$  is the *SGER* calculated with  $\hat{R}OE\_CP_{i,t}$

$$\hat{S}GER\_CP_{i,t} = \hat{R}OE\_CP_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.12**  $\hat{S}GER\_CP$  is the average of  $\hat{S}GER\_CP_{i,t}$ .

$$\hat{S}GER\_CP = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (\hat{S}GER\_CP_{i,t}) \right)$$

**A.5.13**  $m\hat{S}GER\_TTM_{i,t}$  is the *SGER* calculated with  $m\hat{R}OE\_TTM_{i,t}$ .

$$m\hat{S}GER\_TTM_{i,t} = m\hat{R}OE\_TTM_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.14**  $m\hat{S}GER\_TTM$  is the average of  $m\hat{S}GER\_TTM_{i,t}$ .

$$m\hat{S}GER\_TTM = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (m\hat{S}GER\_TTM_{i,t}) \right)$$

**A.5.15**  $m\hat{S}GER\_AN_{i,t}$  is the *SGER* calculated with  $m\hat{R}OE\_AN_{i,t}$ .

$$m\hat{S}GER\_AN_{i,t} = m\hat{R}OE\_AN_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.16**  $m\hat{S}GER\_AN$  is the average of  $m\hat{S}GER\_AN_{i,t}$ .

$$m\hat{S}GER\_AN = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (m\hat{S}GER\_AN_{i,t}) \right)$$

**A.5.17**  $SGER\_TTM_{i,t}$  is the *SGER* calculated with  $ROE\_TTM_{i,t}$ .

$$SGER\_TTM_{i,t} = ROE\_TTM_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.18**  $SGER\_TTM$  is the average of  $SGER\_TTM_{i,t}$ .

$$SGER\_TTM = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (SGER\_TTM_{i,t}) \right)$$

**A.5.19**  $SGER\_AN_{i,t}$  is the  $SGER$  calculated with  $ROE\_AN_{i,t}$ .

$$SGER\_AN_{i,t} = ROE\_AN_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.20**  $SGER\_AN$  is the average of  $SGER\_AN_{i,t}$ .

$$SGER\_AN = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (SGER\_AN_{i,t}) \right)$$

### Long Run $ROE$ Forecasts

**A.5.21**  $FF\_LT\_R\hat{O}E_{i,t}$  is the ergodic (long-run)  $ROE$  forecasted from Equation (5.2)

with most recent M/B and D/B.

$$FF\_LT\_R\hat{O}E_{i,t} = \bar{d}_{0,t} + \bar{d}_{1,t} \frac{M_{i,t}}{B_{i,t}} + \bar{d}_{2,t} \frac{D_{i,t}}{B_{i,t}}$$

**A.5.22**  $FF\_LT\_R\hat{O}E$  is a median value of  $FF\_LT\_R\hat{O}E_{i,t}$ .

$$FF\_LT\_R\hat{O}E = \underset{t=1}{\overset{TP}{\text{median}}} \left( \underset{i=1}{\overset{N}{\text{median}}} (FF\_LT\_R\hat{O}E_{i,t}) \right)$$

**A.5.23**  $LTmR\hat{O}E\_TTM_{i,t}$  is  $ROE\_TTM_{i,t}$  with multiple marginal adjustments

$$LTmR\hat{O}E\_TTM_{i,t} = \left( \bar{\alpha}_{1,t,b} \right)^j \times ROE\_TTM_{i,t}$$

**A.5.24**  $LTmR\hat{O}E\_TTM$  is a median value of  $LTmR\hat{O}E\_TTM_{i,t}$ .

$$LTmR\hat{O}E\_TTM = \underset{t=1}{\overset{TP}{\text{median}}} \left( \underset{i=1}{\overset{N}{\text{median}}} (LTmR\hat{O}E\_TTM_{i,t}) \right)$$

**A.5.25**  $LTm\hat{ROE}_{-AN_{i,t}}$  is  $ROE_{-AN_{i,t}}$  with multiple marginal adjustments.

$$LTm\hat{ROE}_{-AN_{i,t}} = \left(\bar{\hat{\alpha}}_{1,t,b}\right)^j \times ROE_{-AN_{i,t}}$$

**A.5.26**  $LTm\hat{ROE}_{-AN}$  is a median value of  $LTm\hat{ROE}_{-AN_{i,t}}$ .

$$LTm\hat{ROE}_{-AN} = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(LTm\hat{ROE}_{-AN_{i,t}}))$$

**A.5.27**  $LTm\hat{ROE}_{-CP_{i,t}}$  is  $\hat{ROE}_{-CP_{i,t}}$  with multiple marginal adjustments.

$$LTm\hat{ROE}_{-CP_{i,t}} = \left(\bar{\hat{\alpha}}_{1,t,b}\right)^j \times \hat{ROE}_{-CP_{i,t}}$$

**A.5.28**  $LTm\hat{ROE}_{-CP}$  is a median value of  $LTm\hat{ROE}_{-CP_{i,t}}$ .

$$LTm\hat{ROE}_{-CP} = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(LTm\hat{ROE}_{-CP_{i,t}}))$$

**A.5.29**  $ROE_{-QMED_t}$  is the quintile median  $ROE$  at time  $t$ .

$$ROE_{-QMED_t} = \underset{t=0}{\overset{12 \leq x \leq 60}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(ROE_{-TTM_{i,t}}))$$

**A.5.30**  $ROE_{-QMED}$  is a median value of  $ROE_{-QMED_t}$ .

$$ROE_{-QMED} = \underset{t=1}{\overset{TP}{\text{median}}}(ROE_{-QMED_t})$$

**A.5.31**  $ROE_{-Grand_t}$  is the median  $ROE$  of all firms at time  $t$ .

$$ROE_{-Grand_t} = \underset{t=0}{\overset{12 \leq x \leq 60}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(ROE_{-TTM_{i,t}}))$$

**A.5.32**  $ROE_{-TQG_{i,t}}$  is an  $ROE$  combination which includes one-third of  $ROE_{-TTM_t}$ , one-third of quintile median  $ROE_{-QMED_t}$ , and one-third of grand median  $ROE$ .

$$ROE_{-TQG_{i,t}} = \frac{1}{3} ROE_{-TTM_{i,t}} + \frac{1}{3} ROE_{-QMED_t} + \frac{1}{3} ROE_{-Grand_t}$$



**A.5.33**  $ROE\_TQG$  is a median value of  $ROE\_TQG_{i,t}$ .

$$ROE\_TQG = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(ROE\_TQG_{i,t}))$$

**SGER with Long Term ROE Forecasts**

**A.5.34**  $FF\_LT\_S\hat{G}ER_{i,t}$  is SGER calculated with  $FF\_LT\_R\hat{O}E_{i,t}$ .

$$FF\_LT\_S\hat{G}ER_{i,t} = FF\_LT\_R\hat{O}E_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.35**  $FF\_LT\_S\hat{G}ER$  is a median value of  $FF\_LT\_S\hat{G}ER_{i,t}$ .

$$FF\_LT\_S\hat{G}ER = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(FF\_LT\_S\hat{G}ER_{i,t}))$$

**A.5.36**  $LTmS\hat{G}ER\_TTM_{i,t}$  is SGER calculated with  $LTmR\hat{O}E\_TTM_{i,t}$ .

$$LTmS\hat{G}ER\_TTM_{i,t} = LTmR\hat{O}E\_TTM_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.37**  $LTmS\hat{G}ER\_TTM$  is a median value of  $LTmS\hat{G}ER\_TTM_{i,t}$ .

$$LTmS\hat{G}ER\_TTM = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(LTmS\hat{G}ER\_TTM_{i,t}))$$

**A.5.38**  $LTmS\hat{G}ER\_AN_{i,t}$  is SGER calculated with  $LTmR\hat{O}E\_AN_{i,t}$ .

$$LTmS\hat{G}ER\_AN_{i,t} = LTmR\hat{O}E\_AN_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.39**  $LTmS\hat{G}ER\_AN$  is a median value of  $LTmS\hat{G}ER\_AN_{i,t}$ .

$$LTmS\hat{G}ER\_AN = \underset{t=1}{\overset{TP}{\text{median}}}(\underset{i=1}{\overset{N}{\text{median}}}(LTmS\hat{G}ER\_AN_{i,t}))$$

**A.5.40**  $LTmS\hat{G}ER\_CP_{i,t}$  is SGER calculated with  $LTmR\hat{O}E\_CP_{i,t}$ .

$$LTmS\hat{G}ER\_CP_{i,t} = LTmR\hat{O}E\_CP_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.41**  $LTmS\hat{G}ER\_CP$  is a median value of  $LTmS\hat{G}ER\_CP_{i,t}$ .

$$LTm\widehat{SGER}_{CP} = \text{median}_{t=1}^{TP}(\text{median}_{i=1}^N(LTm\widehat{SGER}_{CP_{i,t}}))$$

**A.5.42**  $SGER\_QMED_{i,t}$  is  $SGER$  calculated with  $ROE\_QMED_t$ .

$$SGER\_QMED_{i,t} = ROE\_QMED_t + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.43**  $SGER\_QMED$  is a median value of  $SGER\_QMED_t$ .

$$SGER\_QMED = \text{median}_{t=1}^{TP}(\text{median}_{i=1}^N(SGER\_QMED_{i,t}))$$

**A.5.44**  $SGER\_TQG_{i,t}$  is  $SGER$  calculated with  $ROE\_TQG_{i,t}$ .

$$SGER\_TQG_{i,t} = ROE\_TQG_{i,t} + (1 - M_{i,t}/B_{i,t}) \times dy_{i,t+1}$$

**A.5.45**  $SGER\_TQG$  is a median value of  $SGER\_TQG_{i,t}$ .

$$SGER\_TQG = \text{median}_{t=1}^{TP}(\text{median}_{i=1}^N(SGER\_TQG_{i,t}))$$

## **DGER**

**A.5.46**  $D\widehat{GER}_{TTM}_{i,t}$  is the dynamic growth expected return calculated with the most recent trailing-twelve-month  $ROE\_TTM_{i,t}$ .

$$D\widehat{GER}_{TTM}_{i,t} = \overline{\widehat{\gamma}}_{0,t}^{TTE} + \widehat{\gamma}_{1,t}^{AN} ROE\_TTM_{i,t}$$

**A.5.47**  $D\widehat{GER}_{TTM}$  is the average of  $D\widehat{GER}_{TTE}_{i,t}$ .

$$D\widehat{GER}_{TTM} = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (D\widehat{GER}_{TTM}_{i,t}) \right)$$

**A.5.48**  $D\widehat{GER}_{AN}_{i,t}$  is the dynamic growth expected return calculated with the most recent analyst earnings forecast  $ROE\_AN_{i,t}$ .

$$D\widehat{GER}_{AN}_{i,t} = \overline{\widehat{\gamma}}_{0,t}^{AN} + \widehat{\gamma}_{1,t}^{AN} ROE\_AN_{i,t}$$

**A.5.49**  $D\hat{G}ER\_AN$  is the average of  $D\hat{G}ER\_AN_{i,t}$ .

$$D\hat{G}ER\_AN = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (D\hat{G}ER\_AN_{i,t}) \right)$$

### **MSE and QMSE**

**A.5.50**  $MSE_{SGER}$  is the sum of mean squared error between  $SGER_{i,t}$  and annualized realized returns,  $R_{i,t}^A$ .

$$MSE_{SGER} = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (SGER_{i,t} - R_{i,t}^A)^2 \right)$$

**A.5.51**  $QMSE_{SGER}$  is the average squared distances between quintile mean  $SGER$  and quintile mean realized returns  $\bar{R}$ .

$$QMSE_{SGER} = (SGER - \bar{R})^2$$

**A.5.52**  $MSE_{DGER}$  is the average mean squared error between  $D\hat{G}ER_{i,t}$  and  $R_{i,t}^A$ .

$$MSE_{DGER} = \frac{1}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (D\hat{G}ER_{i,t} - R_{i,t}^A)^2 \right)$$

**A.5.53**  $QMSE_{DGER}$  is the average squared differences between quintile mean  $DGER$  and quintile mean realized returns  $\bar{R}$ .

$$QMSE_{DGER} = (D\hat{G}ER - \bar{R})^2$$

## Appendix 5B

### Realized Returns

I measure portfolio returns from a Statistical Period date, where I form a portfolio, to the following Statistical Period date, which is approximately a month later. Because Statistical Period dates are mid-month rather than month-end, I cannot use *CRSP* monthly returns. Instead, for firm  $i=1,2,\dots,N$ , in portfolio  $b=1,2,3,4,5$ , for Statistical Period month  $t=1,2,\dots,TP$ , where  $TP$  is the number of months in my test period, I calculate return as the change in closing share price between Statistical Period dates plus dividends 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  $t=1,2,\dots,TP$ , for firm  $i=1,2,\dots,N$ , in portfolio  $b=1,2,3,4,5$ , between Statistical Period dates, is,

$$R_{i,t} = \left( \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \right)_i \quad (\text{B5.1})$$

where  $P_t$  and  $P_{t+1}$  are closing share prices<sup>77</sup> 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  $t+1$ . Annualized return is,

$$R_{i,t}^A = 12 \times R_{i,t} \quad (\text{B5.2})$$

The equally weighted portfolio return in month  $t$  is  $R_t = \frac{1}{N} \sum_{i=1}^N R_{i,t}$ . Average annualized portfolio return over my test period is,

$$\bar{R} = \frac{12}{TP} \sum_{t=1}^{TP} \left( \frac{1}{N} \sum_{i=1}^N (R_{i,t}) \right) = \frac{12}{TP} \sum_{t=1}^{TP} R_t. \quad (\text{B5.3})$$

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<sup>77</sup> If a stock is delisted during statistical period month  $t$  or closing share price is missing on the Statistical Period date  $t+1$ , I use the *CRSP* delisting price (if available) or last trading price in the statistical period month  $t$  as  $P_{t+1}$ . If closing share price is missing on the Statistical Period date  $t$ , I use the next opening price (if available from *CRSP*) or the first closing price in the statistical period month  $t$ . 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.

## CHAPTER 6: CONCLUSION

In this chapter, I conclude my dissertation by describing the instances where empirical results are consistent with and the instances where empirical results are inconsistent with my theoretical modeling. In this dissertation I learnt a great deal about the supportive and symbiotic relation between theoretical modeling and empirical testing in financial academic research. The instances where empirical results supported theoretical modeling strengthen my initial views and encouraged me to search out other areas where these views might be applied. On the other hand, instances where empirical results were not consistent with my theoretical modeling forced me to rethink my initial views. This rethinking is a valuable exercise and allowed me to develop explanations for what otherwise are some rather puzzling phenomenon in financial market equity returns.

In three of the four principal chapters in my dissertation, chapters 2, 3, and 4, I use distinct but related dynamic equity valuation models as guidance for empirical testing. An interesting question is why I do not use a general model that incorporates the equity valuation models in these three chapters as special cases. The reason is that, in the first instance, this research strategy would be unduly risky. The research that produced Chapters 2, 3 and 4 was sequential. Chapter 2 required a model, incomplete as it is, for the purpose of that chapter. If results in Chapter 2 had not been confirming, there would have been little reason to proceed. The confirming results in Chapter 2 suggested the additional topics that I investigated in Chapters 3 and 4. These topics required a theoretical model for guidance in empirical testing but not the most general model possible. Now that I have found confirming empirical evidence for the theoretical models in each of these chapters, a future researcher might find it useful for extensions of my

analysis to develop a general model that incorporates the models from Chapters 2, 3, and 4 as special cases. While my empirical results suggest the value of this general model for financial economic modeling of returns, it was not critical for my dissertation. Future research will determine whether a general model is useful for the representation of equity market returns or not.

This dissertation investigates the relation between equity returns and profitability. Traditional static equity valuation models predict a negative relation between returns and profitability. This prediction does not explain a number of equity market phenomena. Alternatively, I develop several dynamic equity valuation models. These models have the common characteristic that a value maximizing manager suspends corporate growth upon low profitability. Profitability increases the likelihood of future growth which engenders risk and increases return. Thus, over some range of profitability, returns and profitability relate positively. I use these dynamic equity valuation models to investigate a number of hitherto unexplained phenomena in equity markets. These phenomena are all related to the “value-premium” which is the empirical observation that low market/book “value” stocks have higher returns than high market/book “growth” stocks.

First, I propose a new explanation for the value-premium: the “limits-to-growth hypothesis.” With organizational limits on growth expenditure, profitability decreases risk for high profitability growth firms but increases risk for low profitability value firms in anticipation of future growth-leverage. The prediction that high profitability “growth” firms have low returns is the relation between profitability and returns “in-the-large.” Consistent with the limits-to-growth hypothesis, for dividend paying firms, for whom it is

best applied, I find evidence that high profitability “growth” firms have lower returns than low profitability “value” firms.

Second, the profitability motivated risk/return dynamics of non-dividend paying firms is distinct from dividend paying firms. I find no evidence of limited growth opportunities that would otherwise induce low returns for high profitability non-dividend paying companies. Earnings that are retained for growth rather than paid as dividends suggests that non-dividend paying firms do not face the same growth limits as dividend paying firms. Rather, with constraints on external financing, non-dividend paying firms finance growth investments internally only as profitability permits. These investments increase risk and return. Consistent with this prediction, I find evidence that high profitability non-dividend paying “growth” firms have higher returns than low profitability non-dividend paying “value” firms which is a negative value-premium.

Third, for firms in financial distress, I contend that profitability impacts two risks in opposite ways. Profitability decreases distress-risk but increases growth-leverage. Thus, high profitability firms with low distress-risk and high growth-leverage can have higher returns than low profitability firms with high distress-risk and low growth-leverage. The combination of these two risks forms a U-shape relationship between returns and profitability. I find strong evidence for this U-shape.

In a number of instances, I find empirical results that are inconsistent with my theoretical modeling. These instances allow me to modify my initial views of the financial world and develop some explanations for what otherwise are some rather puzzling phenomenon in equity returns.

First, the dynamic model that I develop in Chapter 2 suggests the circumstances under which returns increase with profitability. Returns increase with profitability for value firms but decrease with profitability for growth firms. However, I find empirically that returns increase with profitability for *both* value and growth stocks. Thus, I use a modified version of the limits-to-growth hypothesis to explain the relation between returns and profitability “in-the-small.” The relation between returns and profitability in-the-small is for either value or growth firms separately. For value firms, increasing profitability increases the likelihood of growth which increases growth-leverage which increases return. At the same time, increasing profitability increases the ability of the firm to finance growth internally when they cannot finance externally. This increase in the corporate growth-rate increases risk, which increases return. These two forces work together so that the relation between returns and profitability is quite strong for value firms. On the other hand, for growth firms, increasing profitability covers growth costs, which decreases leverage and decreases return. At the same time, increasing profitability increases the ability of the firm to finance growth internally when they cannot finance externally. This increase in the corporate growth-rate increases risk, which increases return. These two forces work in opposite directions. So, the relation between returns and profitability can be either positive or negative for growth firms (depending upon which force dominates), but it is weaker for growth firms than it is for value firms. I find empirical evidence that is consistent with this modified version of the limits-to-growth hypothesis.

Second, in Chapter 4, I find both a U-shape relation between returns and profitability and a value-premium for firms in financial distress. However, on the face of



it, one would not expect a value premium—high returns for low market/book “value” stocks—from a U-shaped relation between returns and profitability. Any reasonable equity valuation model predicts a positive relation between market/book and profitability, *ROE*. Thus, depending upon where firms in a particular sample fall along this U-shaped curve, returns and market/book might relate positively or negatively, but this relation is unlikely to be strong or persistent. In more detailed investigation, I find that *ROE* initially increases but then decreases market/book. A negative relation between *ROE* and market/book suggests that *ROE* changes an economic factor that I presume fixed in my theoretical model. A volatility effect is a likely cause of this unexpected relation. I find that *ROE* decreases volatility of operating earnings for firms in financial distress. This decrease in volatility does not arise solely from a fall in financial leverage because it occurs for not only for earnings but also for operating earnings before interest. Rather, I argue that managers “risk-shift” into higher risk business-investments with financial distress because they put creditors’ (rather than shareholders’) capital at risk with impunity. This behavior is consistent with the view that distress-risk accentuates the call option features of common equity. As *ROE* decreases volatility, value falls because lower volatility decreases call option value. Thus, for firms in financial distress, but with relatively great *ROE*, earnings-volatility is low, value is low, and market/book is low. For both exceptionally low *ROE* and high *ROE* (amongst the firms in financial distress that I study), market/book is low which is a hill-shaped relation between market/book and profitability. Along with a U-shaped relation between returns and profitability, there is a value premium for firms in financial distress. When market/book is low (high or low profitability), returns are high.

Third, the implicit expected return measure I develop in Chapter 2, *SGER*, overstates realized returns for high-profitability growth stocks and understates realized returns for low-profitability value stocks. A possible reason for this value-versus-growth bias is that the *ROE* forecast that I use in *SGER* does not recognize the reversion in profitability that Fama and French (2000) empirically document. In Chapter 5, I investigate whether I can reduce or eliminate the value-versus-growth bias in *SGER* as a conditional expected return measure by recognizing earnings-reversion prior to inputting *ROE* into *SGER*. In other words, high profitability for growth firms is unsustainably high and is not a good forecast of future profitability for the purpose of expected return determination (and vice versa for value stocks). I compare several *ROE* forecasts using both historical and analysts' earnings estimates. Nonetheless, *SGER* continues to overstate realized returns for growth stocks and understates realized returns for value stocks. The fact that earnings reversion does not eliminate the value-versus-growth bias for *SGER* as a conditional expected return measure suggests that this bias will never be removed with implicit-returns from static models of equity valuation. Rather, only expected returns from a dynamic model of equity valuation that recognize the value-premium will eliminate this bias. In Chapter 2, I propose a new explanation for the value-premium: the "limits-to-growth hypothesis." With organizational limits on growth expenditure, profitability decreases risk for high profitability growth firms but increases risk for low profitability value firms in anticipation of future growth-leverage. Consistent with a modified version of the limits-to-growth hypothesis, I find that returns and profitability relate positively for *both* value and growth stocks but that the relation is stronger for value stocks than it is for growth stocks. The estimated regressions of

realized returns on profitability, *ROE*, that lead to these results are effectively a conditional reduced-form version of a dynamic equity valuation model that recognizes the value-premium. I investigate *ROE* with historical earnings and consensus analysts' earnings forecasts as input in these regressions to produce an expected return. I call return forecasts from these regressions "dynamic growth expected returns," *DGER*. These *DGERs* effectively eliminate the value-versus-growth bias.

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