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The Effect of Gross Profitability on Share Price Appreciation

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on Share Price Appreciation

By

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ABSTRACT

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The purpose of this study is to analyze the relationship between gross profitability and share price appreciation. Dimensional Fund Advisors, an investment firm managing $338 billion, builds portfolios based on a number of different metrics and added gross profitability as a factor in early 2013. Profitable firms may be systematically undervalued and, therefore, gross profitability should predict future share price appreciation.

Gross profitability is a firm's gross profit multiplied by its asset turnover. A high gross profitability may signal a firm's pricing power or quality in comparison with other businesses. Investors may neglect profitable firms and overpay for "lottery stocks" that have a small possibility of generating an outsized return. Novy-Marx (2013) pairs gross profitability with value metrics to serve as a measurement of quality. His findings indicate that a portfolio built on gross profitability and value will deliver superior risk and return statistics. This study incorporates growth and risk metrics along with gross profitability to analyze their effects on share price appreciation.

This study uses panel data on firms from the Russell 3000 Index over two separate time periods to investigate the effect of gross profitability on share price appreciation. Distinct time periods were chosen to analyze the effectiveness of gross profitability as a predictor of returns in differing macroeconomic climates. The first sample covers 618 cross-sections from 1990 to 1997 and the second sample covers 1,629 firms from 2003 to 2012. Regression analyses are used to study the relationship between gross profitability and subsequent share price appreciation.

Contrary to Novy-Marx (2013) and Dimensional Fund Advisors (Goodman 2014), this study finds little to no relationship between gross profitability and share price appreciation. The most robust factor in this analysis is risk premium. This follows the efficient market hypothesis that higher risk should yield higher returns.

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CHAPTER ONE: INTRODUCTION

The Role of Gross Profitability in Investing

Investment analysts around the world keep a hawkish watch on a firm's gross profitability: even a small percentage point change in the downward direction can be cause for concern. For years, investors have sought superior and repeatable investment strategies. One such debate centers on the performance of growth strategies versus value strategies. Other analysts and academics support market capitalization-based investing, due to the superior returns of small cap stocks over time. Another common and popular strategy is to attempt to forecast a firm's earnings growth into the future. Yet other approaches center on dividends, investor psychology and sharp price drops or even significant stock purchases by insiders. However, it is not until recently that a strong proxy for future profitability has been discovered. Over the past few years, gross profitability has been viewed and studied as an important factor in determining share price appreciation. Investment managers use gross profitability both as a qualitative factor on a case-by-case basis and as a quantitative factor incorporated into stock screens. Dimensional Fund Advisors, an investment firm managing $332 billion, builds portfolios based on a number of different quantitative metrics. Near the beginning of 2013, the firm added their most recent factor: gross profitability (Goodman 2014).

Gross Profitability at Dimensional Fund Advisors[1]

Dimensional Fund Advisors (DFA) is one of the largest mutual fund firms in business and is based on the academic research of Eugene Fama. The company offers quantitative funds, "driven by computer models, rather than by individual security selection." These models are all based on the efficient market hypothesis, or the idea that it is impossible to consistently beat the market by stock picking. However, those at DFA believe there are certain metrics that can be exploited to provide market-beating returns. Profitability was steadily introduced into the DFA lineup of funds and now is a factor in all DFA funds. This factor "incorporates firms with higher profitability relative to price, cash flow, or other metrics." The logic behind this factor has to do with investor behavior and the distribution of stock returns. There are far more returns that fall below the average, but a small number of stocks that deliver large excess returns. DFA believes that investors generally do not apply enough of a risk discount to "lottery stocks" that have the potential to outperform significantly. In summary, the "market's willingness to pay for the small chance of outsize gains means that other profitable firms, relatively speaking, have lower prices." We are motivated to further study gross profitability due to its recent popularity and the debate that investors may systematically undervalue profitable firms.

[1] This section paraphrases key points from Beverly Goodman's January 4th, 2014 Barron's article: "A Different Dimension."

Contribution and Organization of this Paper

Outline of Study

In Chapter Two we provide a theoretical argument for gross profitability as a predictor of share price appreciation. Next, we explain how gross profitability may be most effective when positioned as a marker of quality. We discuss other variables that are related to future returns as well.

In Chapter Three we describe the economic model that may explain a relationship between gross profitability and returns. To begin, we discuss the efficient market hypothesis, followed by an analysis of what fundamentally drives stock returns. We conclude the chapter with the regression model relating share price appreciation to gross profitability, revenue growth, earnings growth and a risk premium.

In Chapter Four we discuss sample selection, descriptive statistics and estimation results. This study analyzes the impact of gross profitability and other metrics of Russell 3000 stocks on share price appreciation over subsequent 1-, 3-, 5- and 10-year periods during 1990 – 2012.

In Chapter Five we conclude that, although other studies find gross profitability to be predictive, the results of this investigation indicate little to no correlation between gross profitability and the return on investment in specific stocks. In addition we give suggestions for future research.

CHAPTER TWO: A THEORETICAL ARGUMENT FOR GROSS PROFITABILITY AS A PREDICTOR OF SHARE PRICE APPRECIATION

In this chapter we analyze gross profitability and other factors that affect share price appreciation. First, we present a theoretical explanation for why gross profitability should predict returns. This argument focuses on the ability of gross profitability to signal firms with pricing power and success in their core business. Next, gross profitability is studied as a quality metric when paired with value factors. Gross profitability may help differentiate between stock prices that have fallen for some legitimate reason and shares that have dipped due to investor overreaction or other short-term headwinds. Finally, we analyze other variables, such as earnings growth rates and valuation multiples, that affect share price appreciation.

Why Gross Profitability

Most financial economists would agree that profitability should help to forecast stock returns; however, return on equity (ROE) does a poor job predicting stock performance. The fact that profitability can be expected to forecast returns makes perfect economic sense: a security's current price is based on the expectation of future payouts, and greater profitability should lead to greater payouts. Fama and French (2006) find that greater profitability is correlated with greater returns. However, Fama and French (2008) report that portfolio tests centered on trading strategies available to investors show poor empirical performance of ROE in predicting returns. On the other hand, Novy-Marx references the valid economic

theory and the practical success of gross profitability as opposed to other profitability metrics:

> According to Chi and Fogdall (2012), the co-heads of portfolio management at Dimensional Fund Advisors, 'the research breakthrough in this case is not the discovery of expected profitability as a dimension of expected returns per se, something that financial economists have suggested for some time…rather, it is the discovery of reasonable proxies for expected profitability, which allow us to use profitability as another dimension of expected returns in the creation of investment solutions' (2013, 25).

Furthermore, Novy-Marx adds, "that gross profitability performs better predicting future stock returns than ROE…because it is a better proxy for true economic profitability" (2013, 23). This is due to the fact that accountants will treat certain forms of economic investment, such as research and development, advertisement and human capital development, as expenses. In any case, the accounting work that is done in a firm's financial statements may be misleading. Therefore, gross profitability may better reflect the success or failure of a company's core business.

Gross profitability is gross margin multiplied by asset turnover. Gross margin, or gross profits-to-sales, is a strong measure of market power. Gross profits are simply what a firm takes in from revenue, less the cost of the goods and services provided. It is important to have a high gross margin because even the most talented management team needs to have ample coverage to pay the operational costs of running a business. A firm that can earn a high margin on its products may have strong pricing power and a type of economic moat against outside competition. These types of companies tend to have competitive advantages, either in the form of loyal customers, a strong brand or any other factor that prevents the entry of

potential competitors. In any case, the market power reflected by a strong gross margin should allow a firm to deliver superior returns going forward.

The second ingredient in gross profitability, asset turnover, or the dollar value of annual sales generated by each dollar of book assets, is a measure of capital productivity (Novy-Marx 2013, 24). The combination of gross margins and asset turnover yields gross profitability, or gross profits-to-assets. Any firm that is able to generate a high level of profits in comparison to assets is likely to be a well-run, efficient company. Importantly, Novy-Marx notes the pragmatic justification of gross profitability when he states, “empirically gross profitability, which appears almost at the top of the income statement, is a much better predictor of a firm’s future stock performance” (2013, 25). Gross profitability can be argued to predict competitive advantages, core business success and economic profitability and, in turn, future stock returns. However, Novy-Marx believes that it serves best as a signal of quality for cheaply valued stocks.

Gross Profitability as a Quality Metric

Novy-Marx (2013) illustrates that a strategy of gross profitability, or buying profitable firms and selling unprofitable firms, yields a type of return premium similar to that of a value premium. Furthermore, Novy-Marx compares gross profitability against many other quality metrics: beginning with traditional value and the Benjamin Graham Strategies. These quality and quantity criteria are somewhat outdated, but include a combination of time-tested factors such as market capitalization, earnings stability and price-to-earnings ratios. Next, Jeremy Grantham’s idea of quality, which points to firms with low leverage, high

profitability and low earnings volatility, is investigated (Novy-Marx 2013). This is followed by Joel Greenblatt's "Magic Formula," in which firms are ranked on the basis of return on invested capital (ROIC) and earnings yield (EY). Finally, Sloan's accruals-based measure of earnings quality and Piotroski's F-score measure of financial strength are considered (Novy-Marx 2013). The result of this analysis is that gross profitability, a simpler measure of quality, yields a superior net active return, information ratio and max drawdown in a portfolio built on value and quality. In addition, gross profitability is strongly negatively correlated with value, creating a useful hedge to value investors (Novy-Marx 2013). In any regard, prior studies suggest a plethora of other metrics that aid in predicting future share price appreciation.

Other Metrics used to Predict Share Price Appreciation

Many investment managers center their approaches on value strategies, growth strategies or other strategies that may focus on dividends, investor psychology and management actions. Value investors generally fit into the category of passive screeners, although they may also take a contrarian stance or an activist posture (Damodaran 2012, 4). The common metrics employed in value screens are price-to-earnings (P/E) and price-to-book (P/B). These value strategies tend to have a long time horizon and hope to capture a systematic market opportunity. Chan and Lakonishok (2002) find that value investing generates superior returns that cannot be explained by common measures of risk. The study points to investor psychology, or the fact that investors extrapolate past performance too far into the future, as a cause for these additional returns. In this type of model, investors are

expected to overvalue stocks with recent strong performance and shun stocks with poor stock returns in the recent past. This type of contrarian strategy hopes to capitalize on stocks that have dropped in price due to short-term headwinds and not because of long-term fundamental issues. Activist investors generally have to hold a very large share of a firm and essentially take a private equity approach to a public company. While Chan and Lakonishok find value strategies to be superior, other studies actually find growth strategies to outperform and offer greater downside protection in the event of catastrophes (Dow 2007).

The idea that growth investors enjoy additional returns is predicated on the fact that they must accept higher short-term volatility and irregular returns via capital gains, as opposed to dividends. In any regard, there is not just one type of growth investor or growth strategy. Growth investors too may fall into distinct categories, such as passive screeners, small cap investors, initial public offering (IPO) investors or activist investors (Damodaran, 4). A passive screener that believes in growth strategies will focus on metrics such as earnings growth and momentum. This, however, leads to another question: how to best extrapolate growth rates? Chan and Lakonishok (2002) find that there may be some evidence for short-term forecast ability, but that earnings growth is generally unpredictable.

In addition, it is important to consider trends as opposed to just the level of earnings. A firm that has negative earnings for four consecutive years, but a massive jump in earnings in the fifth year should be viewed differently from a firm that has slowly and steadily increased earnings. Zhan Gao and Wan-Ting Wu (2013) use multiple information sources to predict long-term earnings growth. They utilize

analysts' forecasts, stock prices and financial statements to develop a more robust model. Their end result takes into account analysts' long-term growth forecasts, past earnings growth, forward price-to-earnings ratios and past stock returns. Because these measurements come from different sources, they provide an uncorrelated and more accurate prediction of future earnings growth. Small capitalization companies and firms that have just released an initial public offering may also be expected to grow at a higher rate than a mature company. Also, activist investors are present in the growth space in the same form that they are in the value universe. While value and growth strategies are two of the most popular divisions amongst investors, other metrics have proven success in predicting share price appreciation as well.

Dividends and payout ratios are also used to predict future earnings growth and, in turn, future returns. Arnott and Asness (2003) find that higher dividends can be used to forecast higher aggregate earnings growth. Similarly, Vivian (2006) finds that payout ratios are correlated to future earnings growth. This study was performed using U.K. industry evidence, suggesting that payout ratios predicting earnings growth is not only a U.S. capital market phenomena, but a more systematic and global occurrence. Corporate managers may use dividends as a way to signal future earnings growth. After all, who knows the future prospects of a firm better than the management team that runs it? Tweedy, Browne Company LLC (2009) echoes the idea that managers can signal future business results in their study of what has worked in investing.

After analyzing over 50 studies of both U.S. and international stock strategies, the Tweedy, Browne study (2009) finds that five key characteristics lead to superior returns. The analysis first references value metrics such as low price in relation to asset value and low price in relation to earnings. Next, a significant pattern of purchases by one or more insiders, where insiders are officers and directors, is shown to be effective in signaling subsequent excess returns. In addition, the study points to a contrarian approach, or a significant decline in a stocks price, as a key determinant of returns. Finally, market capitalization strategy is cited: investing in small market cap stocks. The number of different strategies and factors that may contribute to share price appreciation illustrates that no one single metric should explain a large degree of stock returns. However, that does not mean that systematic inefficiencies do not exist over longer time horizons.

While earnings-per-share growth, revenue growth and a risk measure are all included in the model, they do not draw from multiple information sources or include traditional value metrics as other prior studies do. Gross profitability is very important in demonstrating quality. With the abundance of mutual funds available to investors today, “One of the most fascinating aspects…is the buying public’s utter disregard for the quality of the investments in the portfolios of the mutual funds it acquires” (Dow 2007, 1). Investors seem to only consider what returns they can earn and not focus on how those returns are realized. Therefore, the underappreciation of gross profitability may potentially be exploited to offer systematically superior returns.

CHAPTER THREE: DEVELOPING A MODEL TO PREDICT SHARE PRICE APPRECIATION

In this chapter we develop the economic model relating gross profitability to share price appreciation. First, we present the efficient market hypothesis. After reviewing the weak, semi-strong and strong forms of the efficient market hypothesis, we describe why the undervaluation of gross profitability may be a market-wide phenomenon. Afterwards, we examine the different components that lead to share price appreciation. Through the Gordon Model and the Capital Asset Pricing Model we frame the fundamental drivers of stock returns. Finally, we present the regression model relating share price appreciation to gross profitability, revenue growth, earnings growth and risk premium.

The Efficient Market Hypothesis

According to Burton Malkiel, "no one person or institution consistently knows more than the market" (2012, 106). This idea, which Malkiel refers to as a random walk theory, is commonly known as the efficient market hypothesis. The underlying assumption behind this theory is that all information regarding a specific security is known and public, and is reflected in the price of that stock. It further supports the notion that short-term changes in a stock's price are unpredictable and that investment advisory services utilizing complex charts and forecasts are worthless. In essence, this view argues that absolutely nothing that is known or could be known about a company will benefit investors. This means that even inside information will not lead to above average performance. This is not to say that markets do not react to fundamental information, but rather that they react so

quickly and efficiently that no one can create a beneficiary trading strategy. While this may be a more extreme view, known as the "strong" form of the efficient market hypothesis, there are two other forms: the "semi-strong" and the "weak."

Semi-Strong Form of the Efficient Market Hypothesis

The "semi-strong" view of the efficient market hypothesis asserts, "that no publicly announced news event can be exploited by investors to obtain above-average returns" (Malkiel 2012, 184). The idea here is that analysts already take into account any public information that may be hiding in areas such as financial statements or aggressive marketing plans. This hypothesis has been tested using trading systems that react to press announcements of new fundamental information. This information may include unexpectedly good or bad earnings reports, stock splits or buy-backs, or even dividend increases. The results of these tests are generally that the market is so efficient in adjusting to new information that the general investor cannot take advantage of fresh news. Furthermore, the market has been found to anticipate many of these events in the weeks and days leading up to the final announcement. Malkiel does admit that some studies have discovered that stock prices will underreact or overreact to news stories. This realization gives hope to supporters of the "weak" form of the efficient market hypothesis.

Weak Form of the Efficient Market Hypothesis

The "weak" structure of the efficient market hypothesis claims, "that past price information cannot be exploited to develop successful trading strategies" (Malkiel 2012, 184). Therefore, while technical analysis may not be useful, public

announcements may be used to profit. As mentioned earlier, some studies prove that abnormalities exist around the release of big news events. These deviations can be used to profit for some amount of time; however, studies also show that these irregularities do not occur consistently over time. These differing results may be due to the behavior and psychology of investors. Behavioral finance may help demonstrate that the market is irrational over the short term, but over longer time periods the efficient market hypothesis seems to prevail. In any case, it is very difficult to correctly time market events and this risk, which can lead to superior returns, would seem to support a "strong" form of the efficient market hypothesis.

Caveats to the Efficient Market Hypothesis

Supporters of the efficient market hypothesis do recognize certain short-term caveats. It is true that inefficiencies, such as market bubbles, will arise from time to time. The tech bubble of the early 2000's and the housing market crash that led to the financial crisis in 2007 – 2008 are both examples of market imbalances. These are situations when investors are content to buy a security not for its value, but because they believe some other investor will pay them a higher price in the future. This makes it evident that investor behavior and psychology can have a great impact on the workings of financial markets. Another market anomaly has to do with relative pricing and arbitrage. For example, if a soda is for sale for $0.90 in one market and for $1.00 in another market, there seems to be a risk-free profit available. Many hedge funds take part in trades such as this, but with more complex instruments that deal with different currencies or fixed income derivatives. However, to realize any significant profit, hedge fund managers may leverage their

bets. Although this may increase gains, it also may increase losses. Furthermore, once an arbitrage opportunity is identified, it is normally exhausted extremely quickly. How does this contribute to the efficient market hypothesis? To begin with, any potential gains are normally small and only available for a very short time. Higher profits may be earned, but with the expense of higher risk; this is in line with the efficient market hypothesis. Yet another practical issue with the efficient market hypothesis is the issue of liquidity.

If an investor realizes an issue with his or her security and wishes to sell it, there has to be another investor willing to buy it. Therefore, liquidity demand can move prices even if there are no changes to underlying business fundamentals. Regardless of the reason, being on the wrong end of a liquidity squeeze can wreck havoc on any investment portfolio. While these shorter duration imperfections exist, those that believe in the efficient market hypothesis argue that all market inefficiencies are eventually corrected. As Benjamin Graham puts it, "the stock market is not a voting mechanism, but a weighing mechanism" (Malkiel 2012, 106). As a long-term strategy, the efficient market hypothesis seems to prevail; yet countless investment professionals still aim to beat the market through stock picking.

To use gross profitability as a quality metric or a factor in predicting future share price appreciation is not to dismiss the efficient market hypothesis. In fact, those that use gross profitability hope to take advantage of the systematic reality that investors, in the aggregate, overvalue "lottery stocks" and undervalue profitable

stocks. While such a strategy may not produce jaw-dropping outperformance, it is hoped that it will yield steady excess returns.

Share Price Appreciation

Risk premiums are often used to explain superior performance of a stock or fund over time. This is due to the belief that there is no such thing as a free lunch and that, to earn extra returns, investors must take on extra risks. Before discussing different examples of risk premiums, it is important to understand some basic methods used to value an investment.

$$\textit{Gordon Model: } P = CF_0(1+g)/(k-g)$$

The value of an asset, such as a share of stock, can be computed by summing all future cash flows multiplied by an appropriate discount factor beginning in the present and continuing infinitely into the future. The Gordon Model provides a framework for this calculation. The time value of money is very important when valuing any asset because it is a main principle driving all forms of investing; an investor must gain something for giving up present liquidity. When it comes to a share of stock, there are two variables that can provide an appropriate value for measuring future cash flows: a current cash flow, CF_0, and a growth rate, g. Next, it is imperative to discount future cash flows, which is why a required return rate, k, is needed. These three variables can be entered into the Gordon Model in order to determine the present value of a share of stock. The Gordon Model is limited because it is very difficult to predict a single growth rate, g, which will continue indefinitely into the future. Furthermore, a myriad of economic conditions, such as inflation and financial crisis, would force the required return, k, to fluctuate. While

the Gordon Model is a very simple way to calculate the price of an asset, it does provide a logical and theoretical background on how investors decide what they are willing to purchase.

Capital Asset Pricing Model (CAPM): $K = k_{rf} + \beta(k_m - k_{rf})$

The Capital Asset Pricing Model is used to determine the required return for specific company stocks. This is crucial in valuing a stock because with it future cash flows can be discounted appropriately. This formula calls for a risk-free return rate, k_{rf}, a market return rate, k_m, and beta value. The risk-free rate, k_{rf}, captures the time value of money for a supposedly risk-free investment. In other words, a risk-free rate demonstrates how much an investor's principal could grow over a given time period with no risk of losing that money. This risk-free rate can be measured by the return on a U.S. Treasury Bill or the income return on long-term government bonds. These investments are viewed as being "risk-free" because the default risk with the U.S. Government is essentially nonexistent. U.S. T-bills are considered the most "pure" type of risk-free investment due to their short maturity (3 months) and their especially low default risk. A long-term government bond is a somewhat riskier investment because there is a greater chance of default and interest rate risk has the potential to negatively affect the return. However, a long-term government bond will probably give a more accurate risk-free rate for a stock valuation because stocks are infinite investments.

In any regard, a risk-free rate must be calculated to compare against the market return. A market return rate, k_m, is necessary to determine the equity risk premium, $k_m - k_{rf}$. This difference illustrates the reward that an investor must

receive for taking on the extra risk of investing in equities. A market return rate should accurately reflect the average return that one could expect when investing in the stock market. A strong example of a market portfolio return can be given by the historical S&P 500 annual rates of return for large company stock. This is a fair estimate for a market return rate because roughly 90% of the value in equities is within the S&P 500. A company's beta, ß, is used to determine the asset risk, $ß(k_m - k_{rf})$, associated with a specific stock. This beta value adjusts the equity risk premium to fit a certain stock, which may be riskier or less risky than the general market. Beta values are derived based on the return of a stock compared to the return of the S&P 500 and aim to convey how sensitive a security is to movements in the overall market. Beta is one example of a way to measure risk, but there are other important risk premiums that every investor should consider. Some common risk premiums include the value premium and the market capitalization premium.

Many studies have found that value investing, or investing in stocks with low price-to-earnings (P/E) multiples, can generate superior returns to a corresponding benchmark of both value and growth stocks. Tweedy, Browne Company LLC (2009) argues that low price in relation to asset value (low book-to-market or low B/M) and low price in relation to earnings (low P/E) seem to lead to excess long-term returns. Chan and Lakonishok (2002) also find that low P/E and low B/M will lead to superior returns over time. Upon discovery of this value premium, many academics wondered why such a strategy would yield higher returns. One explanation is that these stocks carry higher risks. The idea here is that there is a reason that investors are not willing to pay a lot of money per each dollar of

earnings (P/E) or per each dollar of assets (B/M). Clifford G. Dow, Sr., Chief Investment Officer for Delta Global Asset Management, points out that the value premium is essentially a safety premium. Growth stocks score much higher marks in terms of S&P Quality Ratings and VL Financial Strength Ratings (Dow 2007, 4). In times of financial distress and crisis, value stocks are expected to underperform their core and growth counterparts.

Another common risk premium has to do with market capitalization. Small capitalization stocks tend to outperform large capitalization stocks over time. This phenomenon is quickly credited to the extra risk that small cap stocks hold. These companies may face more intense competition or may not have as much access to capital as more giant firms. Inherent in the market cap premium is the idea of liquidity. If a smaller firm does not have many shares outstanding, then it may be more risky to hold a lot of that company's shares.

In any case, each individual investor must consider which risk premiums he or she can tolerate. If an investor has a very stable job that does not depend on the health of the economy, then this investor may be perfectly comfortable holding the riskier value stocks or riskier small cap stocks in return for a higher return. Similarly, a young investor with many years before retirement would probably not worry as much about the possibility of a short-term market pullback. Rather, this investor would happily hold a portfolio of small capitalization and value stocks. On the other end of this trade are those with sensitive employment and those near retirement who are willing to give up some return potential for added safety and protection. Just as in any type of deal or agreement, there must be two sides in

order to reach an accord. While additional returns often come with additional risk, the gross profitability premium seems to be tied more to investor psychology than to extra risk. Because the market seems to systematically underappreciate profitable firms, the additional returns gained through gross profitability strategies seem to actually be excess returns even when adjusting for risk.

The Regression Model[2]

Because there are so many variables that may affect share price appreciation, it is difficult to create a model that captures every determinant of returns. Factors ranging from interest rates and corporate performance to investor psychology and liquidity may all alter share price performance. Therefore, our model is developed based on past studies, but with some distinct differences.

The focus of our regression is gross profitability (Gross_Profitability). Novy-Marx (2013) also centers his analysis on gross profitability, but includes other control variables as well. While Novy-Marx uses value metrics as control variables we employ growth and risk factors. Year-over-year revenue growth (YoY_Revenue_Growth) and trailing-twelve-month earnings-per-share growth (TTM EPS Growth) account for the recent growth of a firm. A company that has higher gross profitability given the same YoY revenue growth may be more efficient in turning revenues into profit. Additionally, controlling for TTM EPS growth may signal more organic profitability in comparison to potentially financially engineered profitability measures. We include a risk measure (Risk_Premium_Applied_Beta) to

[2] A description of all variables used in our model may be found in the Sample Selection section on page 22

capture value risk factors, market-capitalization risk factors and overall volatility risk factors. More direct value metrics, such as price-to-earnings ratio, are excluded due to a lack of data. The final regression model is as follows:

$$\textbf{Share\_Price\_Appreciation} = \textbf{Gross\_Profitability}\beta_1 + \textbf{YoY\_Revenue\_Growth}\beta_2 + \textbf{TTM EPS Growth}\beta_3 + \textbf{Risk\_Premium\_Applied\_Beta}\beta_4 + \beta_5$$

CHAPTER FOUR: EMPIRICAL ESTIMATES OF THE IMPACT OF GROSS PROFITABILITY ON SHARE PRICE APPRECIATION

In this chapter we present the results of the empirical test. To begin, we detail the sample selection and the measurement of variables. We use the Bloomberg Professional® Service to gather firm level data on companies in the Russell 3000 Index from 1990 – 2012. Next, we present descriptive statistics and then review the regression results. We find little to no relationship between gross profitability and returns. However, we discover a strong correlation between risk and return, as the efficient market hypothesis suggests. Finally, we compare our results with prior studies and point out the most significant differences.

Sample Selection

This study uses panel data on firms from the Russell 3000 Index over two separate time periods to investigate the effect of gross profitability on share price appreciation. Distinct time periods are chosen to analyze the effectiveness of gross profitability as a predictor of returns in differing macroeconomic climates. The first sample covers 618 cross-sections from 1990 to 1997. Each cross-section is a Russell 3000 firm and is accompanied by a gross profitability measurement and subsequent 1-, 3-, 5- and 10-year returns. The second sample covers 1,629 firms from 2003 to 2012. Each company has values for gross profitability, year-over-year revenue growth, trailing twelve-month earnings per share growth, and risk premium, as well as subsequent 1-, 3-, 5-, and 10-year returns. The first sample does not include all of the variables that the second sample does due to a lack of data.

The Russell 3000 Index covers the top 3,000 U.S. stocks by market cap, representing 98% of the U.S. equity investable universe (Russell Indexes 2014). Russell 3000 firms may better capture the behavior of all cap public equities when compared to an alternative index, such as the S&P 500, which only encapsulates 500 large-cap stocks. The data used in this study is all year-end data, taken annually as of December 31st.

All data is obtained from the Bloomberg Professional® Service. Bloomberg L.P. is a worldwide leader in "quickly and accurately delivering data, news and analytics through innovative technology" (Bloomberg 2014). While Bloomberg is considered to be one of the premier providers of financial information, there are still certain data points that are unavailable. Firms in some years had price-to-earnings, price-to-book, standard deviation and market cap data available, but there were gaps in other years leaving the data unusable in a regression. After adjusting for this lack of data, any firm missing information on gross profitability, year-over-year revenue growth, trailing-twelve-month earnings-per-share growth or risk premium are excluded from this study. Furthermore, the Russell 3000 constituents as of the fourth quarter of 2013 are used, which may exclude older, failed firms. There seem to be no distinct patterns in terms of which firms were missing data. In addition, we still have large sample sizes even after excluding some firms. However, the sample is not all-inclusive, which may cause some distortions to the results.

<u>Measurement of Variables</u>

Although the regression model shares similarities with previous studies, the source and measurement of data can have a meaningful effect on results. As stated

previously, all data is taken from the Bloomberg Professional® Service. In this section, we describe the composition of each variable.

Share Price Appreciation:

Share price appreciation is the cumulative return of a firm, measured in percentage terms. We obtain this data from the Bloomberg Professional® Service by writing a Microsoft Excel formula specifying the firm, start date and end date of the desired return period. All return periods begin and end on December 31st to represent calendar year-end data. While share price appreciation is the mnemonic used for a historical data pull, this measure includes dividends and, therefore, represents total return.

Gross Profitability:

Gross profitability is the product of gross margin and asset turnover. We use Microsoft Excel formulas to gather gross margin and asset turnover as static values from the Bloomberg Professional® Service as of December 31st of a given year. Gross profitability is the ratio of gross profit (measured in dollars) to total assets (measured in dollars).

YoY Revenue Growth:

Year-over-year revenue growth is the percentage increase or decrease in total revenue at a point in time, relative to the prior year. YoY revenue growth is taken from the Bloomberg Professional® Service on December 31st of a given year through the use of Microsoft Excel formulas.

TTM EPS Growth:

Trailing-twelve-month earnings-per-share growth is the percentage increase or decrease in earnings-per-share at a point in time, relative to the prior year. TTM EPS growth is taken from the Bloomberg Professional® Service on December 31st of a given year through the use of Microsoft Excel formulas.

Risk Premium Applied Beta:

Risk premium applied beta is the product of a firm's beta and country risk premium. Beta is a common measure of volatility that conveys how sharply a particular stock price changes in relation to the overall market. A beta value of one signifies that a stock has historically moved at the same rate as the market. A beta value may also be negative, signifying that a stock's price moves in the opposite direction of the market as a whole. Country risk premium is a proprietary measure that aims to capture the additional risk associated with a stock due to its country of domicile. These risks include political instability, unfavorable exchange rates and other forms of economic instability. A higher value of risk premium applied beta illustrates a higher expected return. We obtain this measure as a static value on December 31st of a given year using Microsoft Excel formulas that draw from the Bloomberg Professional® Service.

Descriptive Statistics

Before analyzing regression outputs, it is crucial to understand the data being used and any potential flaws or abnormalities within the data. During the 1990 – 1997 period data is available for 1-, 3-, 5- and 10-year share price appreciation as well as gross profitability. All of these factors have 2757 observations.

Exhibit 1[3] illustrates the descriptive statistics for the 1990 – 1997 sample. The share price appreciation descriptive statistics show a mean value that is greater than the median value, indicating that some large outsized returns are raising the average value. This is to be expected because while a positive return has no limit in terms of magnitude, a negative return can only be as low as -99.99%. If a firm had a -100% share price return, it would be delisted and no longer included in this study. Exhibit 1, Exhibit 2 and Exhibit 3[4] demonstrate consistency across all time periods in relation to the fact that share price appreciation maximum returns exceed minimum returns and that mean values are higher than median values.

At first glance, the minimum values for 1-, 3- and 5-year share price appreciation in Exhibit 2 may be troublesome as they are close to -100%. However, after analyzing the data further there do not seem to be very many outliers. Only nine firms returned worse than -90% over the one-year period and only three returned worse than -95%. In the three-year period 41 returned lower than -90% and 18 returned worse than -95%. This was essentially the same for the five-year period with 41 companies returning worse than -90% and 19 firms returning lower than -95%. The pattern of these descriptive statistics is very important when interpreting the data and ultimate regression results. Because returns are capped on the downside, share price appreciation values are skewed in the positive direction.

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[3] Found on page 38

[4] Found on pages 38 and 39

Gross profitability does not vary in such a fashion as the share price returns because there is no limit to the downside or upside. Exhibits 1, 2 and 3[5] all show that gross profitability has greater mean values than median values. Interestingly, the minimum values exceed the maximum values in magnitude. However, the relationship between mean and median reflect that positive values outweigh negative values.

The sample from 2003 – 2012 includes additional variables relative to the 1990 – 1997 sample and yields some more informative values. Year-over-year (YoY) revenue growth and trailing-twelve-month (TTM) earnings-per-share (EPS) growth exhibit the same skew that share price appreciation variables do because they are also measured in percentage terms. Risk premium statistics also illustrate a mean that is higher than the median and a maximum value that is greater than a minimum value in absolute terms.

The final regression utilizes the year-over-year (YoY) percentage change in gross profitability to predict share price appreciation over the same time frame. Exhibit 3 shows that the 1-year share price appreciation follows the same patterns as in the prior two regressions, but the YoY percentage change in gross profitability is somewhat surprising. The mean value is very small while the median is actually negative. Furthermore, the absolute minimum value is much greater than the absolute maximum value. This could be troublesome as lower and lower negative values of gross profitability can only translate to a -99.99% share price appreciation. Therefore, it may seem that gross profitability does not predict share price

[5] Found on pages 38 and 39

appreciation very accurately past a certain cutoff value. The nature of these data is important to understand in order to analyze the regression results.

Analysis of Estimation Results

To analyze the regression results, each dependent variable will be examined across the different time periods utilized. Exhibit 4[6] illustrates key information from regressions with 1-year share price appreciation as the dependent variable. For every percentage point increase in gross profitability, 1-year share price appreciation is expected to increase by 0.104 percentage points. This is not a meaningful jump in returns and the results over other time periods do not bode well for gross profitability as a broad indicator of returns. Exhibit 5 and Exhibit 6[7] show that the coefficients are even smaller over other time periods and gross profitability is only significantly significant some of the time. These results may suggest that gross profitability was not being focused on as much during the 1990 – 1997 period or that technology to take advantage of such a factor was not yet commonly applied.

Exhibit 4, Exhibit 5 and Exhibit 6 all indicate that neither YoY revenue growth nor TTM EPS have strong coefficients and are only statistically significant at the 0.10 level on three occasions. However, the risk premium measure is statistically significant at the 0.01 level during each period in which it was incorporated into the model. Furthermore, a one-unit increase in the risk premium would lead to as much as a two percentage point increase in returns. This idea that

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[6] Found on page 39
[7] Found on page 40

greater risk brings higher returns is perfectly consistent with the efficient market hypothesis.

Interestingly, gross profitability is statistically significant at the 0.01 level during all time periods in Exhibit 5[8]. However, the coefficients are low and one percentage point increase in gross profitability only leads to 20 or 30 basis points of additional cumulative return. Those extra returns are especially low when spread across a three-year time period. In any case, the statistical significance over a three-year time span may suggest that there is a distinct lag time involved with gross profitability. Once again, the risk premium is statistically significant at the 0.01 level and with meaningful coefficients.

Because the gross profitability is statistically significant in the 1990 – 1997 period, this may suggest that in more recent times there is a greater lag in gross profitability predicting future returns. Once more, however, the coefficient would only result in about 10 basis points of additional returns per year over a five-year time frame. When the average return over a five-year period is 136% and 54% in 1990 – 1997 and 2003 – 2012 respectively, these additional 10 basis points demonstrate essentially no change in returns.

For 10-year share price appreciation, gross profitability is not statistically significant and still carries a miniscule coefficient. It would be surprising if a gross profitability value affects a firm's stock price ten years later and so this result is expected.

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[8] Found on page 40

The YoY percentage change in gross profitability also shows no statistical significance or meaningful coefficient on 1-year share price appreciation. As pointed out previously, the abundance of negative gross profitability figures combined with a floor for negative returns may have distorted this relationship. In addition, forecasts over such a short time frame may be able to account for such increases or decreases. In any case, this study reveals little to no relationship between gross profitability and share price appreciation.

Comparison of Results with Previous Studies

Novy-Marx (2013) finds gross profitability to greatly improve investment portfolios. In his study, large cap portfolios created using gross profitability earn net active returns of 3.1% per year, which is almost a full point higher than any other large cap strategy in his analysis. This portfolio earned such returns while having a tracking error volatility of only 4.7% and an information ratio of 0.66, which was almost 80% higher than the next best information ratio of 0.37. The maximum drawdown of this portfolio was only 13.4% or only about one third the size of the next best maximum drawdown realized. The small cap portfolios built on profitability also outperform all other strategies with net active returns of 3.9% per year and an information ratio of 0.80. Finally, the long/short strategies performed even better with net excess returns of 5.6% and 8.5% for the large cap and small cap portfolios respectively. Both of these portfolios had volatilities of roughly 8% and 10%, Sharpe ratios of 0.68 and 0.83 and t-stats larger than four. In short, Novy-Marx reveals gross profitability portfolio strategies that outperform similar

strategies on the basis of excess returns, superior risk metrics, and across market capitalizations and market conditions.

As seen in Exhibit 4, Exhibit 5 and Exhibit 6[9], the highest statistically significant coefficient of gross profitability in this study is roughly 0.10. This means that a one percentage point increase in gross profitability, which is not a very easy achievement, would only lead to a 0.10 percentage point increase in return over the course of an entire year. While this value may be statistically significant, or not caused by random occurrences, it is so small that it does not suggest a relationship between gross profitability and share price appreciation. YoY revenue growth and TTM EPS growth are never statistically significant at the 0.01 level in this study. There are times when these two variables are statistically significant at the 0.05 and 0.10 levels, but as with gross profitability they hold very small and immaterial coefficients. However, risk premium is always statistically significant and, as seen in Exhibit 6, a one-percentage point increase can lead to three additional percentage points of return per year. In summary, we must further analyze and interpret the considerable differences between the results of this study and prior studies.

[9] Found on pages 39 and 40

CHAPTER FIVE: CONCLUSION

Interpretation of Results

In this study, we find little to no relationship between gross profitability and share price appreciation. This suggests that current gross profitability alone may not be a strong proxy for future levels of gross profitability. The most robust factor in this analysis is the risk premium, which follows the efficient market hypothesis that higher risk should yield higher returns. Economic theory proves that, all else equal, greater future profitability should lead to greater future payouts and greater stock returns. However, the level of gross profitability at a point in time probably does not predict future share price appreciation because investors have already accounted for such a value in the pricing of a stock. This proves that the timing of measurements may have impeded the results of this study. Investors follow a firm's gross profitability throughout the year and will therefore have a strong sense of what a year-end gross profitability value may be. For this reason, that expectation is already "priced in" and a very high gross profitability value may not lead to any additional returns if it is in line with expectations. On the other hand, a very small gross profitability value may lead to more returns if it beats expectations. The idea of expectations and forecasting provides another possible shortfall of this study.

It is unclear whether gross profitability is a leading variable or a lagging variable. The results of this study suggest that it is a lagging variable because it does not explain future share price appreciation. However, the fact that prior studies have found gross profitability to be a leading variable may suggest a flaw in our regression model. It is very possible that gross profitability is a lagging variable

when not paired with, or isolated entirely from, the correct combination of variables. The lack of value metrics in our model may detract from the predictive power of gross profitability. Alternatively, the inclusion of such a powerful risk premium variable may have subsumed all predictive powers of gross profitability. In any case, while there is no evidence here for gross profitability leading to excess returns there are a number of empirical limitations and suggestions for future research that may uncover a relationship.

Empirical Limitations and Suggestions for Future Research

Novy-Marx (2013) uses portfolio tests to study gross profitability and rebalances the group of holdings when necessary. Similarly, DFA (Goodman 2014) must rebalance mutual fund portfolios on a regular basis. In this study we did not rank firms or exclude outliers. Future studies may generate superior results if firms are ranked on the basis of gross profitability measures and only certain segments are analyzed. A ranking system would also allow for periodic rebalancing as in Novy-Marx's study.

Furthermore, data limitations prevented the use of value signals or market capitalization metrics. A more comprehensive model with a long list of factors affecting stock returns would be preferable. The combination of variables alongside gross profitability may greatly enhance or diminish its predictive ability. In addition, more variables may help frame gross profitability as a leading variable as opposed to a lagging variable. It is important to have the right balance and combination of variables so that the predictive ability of gross profitability can be studied without having its effects subsumed by other variables.

In relation to gross profitability as a leading or lagging variable, the timing of measurements could be improved in future studies. Instead of annually measuring variables, it may be more helpful to analyze data on a quarterly basis. A lot of developments can happen to a company over the course of a year and, therefore, static annual measurements may not be as effective in analyzing gross profitability as quarterly results. Furthermore, the absolute level of gross profitability is much less important than the trend of gross profitability. Future studies should analyze this trend over time in the search for a relationship between gross profitability and returns. Positive or negative trends over a sustained period of time may lead to a greater correlation between gross profitability and share price appreciation. In addition, inflection points of gross profitability may prove to be very successful in predicting future returns. A company that has had negatively trending gross profitability for some time may experience a meaningful boost in share price when that gross profitability begins to sustain a positive trend.

Also, future studies may want to focus on the differences between sectors and industries. There are certainly some areas of the market where increasing gross profitability is more necessary to achieve strong stock performance. Certain firms, such as Amazon or certain pharmaceutical companies, are able to generate small profits and still experience strong share price performance.

Another suggestion would be to use multiple information sources, as do Gao and Wu (2013), to forecast gross profitability and returns. Share prices inherently hold a number of expectations and predictions about future circumstances and positive or negative surprises may greatly affect returns.

All in all, we find that investors must consider a plethora of variables before making an investment decision. The fact that asset management firms offer so many distinct equity strategies enforces the idea that no one variable can hold too much predictive power in relation to future returns. Strategies may go in and out of favor over time, but the efficiency of the market usually will not allow for prolonged excess performance without adapting to changing economic conditions. Gross profitability is an important metric in evaluating a potential investment, but it is difficult to implement into an all-encompassing strategy. To conclude, individual and professional investors alike must show caution and prudence in their approach to gross profitability-based investment strategies.

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Exhibit 1: Descriptive Statistics for 1990 – 1997 Sample

DESCRIPTIVE STATISTICS (1990 – 1997)						
	Number of Observations	Mean/ Median	Standard Deviation	Min	Max	Units
1-Year Share Price Appreciation	2757	21.49/ 14.35	57.69	-88.33	1,211.11	Percent
3-Year Share Price Appreciation	2757	74.90/ 40.18	165.74	-96.80	3,512.75	Percent
5-Year Share Price Appreciation	2757	136.04 /58.10	492.97	-96.28	17,700.00	Percent
10-Year Share Price Appreciation	2757	303.47 /163.7	900.60	-94.22	25,259.06	Percent
Gross Profitability	2757	37.64/ 32.51	31.81	-411.87	285.57	Ratio

Exhibit 2: Descriptive Statistics for 2003 – 2012 Sample

DESCRIPTIVE STATISTICS (2003 – 2012)						
	Number of Observations	Mean/Median	Standard Deviation	Min	Max	Units
1-Year Share Price Appreciation	10,011	17.55/13.06	50.54	-96.63	1,366.67	Percent
3-Year Share Price Appreciation	7,357	38.30/19.80	102.49	-99.13	3,100.00	Percent
5-Year Share Price Appreciation	5,394	64.15/25.48	180.82	-99.99	4,394.44	Percent
Gross Profitability	10,011	34.21/29.02	73.84	-6,906.4	243.47	Ratio
YoY Revenue Growth	10,011	27.05/9.13	702.15	-99.99	66,709.83	Percent
TTM EPS Growth	10,011	14.61/1.28	639.56	-972.66	39,699.75	Percent
Risk Premium	10,011	8.18/7.80	3.30	-6.20	28.23	Ratio

Exhibit 3: Descriptive Statistics for YoY Percentage Change Regression

DESCRIPTIVE STATISTICS: YoY Percentage Change in Gross Profitability (2003 – 2011)						
	Number of Observations	Mean/ Median	Standard Deviation	Min	Max	Units
1-Year Share Price Appreciation	7,760	15.36/ 11.01	48.96	-95.69	1,366.67	Percent
YoY Percentage Change in Gross Profitability	7,760	0.0068 /-0.52	1.51	-74.06	30.20	Percent

Exhibit 4: Estimates for 1-Year Share Price Appreciation Regressions

	Dependent Variables: 1-Year Share Price Appreciation			
Independent Variables	1990 – 1997	2003 – 2008	2003 – 2010	2003 – 2012
Gross Profitability	0.104*** (0.034)	0.014 (0.031)	0.034 (0.024)	0.011* (0.007)
YoY Revenue Growth	N/A	-0.003 (0.003)	-0.0006 (0.0007)	-0.0007 (0.0007)
TTM EPS Growth	N/A	-0.001* (0.001)	-0.001* (0.0008)	-0.001* (0.0007)
Risk Premium	N/A	2.104*** (0.254)	0.903*** (0.195)	1.33*** (0.153)

Note: The values in the table represent the coefficients for each independent variable. The values in parenthesis are standard errors.
*Statistically significant at the 0.10 level
**Statistically significant at the 0.05 level
***Statistically significant at the 0.01 level

Exhibit 5: Estimates for 3-Year Share Price Appreciation Regressions

	Dependent Variables: 3-Year Share Price Appreciation		
Independent Variables	1990 – 1997	2003 – 2008	2003 – 2010
Gross Profitability	0.339*** (0.099)	0.217*** (0.060)	0.236*** (0.048)
YoY Revenue Growth	N/A	-0.008 (0.006)	-0.002 (0.001)
TTM EPS Growth	N/A	-0.003** (0.002)	-0.004** (0.002)
Risk Premium	N/A	1.996*** (0.491)	2.397*** (0.388)

Note: The values in the table represent the coefficients for each independent variable. The values in parenthesis are standard errors.
*Statistically significant at the 0.10 level
**Statistically significant at the 0.05 level
***Statistically significant at the 0.01 level

Exhibit 6: Estimates for 5-Year Share Price Appreciation Regressions

	Dependent Variables: 5-Year Share Price Appreciation	
Independent Variables	90 – 97	03 - 08
Gross Profitability	0.323 (0.295)	0.522*** (0.097)
YoY Revenue Growth	N/A	-0.011 (0.01)
TTM EPS Growth	N/A	-0.005* (0.003)
Risk Premium	N/A	15.920*** (0.798)

Note: The values in the table represent the coefficients for each independent variable. The values in parenthesis are standard errors.
*Statistically significant at the 0.10 level
**Statistically significant at the 0.05 level
***Statistically significant at the 0.01 level

Exhibit 7: Estimates for 10-Year Share Price Appreciation Regression

	Dependent Variable: 10-Year Share Price Appreciation
Independent Variable	90 – 97
Gross Profitability	0.691 (0.539)

Note: The values in the table represent the coefficients for each independent variable. The values in parenthesis are standard errors.
*Statistically significant at the 0.10 level
**Statistically significant at the 0.05 level
***Statistically significant at the 0.01 level

Exhibit 8: Estimates for 1-Year Share Price Appreciation based on YoY Percentage Change in Gross Profitability

	Dependent Variable: 1-Year Share Price Appreciation
Independent Variables	03 - 11
YoY Percentage Change in Gross Profitability	0.414 (0.368)

Note: The values in the table represent the coefficients for each independent variable. The values in parenthesis are standard errors.
*Statistically significant at the 0.10 level
**Statistically significant at the 0.05 level
***Statistically significant at the 0.01 level

Appendix: Regression Outputs[10]

Equation 1:

Share_Price_Appreciation_1-Year = Gross_Profitability + C

1990 – 1997

1-Year

Dependent Variable: SHARE_PRICE_APPRECIATION
Method: Panel Least Squares
Date: 02/19/14 Time: 21:25
Sample: 1990 1997
Periods included: 8
Cross-sections included: 618
Total panel (unbalanced) observations: 2757

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.103717	0.034496	3.006595	0.0027
C	17.58333	1.699922	10.34361	0.0000

R-squared	0.003270	Mean dependent var	21.48687
Adjusted R-squared	0.002909	S.D. dependent var	57.70051
S.E. of regression	57.61654	Akaike info criterion	10.94622
Sum squared resid	9145678.	Schwarz criterion	10.95052
Log likelihood	-15087.37	Hannan-Quinn criter.	10.94777
F-statistic	9.039611	Durbin-Watson stat	1.677711
Prob(F-statistic)	0.002666		

Equation 2:

Share_Price_Appreciation_3-Year = Gross_Profitability + C

3-Year

Dependent Variable: SHARE_PRICE_APPRECIAT01
Method: Panel Least Squares
Date: 02/19/14 Time: 21:28
Sample: 1990 1997
Periods included: 8
Cross-sections included: 618
Total panel (unbalanced) observations: 2757

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.338755	0.099057	3.419805	0.0006
C	62.14553	4.881354	12.73121	0.0000

R-squared	0.004227	Mean dependent var	74.89512
Adjusted R-squared	0.003866	S.D. dependent var	165.7676
S.E. of regression	165.4468	Akaike info criterion	13.05590
Sum squared resid	75411674	Schwarz criterion	13.06020
Log likelihood	-17995.56	Hannan-Quinn criter.	13.05745
F-statistic	11.69507	Durbin-Watson stat	0.997763
Prob(F-statistic)	0.000636		

[10] All regressions are generated using EViews7

Equation 3:
Share_Price_Appreciation_5-Year = Gross_Profitability + C
5-Year

Dependent Variable: SHARE_PRICE_APPRECIAT02
Method: Panel Least Squares
Date: 02/19/14 Time: 21:32
Sample: 1990 1997
Periods included: 8
Cross-sections included: 618
Total panel (unbalanced) observations: 2757

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.322799	0.295198	1.093503	0.2743
C	123.8926	14.54683	8.516811	0.0000

R-squared	0.000434	Mean dependent var	136.0417
Adjusted R-squared	0.000071	S.D. dependent var	493.0626
S.E. of regression	493.0451	Akaike info criterion	15.23980
Sum squared resid	6.70E+08	Schwarz criterion	15.24410
Log likelihood	-21006.07	Hannan-Quinn criter.	15.24136
F-statistic	1.195748	Durbin-Watson stat	0.894287
Prob(F-statistic)	0.274269		

Equation 4:
Share_Price_Appreciation_10-Year = Gross_Profitability + C
10-Year

Dependent Variable: SHARE_PRICE_APPRECIAT03
Method: Panel Least Squares
Date: 02/19/14 Time: 21:32
Sample: 1990 1997
Periods included: 8
Cross-sections included: 618
Total panel (unbalanced) observations: 2757

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.690570	0.539246	1.280621	0.2004
C	277.4750	26.57313	10.44194	0.0000

R-squared	0.000595	Mean dependent var	303.4657
Adjusted R-squared	0.000232	S.D. dependent var	900.7645
S.E. of regression	900.6600	Akaike info criterion	16.44486
Sum squared resid	2.23E+09	Schwarz criterion	16.44915
Log likelihood	-22667.24	Hannan-Quinn criter.	16.44641
F-statistic	1.639991	Durbin-Watson stat	0.673757
Prob(F-statistic)	0.200434		

Equation 5:

Share_Price_Appreciation_1-Year = Gross_Profitability + YOY_Revenue_Growth + TTM EPS Growth + Risk_Premium_Applied_Beta + C

2003 – 2008

1-Year

Dependent Variable: SHARE_PRICE_APPRECIATION
Method: Panel Least Squares
Date: 02/19/14 Time: 21:34
Sample: 2003 2008
Periods included: 6
Cross-sections included: 1300
Total panel (unbalanced) observations: 5394

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.014083	0.030828	0.456806	0.6478
YOY_REVENUE_GROWTH	-0.003255	0.003201	-1.017017	0.3092
TTM_EPS_GROWTH	-0.001429	0.000867	-1.648859	0.0992
RISK_PREMIUM__APPLIED_BE	2.104051	0.253956	8.285111	0.0000
C	-1.258142	2.237347	-0.562336	0.5739

R-squared	0.013266	Mean dependent var	13.76089
Adjusted R-squared	0.012534	S.D. dependent var	55.76576
S.E. of regression	55.41518	Akaike info criterion	10.86851
Sum squared resid	16548766	Schwarz criterion	10.87462
Log likelihood	-29307.37	Hannan-Quinn criter.	10.87064
F-statistic	18.11329	Durbin-Watson stat	2.049346
Prob(F-statistic)	0.000000		

Equation 6:

Share_Price_Appreciation_3-Year = Gross_Profitability + YOY_Revenue_Growth + TTM EPS Growth + Risk_Premium_Applied_Beta + C

3-Year

Dependent Variable: SHARE_PRICE_APPRECIAT01
Method: Panel Least Squares
Date: 02/19/14 Time: 21:36
Sample: 2003 2008
Periods included: 6
Cross-sections included: 1300
Total panel (unbalanced) observations: 5394

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.216993	0.059650	3.637739	0.0003
YOY_REVENUE_GROWTH	-0.008453	0.006193	-1.364769	0.1724
TTM_EPS_GROWTH	-0.003525	0.001677	-2.102475	0.0356
RISK_PREMIUM__APPLIED_BE	1.995770	0.491386	4.061513	0.0000
C	9.788851	4.329104	2.261173	0.0238

R-squared	0.006522	Mean dependent var	30.99018
Adjusted R-squared	0.005784	S.D. dependent var	107.5358
S.E. of regression	107.2243	Akaike info criterion	12.18865
Sum squared resid	61957630	Schwarz criterion	12.19476
Log likelihood	-32867.79	Hannan-Quinn criter.	12.19078
F-statistic	8.844275	Durbin-Watson stat	1.000712
Prob(F-statistic)	0.000000		

Equation 7:

Share_Price_Appreciation_5-Year = Gross_Profitability + YOY_Revenue_Growth + TTM EPS Growth + Risk_Premium_Applied_Beta + C

5-Year

Dependent Variable: SHARE_PRICE_APPRECIAT02
Method: Panel Least Squares
Date: 02/19/14 Time: 21:37
Sample: 2003 2008
Periods included: 6
Cross-sections included: 1300
Total panel (unbalanced) observations: 5394

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.521582	0.096900	5.382706	0.0000
YOY_REVENUE_GROWTH	-0.010835	0.010061	-1.076941	0.2816
TTM_EPS_GROWTH	-0.005057	0.002724	-1.856512	0.0634
RISK_PREMIUM__APPLIED_BE	15.91983	0.798235	19.94378	0.0000
C	-64.44828	7.032441	-9.164425	0.0000

R-squared	0.072990	Mean dependent var	64.15187
Adjusted R-squared	0.072302	S.D. dependent var	180.8415
S.E. of regression	174.1813	Akaike info criterion	13.15900
Sum squared resid	1.63E+08	Schwarz criterion	13.16511
Log likelihood	-35484.81	Hannan-Quinn criter.	13.16113
F-statistic	106.0782	Durbin-Watson stat	0.812964
Prob(F-statistic)	0.000000		

Equation 8:

Share_Price_Appreciation_1-Year = Gross_Profitability + YOY_Revenue_Growth + TTM EPS Growth + Risk_Premium_Applied_Beta + C

2003 – 2010

1-Year

Dependent Variable: SHARE_PRICE_APPRECIATION
Method: Panel Least Squares
Date: 02/19/14 Time: 21:40
Sample: 2003 2010
Periods included: 8
Cross-sections included: 1420
Total panel (unbalanced) observations: 7357

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.033694	0.024237	1.390197	0.1645
YOY_REVENUE_GROWTH	-0.000628	0.000745	-0.843182	0.3992
TTM_EPS_GROWTH	-0.001390	0.000801	-1.734212	0.0829
RISK_PREMIUM__APPLIED_BE	0.902564	0.194594	4.638200	0.0000
C	5.752783	1.825479	3.151382	0.0016

R-squared	0.003562	Mean dependent var	13.56804
Adjusted R-squared	0.003019	S.D. dependent var	51.33836
S.E. of regression	51.26080	Akaike info criterion	10.71241
Sum squared resid	19318624	Schwarz criterion	10.71710
Log likelihood	-39400.60	Hannan-Quinn criter.	10.71402
F-statistic	6.569542	Durbin-Watson stat	2.287179
Prob(F-statistic)	0.000028		

Equation 9:
Share_Price_Appreciation_3-Year = Gross_Profitability + YOY_Revenue_Growth + TTM EPS Growth + Risk_Premium_Applied_Beta + C

3-Year

Dependent Variable: SHARE_PRICE_APPRECIAT01
Method: Panel Least Squares
Date: 02/19/14 Time: 21:41
Sample: 2003 2010
Periods included: 8
Cross-sections included: 1420
Total panel (unbalanced) observations: 7357

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.236182	0.048265	4.893428	0.0000
YOY_REVENUE_GROWTH	-0.001679	0.001484	-1.131146	0.2580
TTM_EPS_GROWTH	-0.003720	0.001596	-2.330647	0.0198
RISK_PREMIUM__APPLIED_BE	2.397462	0.387511	6.186823	0.0000
C	12.41916	3.635233	3.416331	0.0006

R-squared	0.008684	Mean dependent var	38.30362
Adjusted R-squared	0.008145	S.D. dependent var	102.4983
S.E. of regression	102.0800	Akaike info criterion	12.09007
Sum squared resid	76610251	Schwarz criterion	12.09476
Log likelihood	-44468.32	Hannan-Quinn criter.	12.09168
F-statistic	16.10130	Durbin-Watson stat	1.068855
Prob(F-statistic)	0.000000		

Equation 10:

Share_Price_Appreciation_1-Year = Gross_Profitability + YOY_Revenue_Growth + TTM EPS Growth + Risk_Premium_Applied_Beta + C

2003 – 2012

1-Year

Dependent Variable: SHARE_PRICE_APPRECIATION
Method: Panel Least Squares
Date: 02/19/14 Time: 21:42
Sample: 2003 2012
Periods included: 10
Cross-sections included: 1629
Total panel (unbalanced) observations: 10011

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSS_PROFITABILITY	0.010915	0.006821	1.600114	0.1096
YOY_REVENUE_GROWTH	-0.000652	0.000717	-0.909537	0.3631
TTM_EPS_GROWTH	-0.001498	0.000787	-1.903872	0.0570
RISK_PREMIUM__APPLIED_BE	1.331164	0.152787	8.712567	0.0000
C	6.327201	1.374801	4.602267	0.0000

R-squared	0.008149	Mean dependent var	17.54776
Adjusted R-squared	0.007752	S.D. dependent var	50.54293
S.E. of regression	50.34664	Akaike info criterion	10.67624
Sum squared resid	25363053	Schwarz criterion	10.67984
Log likelihood	-53434.92	Hannan-Quinn criter.	10.67746
F-statistic	20.55150	Durbin-Watson stat	2.057901
Prob(F-statistic)	0.000000		

Equation 11:

Share_Price_Appreciation_1-Year = YOY_Percentage_Change_In_GP + C

2003 – 2011

1-Year based on YoY Percentage Change in Gross Profitability

Dependent Variable: SHARE_PRICE_APPRECIATION
Method: Panel Least Squares
Date: 02/24/14 Time: 19:02
Sample: 2003 2011
Periods included: 9
Cross-sections included: 1359
Total panel (unbalanced) observations: 7760

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YOY_PERCENTAGE_CHANGE_IN	0.413501	0.367978	1.123712	0.2612
C	15.35845	0.555788	27.63364	0.0000

R-squared	0.000163	Mean dependent var	15.36128
Adjusted R-squared	0.000034	S.D. dependent var	48.96020
S.E. of regression	48.95937	Akaike info criterion	10.62012
Sum squared resid	18596078	Schwarz criterion	10.62191
Log likelihood	-41204.05	Hannan-Quinn criter.	10.62073
F-statistic	1.262729	Durbin-Watson stat	2.272795
Prob(F-statistic)	0.261170		