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How does the Market View Share Repurchases: Five Possible Book Values in the Fama-French 3 Factor Model

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Abstract

Share repurchase activity has grown significantly over the past twenty years and has emerged as the most popular technique for returning cash to shareholders. Current U.S. generally accepted accounting principles treat share repurchases as a return of capital to shareholders, recording the repurchased shares at market prices and offsetting them against contributed capital accounts. This treatment reduces the recorded book value of the equity of companies. Of course, companies can reissue these shares to fulfill stock option contracts, as consideration in acquisitions, and/or in secondary offerings. These economically relevant uses of repurchased shares suggest that the market may treat share repurchases differently than GAAP-based accounting. This study employs the Fama-French 3-Factor Model to test five potential views on repurchased shares: 1) a permanent return of capital to shareholders; 2) a prepaid cash expense related to stock-options; 3) the monetization of internally generated goodwill; 4) a prepaid asset that can be used as consideration in a future acquisition; and 5) a put option on company shares. Results suggest that the current accounting treatment is as good or better than all other possibilities for diversified portfolios, but we do find support for other treatments in certain industries.

Keywords: Share Repurchases, Stock Options, Dividends, Goodwill, Fama-French 3-Factor Model, Book Value

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Chapter 1: Introduction

"Buying back shares is the simplest and best way a company can reward its investors." Peter Lynch 1990

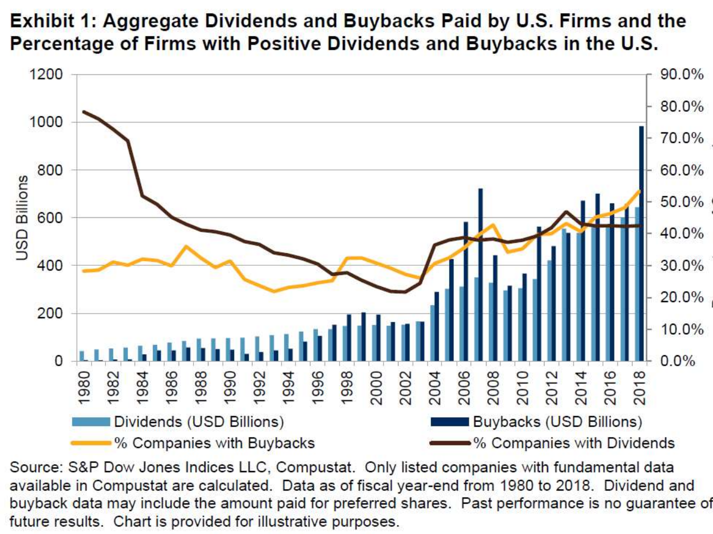
"It's very politically correct to be against buybacks right now." Warren Buffet May 2, 2020

Procter and Gamble (P&G) and Clorox are two consumer staple giants. Between 2014-2018, these two companies had operating margins around 20%, adjusted net income grew marginally, and both paid out between 60%-70% of adjusted income in dividends. During this period, Clorox repurchased between 1-2% of weighted average shares each year, while P&G repurchased 2%-6% of its shares annually, resulting in substantial increases in treasury stock for both companies. By 2018, P&G's book value was $55 billion with $94 billion in treasury stock. Clorox reported book value of $726 million with $547 million of treasury stock. The reduction in the book values due to the share repurchases made these companies not comparable on a multiple basis, a traditional practitioner method of valuation, with P&G's price to book fluctuating between 3x and 4x earnings, while Clorox traded between 23x and 72x book value. (Bloomberg, 2020b).

The United States' economy grew from March 2009 to December 2019 with barely few disruptions (St. Louis Federal Reserve, 2020). During that time, profits generated by the S&P 500 grew at a compound annual growth rate of 9% (Bloomberg, 2021a), and interest rates fell to record lows and remained relatively low throughout the expansion. The combination of high profits and historically low interest rates generated huge amounts of capital for companies to deploy. Prominent among the financial strategies was the return of cash to shareholders via share repurchases and/or dividends. In 1997, share buybacks surpassed dividends as the most common strategy for returning cash to shareholders, and share buybacks continue to grow in value, frequency, and volume. In 2019, the S&P 500 member companies conducted share repurchases totaling

$728.7 billion and paid dividends totaling $485.5 billion. Thus, collectively the S&P 500 returned $1.214 trillion to shareholders, which exceed the collective $1.158 trillion of earnings. From 2014-2019, cash returned to shareholders (share repurchases + dividends) exceeded net income in four of the five years (Zeng & Luk, 2020). The Tax Cut and Jobs Act of 2017 accelerated the buyback trend. The volume was so high Goldman Sachs warned that the “buyback boom was getting out of hand,” as buybacks exceeded free cash flows (Egan, 2019).

Figure 1: “Aggregate Dividends and Buybacks Paid by U.S. Firms and the Percentage of Firms with Positive Dividend and Buybacks in the U.S. (Zeng & Luk, 2020, p. 2)



Historically, only distressed firms tended to report negative book values. Over the last ten years, that has changed. From 2014-2016 McDonald’s reduced its total equity from $12.8 billion to a negative $2.2 billion, despite earnings of more than $9 billion over that period. The company chose to repurchase $16 billion of shares during these years in addition to its generous dividend policy (McDonald's Inc., 2020). As of April 6, 2021, 23 firms in the S&P 500 reported negative book value at the end of their last fiscal year, but only three of these firms had a default probability above 1% and could be considered to be experiencing some financial distress duress (Bloomberg, 2021a).

This shift in strong firms' attitudes towards debt and negative book values raises questions about the relative effectiveness of some traditional financial valuation models in the new changed financial environment. Earlier in the 20th century, analysts widely applied the discounted dividends model. However, this model was supplanted over the years as companies' financial policies changed regarding the widespread payment of dividends. In 2019, Pinto, Robinson and Stowe found that 86.8% of equity analysts used a discounted cash flow approach to justify valuation, while only 35.1% continued to use a dividend discount model. Has the share buyback craze necessitated another such change? The same team found multiples are still the most popular valuation technique, but professionals heavily favor price to earnings (88.1%) and Enterprise Value (76.7%) based multiples over the more skewed book value-based models (59.0%). Analysts might need to adjust book values to bring these forms of valuation back in line with the financial engineering of modern Wall Street. It is essential when screening for stocks. For example, Fairchild (2018) showed a portfolio made up of all negative book value stocks from 1993-2018 outperformed the market, earning a 12.3% annualized return compared to the market's 11.6%.

Many multi-factor capital asset pricing models use reported book values. For example, the HML factor in Fama French's 3 Factor Model (1992) is the basis of many

Wall Street firms' alpha calculations, a metric used to determine mutual fund manager performance.[1] Ma, Tang, and Gomez's (2019) hand collected data show that 75% of mutual funds directly link their portfolio manager's bonus to performance. If repurchased shares skew the HML factor but are not adjusted in models, alpha values could be systematically overstated due to an incorrect assessment of risk (value vs. growth stocks), and they could be overcompensating their mutual fund managers.

Treasury Stock

When a corporation repurchases shares, it has two choices – retire the shares or hold the shares as treasury stock. Treasury stock is reported as a negative component of stockholders' equity on the balance sheet. As of April 12, 2021, 60% of the S&P 500 companies held treasury stock (Bloomberg, 2021b). Of the S&P firms that repurchased shares in their last fiscal year, 75% held the shares in treasury (Bloomberg, 2021b). This preference is logical, as most companies use stock grants to compensate classes of employees, which is one possible use of treasury stock. However, most of these companies hold more treasury shares than they could practically issue as compensation. Reasons for doing so include having them for a possible secondary offering or funding future stock-based acquisitions. Many companies simply prefer the option of reissuing shares without seeking the Securities and Exchange Commission and shareholder approval. Managers appear to desire this financial flexibility, but how does the market value treasury stock?

Alternative Accounting Treatments for Treasury Stock

[1] "The alpha of a stock is its expected return in excess of (or below) the fair expected return as predicted by the CAPM. If the stock is fairly priced, its alpha must be zero" (Bodie, Kane & Marcus, 2005, p.328).

Current U.S. accounting rules treat treasury stock transactions as a reduction in cash and a corresponding reduction in Shareholders' Equity (FASB, 2020). This treatment was in place as early as 1919 when thought leaders of the day, including William Paton, opined that treasury stock was a reduction of equity, not an asset. Since the company retains the right to reissue these shares, this reduction in capital may be temporary or permanent. Walsh (1975) took an opposing view, suggesting that purchasing treasury stock is akin to an investment by a company in its stock. Van Horne (1971) countered Walsh, arguing that since treasury stock does not add to the earnings power of the company, it cannot be considered an investment. Instead, it should be viewed as a financing decision. Each of these theoretical views has merit. Which view does the market appear to adopt?

There are five possible answers to the question of how the market implicitly treats treasury stock.

- Repurchasing shares is a real return of equity capital and should be treated as a reduction in the reported book value of shareholders' equity.
- Repurchasing shares is at least in part prepaid compensation expense and should be reported as a prepaid asset as a result.
- Repurchasing shares is the monetization of internally developed intellectual property and other intangible assets. As such, it should be reported as an intangible asset on the balance sheet.
- Repurchasing shares is a prepaid acquisition asset.
- Holding treasury stock contains an inherent option to re-issue and the value of the option should be treated as an asset.

Using these five methods, this author adjusted the book values of NYSE, AmEx and NASDAQ stocks used as inputs into Fama and French's 3-Factor Model to explain equity returns. Assuming any level of the Efficient Market Hypothesis holds, the method with the greatest explanatory power reflects market participants' collective view on the economic essence of repurchased shares.

Research Contributions

This study is relevant to multiple literatures. Within finance, it will contribute to the understanding of how the market interprets capital allocation decisions. Specifically, the findings could inform the value of share repurchases beyond their signaling power. It will also contribute to the asset pricing model literature. From an accounting perspective, the results will inform literature regarding appropriate accounting for retired and treasury stock transactions and also potentially inform the literature on off-balance-sheet sources of value.

For practitioners, the results of this research could create two primary benefits. The first is a deeper understanding of how the market interprets share buybacks, which can inform trading surrounding repurchase announcements or actions. The second would potentially be a small improvement in CAPM-based models that are often a source of alpha calculations used in compensation decisions.

Chapter 2: Literature Review

Several research streams address share repurchases. One stream is the role of share repurchases in financial policy. This stream examines why companies repurchase shares rather than pay dividends or invest in growth, how they carry out the share repurchases, and what the company does with the repurchased shares. A second stream examines the market impact of share repurchases – both as a signal of strong cash flows and the potential value creation/destruction related to the repurchase activity. As a part of this explanation, the impact share repurchases have on the book value, and the use of book value in asset pricing models must be considered. A third stream, especially relevant to this study, examines the theory underlying the optimal treatment of share repurchases. Are share repurchases a return of capital, or a prepaid expense, or the monetization of intangible assets, or a prepaid acquisition, or an option, or something else?

Investors understand and weigh how, when, and why management decides to repurchase their shares. Additionally, since the stock market is forward looking, investors must also consider how the repurchased shares could be used. These general literature themes need to be explored to understand the market impact of share repurchases.

Section 1: The Basics of Share Repurchases in the United States

Accounting Standards Codification Section 505 defines share repurchases as the act of a company buying its shares (FASB, 2020). The process of repurchasing shares includes three steps. First, the company must seek authorization. In the United States, a company may repurchase its shares with the approval of the board of directors

(McCarthy, 1999). In other countries like England, a shareholder vote is required for authorization to repurchase shares (Sonika, Carline, & Shackleton, 2014). There are no requirements for a company to announce the approval to its shareholders in the U.S. Second, once authorized, management may, or may not, choose to act on the authorization to repurchase shares. It may repurchase all, some, or none of the shares it was authorized to repurchase. To gain the safe harbor protection of S.E.C. Rule 10b-18[2], a company must announce the manner, price, timing, and volume of its execution in its annual 10-K and quarterly 10-Q filings (McCarthy, 1999). Third, once a share repurchase is completed, management must decide if the company will hold the shares in the form of treasury stock or cancel/retire the shares (FASB, 2020), a decision evident in the financial statements released to the market.

The Five Types of Share Repurchases

There are five methods generally utilized for repurchasing shares: fixed-price tender offers, Dutch auction tender offers, private market transactions, open market repurchase programs, or accelerated share repurchase programs.

A fixed-price tender offer states a single price, the number of shares sought, and the expiration date of the offer. Typically, the price is premium to the current market price to entice shareholders who are willing to sell to sign up for the offer rather than sell their shares in the open market. The company will purchase the stated number of shares, even if the offer is oversubscribed (Dann, 1981).

[2] Safe Harbor rules provide the repurchasing firm legal protections from stock price manipulation charges. For an analysis of compliance and impact see Cook, Krigman, and Leach (2003).

A Dutch auction tender offer states a range of prices at which existing shareholders may sign up to sell their stock, the expiration date of the offer, and the number of shares sought in advance. The firm gathers all the minimum prices shareholders signed up to tender and ranks them from lowest to highest. The lowest price that will allow the company to repurchase the desired number of shares becomes the tender price. All sellers receive the tender price (including those who would have accepted a lower amount). The price ranges typically offered by Dutch auctions are a few percentage points higher than the current market price, to entice shareholders to tender, but the resulting tender price is usually lower than the fixed-price tender option (Comment & Jarrell, 1991).

Open market purchases require a company to hire an investment bank to repurchase shares through the secondary stock market, paying the market price at the time of purchase. Managers may instruct the firm to start and stop repurchasing shares at any given time without notifying investors and do not have to purchase the stated number of shares in the authorization. According to the S.E.C.'s data, "90% of all repurchase programs announced between 1985-1996 were to be conducted through open market transactions" (Ikenberry & Vermaelen, 1996, p. 10).

Private market transactions are typical in smaller market capitalization stocks. Large shareholders or former officers, who want to get rid of a large volume of stock, offer to sell it to the company. Due to the thinly traded nature of smaller-cap stocks, large shareholders often cannot exit significant positions quickly. Unlike the other forms of buybacks, privately negotiated transactions are typically at or near market price (Peyer & Vermaelen, 2005). One recent example was Wayside Technology WSTG, which agreed to buy out their former C.E.O. (who was suing the company to try to take back control). The company repurchased the shares as a part of the out-of-court settlement agreement (Wayside Technology Group, 2020).

A more recent invention is the accelerated open market repurchase program. Here, an investment bank borrows a stated number of shares from investors (similar to a short sale), immediately removing the shares from the market. Then, over time, the investment bank repurchases the same number of shares in the open market and returns them to the investors who lent shares. The investment bank and the directing company share the gains or losses resulting from the timing difference. The result is an immediate reduction in the number of shares outstanding and a "hard" number of shares to be repurchased in the open market over time (Michel, Oded, & Shaked, 2010).

Current Accounting for Repurchased Shares – Treasury Stock or Retiring Shares

Once repurchased, treasury shares may be held by the company or formally retired. Shares held in treasury have the status authorized and issued but not outstanding. Formally retired shares have the status authorized but not issued and, therefore, also not outstanding. Theoretically, management makes the hold in treasury versus retire decision based on its intent of how it plans to use the stock. If the company plans to reissue the shares for compensation or other uses, holding the shares in treasury is appropriate. If the company has no intention of using the shares again, then it can signal this to the market by retiring the shares. The net effect on assets (a reduction in cash) and Shareholders' Equity is the same for either method. However, within shareholders' equity, the treasury stock method creates a contra-equity account, while the retirement method reduces a combination of common stock, paid-in capital, and retained earnings. All reductions are based on the market value of the shares repurchased (FASB, 2020).

While the intent of the accounting for treasury stock is to create a temporary account, Banyi and Caplan (2016) found evidence that few Delaware-based public firms with treasury stock reduce their treasury stock holdings over time. Banyi and Caplan suggest that this temporary account is more permanent in practice. Additionally, they found that the average firm that uses treasury stock accounting issues new shares almost as often as those who retire shares – which is contradictory to expectations (Banyi & Caplan, 2016).

Data from Bloomberg (2021b) shows that approximately 65% of firms of the S&P 500 hold the repurchased shares in treasury rather than retiring the shares. Hill, Price, and Ruch (2018) suggest that there are practical reasons for the treasury stock method's popularity. Until 2006, the New York Stock Exchange allowed firms to reissue treasury stock without shareholder approval (NYSE, 2020), making it easier to use than issuing new equity. Treasury stock is listed separately from retained earnings, which can affect some debt covenants that require companies to maintain a certain amount of "earned capital" (Duke & Hunt III, 1990). Additionally, Hill, Price, and Ruch (2018) find that firms are more likely to hold the shares in treasury and not retire them to avoid dropping retained earnings to a negative number.

Why Share Repurchases and Not Dividends

Payout policy – the term used for the distribution of cash to shareholders either via dividends or repurchased shares – is a significant stream of literature in both accounting and finance. The accounting for dividends and share repurchases have the same net effect on assets and total shareholders' equity. So, how and why companies choose one of the alternatives or split between the two has been studied for more than 50 years. While the evidence and market environment have changed, the underlying reasons have remained reasonably steady – management flexibility, tax advantages, earnings management, and debt covenants.

The Substitution Hypothesis argues that dividends and share buybacks are interchangeable in the eyes of management. Miller and Modigliani (1961) and Jensen (1986) provide the foundation for this hypothesis. Miller and Modigliani (1961) posit that dividend policy is irrelevant to the price of a stock. Using the assumptions of a perfect market and rational investors, Miller and Modigliani go through basic dividend discount, earnings and discounted cash flow models to show the dividend policy does not affect the value of the corporation. They go on to demonstrate that an investor should be indifferent to a dollar of capital gains and a dollar of dividend – pointing out many holders, like trusts, do not pay taxes. Consequently, Miller and Modigliani believe share repurchases and dividends are substitutes.

In 1986, Michael Jensen laid out his free cash flow theory that suggests excess cash flows create agency problems for management. Management must disgorge the excess cash flows by either paying dividends or repurchasing shares, as they are substitutes. Jensen, however, goes one step further and suggests companies should borrow money and repurchase shares – using future excess cash flows to service the new debt and thus reduce the temptation to invest future excess cash flows into money-losing diversification ventures. Jensen prefers the borrow/repurchase scenario over the higher promised dividends because it is easier to cut a dividend than to issue shares to pay off debt. He suggests the repurchases are substitutes for dividends in the eyes of the corporation.

Not all scholars find the substitution theory acceptable. Fama and French (2001) suggested that dividend-paying companies repurchase shares as an additional distribution, rather than a substitution for dividends. Research shows there are several rational reasons why share repurchase growth has outstripped dividend growth over the past three decades and has exceeded total cash volume since 1997 (S&P Global, 2020).

The first is management flexibility. In the United States, shareholders see the current level of dividends as a minimum payout forever (Brigham, 1964). When a firm cuts a dividend, the share price drops (e.g., Bessler & Nohel, 1996; Ghosh & Woolridge, 1989; Pettit, 1972; Sonika et al., 2014; Zia & Kochan, 2017). However, the same is not true for share repurchases (Oded, 2005). Jagannathan, Stephens, and Weisbach (2000) found flexibility to be a significant reason why managers prefer share repurchases. Iyer and Rao (2017) used the 2008 financial crisis for data to test if share repurchase cuts were punished like dividends. They found that firms that cut repurchase activities performed better in the market than those who cut their dividends, lending strength to the concept that share repurchases offer more management flexibility.

While investors require consistent or growing quarterly or annual dividends, what about special dividends? One-time or special dividends do not signal an annual commitment. However, there is evidence that investors start to anticipate special dividends if they become a regular source of capital return. For instance, Costco issued special dividends every nine quarters starting in 2012. When late 2019 came around, professional investors and journalists wrote several pieces questioning where the special dividend was (e.g., Sparks, 2020). Consequently, this form of return to shareholders can create an implied contract, much like ordinary dividends.

Second, share repurchases offer a tax advantage to the shareholder, but not the corporation. The corporation must pay all dividends and share repurchases with after-tax dollars. One financial professional, Phil Guziac of Morningstar Inc., calls dividends the "unilateral imposition of a taxable event" (Phil Guziac, personal communication, June 1, 2020). Dividends paid out, even if immediately re-invested in the company, are a taxable event in the year paid (Internal Revenue Service, 2020). Theoretically, share repurchases reward continuing shareholders through capital gains instead, which allow investors to delay the tax effects of the payout policy until they chose the sell the stock. The ability to delay recognizing tax is a significant reason why rational shareholders may prefer share repurchases over dividends (Elton & Gruber, 1968). This situation was obvious when capital gains were taxed at a much lower rate than dividends (Woods & Brigham, 1966). After qualified dividends and long-term capital gains were put on even footing under the Jobs and Growth Tax Relief Reconciliation Act of 2003, companies still favored share repurchases over dividends (Blouin, Raedy, & Shackelford, 2011) even though an updated preference of individuals is missing in the literature.

Third, there is evidence to suggest that managers engage in share repurchases as a form of real earnings management. When a company repurchases shares, the total number of shares decreases without affecting net income. Consequently, earnings per share[3] grow faster than net income. For example, Home Depot's net income grew 77%

[3] Earnings per share is defined as Net Income / Diluted Shares Outstanding

from 2014-2019, while EPS grew 117% over the same five-year period (Home Depot, 2020). Hribar, Jenkins, and Johnson (2006) found evidence that share repurchase activities increased when net income would have failed to meet earnings estimates – suggesting repurchases are used in real earnings management. Burnett, Cripe, Martin, and McAllister (2012) supported earlier findings and found that when high-quality auditing prevents accrual-based earnings games, firms are also more likely to use accretive share repurchases to boost earnings. In a slightly different light, Cheng, Harford, and Zhang (2015) found that managers were more likely to buy back shares when their bonuses were tied to earning per share targets or growth. Additionally, there is evidence that managers increase share repurchases to offset the dilutive effect of stock option grants (Bens, Nagar, Skinner, & Wong, 2003). These four studies combine to support the notion that managers could favor share repurchases over dividends because of their ability to help manage earnings per share.

Finally, debt covenants restrict some firms from paying dividends or increasing their dividends but may allow firms to repurchase shares. Since both require a drain on cash and a reduction in total shareholders’ equity, this may seem strange. Investors recognized this disconnect, and it is changing. Billett, King, and Mauer (2007) studied 15,504 debt issues from 1985 to 2003. The team found that while 25.8% of issues from 1985-1989 had dividend restrictions, only 8.2% had share repurchase restrictions. As share repurchases became more popular, there was greater parity. By the 2000-2003 period, only 16.9% of debt issuances had dividend payment restrictions, but 19.8% had share repurchase restrictions. So, while the likelihood is shrinking, debt covenants could explain some managers' preference of share repurchases to dividends.

While the substitution theory expounded by Grullon and Michaely (2002), with roots back to Miller and Modigliani (1961) and Michael Jensen (1986), suggests dividends are share repurchases are substitutes for each other. We know that share repurchases have increased, and the propensity to pay dividends has declined (Fama & French, 2001). Extant literature points to four possible reasons why managers may favor share repurchases over dividends – flexibility, tax advantages, earnings management, and, to a much lesser extent, debt covenants.

The Uses of Repurchased Shares

With the propensity to repurchase shares established, the next avenue to explore is what the firm does with the repurchased shares. Firms can retire the shares, hold the shares indefinitely, reissue the shares for compensation, reissue shares as a part of a stock-based acquisition, reissue shares as a part of a stock dividend or reissue the shares in a seasoned equity offering.

Firms can choose to retire shares repurchased. State laws can influence this decision by forcing companies to use the retirement method. For example, Massachusetts, Maryland, California, Georgia, Oregon, and Washington, prohibit the use of treasury stock, effectively requiring a firm to retire the shares upon purchase (Banyi & Caplan, 2016). Other firms hold treasury shares for a while and then choose to retire some or all of the shares. Hill et al. (2018) showed that firms were less likely to retire shares if share retirement resulted in negative retained earnings. In the same vein, but outside of the United States, Latif, Mohd, and Kamardin's (2015) study of Malaysian firms found that smaller companies and those whose profitability is increasing are more likely to retire treasury stock. Once retired, the same shares may not be reissued. However, new shares can be created and issued, resulting in virtually the same outcome.

While the treasury stock account is supposed to hold share costs until they are either reissued or retired, there is evidence that corporations retain a certain level of repurchased shares without retiring the shares (Banyi & Caplan, 2016). If held forever, the result is the same as retiring the shares, but the financial statements will differ under the two approaches. The net effect is a permanent return of capital to shareholders (Paton, 1969).

One of the most popular uses of treasury stock is to reissue the shares as a part of stock option or restricted stock grants. As stock options became a more popular form of compensation in the 1990s, share repurchase activity also increased. Kahle (2002) found a positive relationship between the size of share repurchases and the number of exercisable options in a company. Bens, Nagar, Skinner, and Wong (2003) found that share repurchases are tied to the issuing, not exercising of stock option grants. The authors concluded that managers engaged in share repurchases not to provide shares for the option grants, but to manage diluted earnings per share. Weisbenner (2000), Lee and Alam (2004) and Lin, Yu-Chen, You and Cheng (2009) found similar earning management results but found that exercisable (not already exercised) options had the greatest explanatory power of share repurchase activities. All three authors stated that managers were likely motivated by a desire not to let total shares outstanding grow. The popularity of stock options and the volume of shares issued through this form of compensation accounts for about half of all shares repurchased (Liang & Sharpe, 1999). Bonaimé, Kahle, Moore, and Nemani (2019) show that the shift to restricted stock grants rather than options has not altered the positive relationship between the equity grants and stock repurchases.

Firms may also issue treasury stock to an Employee Stock Ownership Plan (ESOP) Trust. In this case, the company encourages its employees to purchase stock in the company, either as a succession planning move for a small business, or a retirement savings plan (Gordon & Pound, 1990). The tax advantages of using ESOPs are not as good when using treasury stock for funding; using cash and debt would be more tax advantageous for the firm. Additionally, the company would avoid having to pay dividends on the treasury stock if they used the cash/debt approach for funding (Freiman, 1990).

When a company completes an acquisition, part or all of the consideration rendered for the target shares may be shares in the acquiring company (i.e., a stock swap). The shares swapped during acquisition can be newly authorized shares (usually a part of the acquisition approval process) or can be shares previously held as treasury stock. Paton (1969) suggests there is minimal difference between treasury stock and newly created issues. Thus, using shares from treasury should serve as a convenient and inexpensive source of shares. Interestingly, Jenkins and Ovtchinnikov (2010) found a significant difference. Firms purchased with newly issued shares saw their stock price decrease as the market took it as a signal of over-valuation of the stock. Firms paying in cash, with treasury stock, or a combination of treasury stock and cash did not see the same drop in the share price. This suggests that the market equates the use of treasury stock much closer to the use of cash in acquisitions than newly issued shares. Like stock options, this remains a widespread use of treasury stock. In 2006, Senior Index Analyst

Howard Silverblatt said, “S&P believes that the greatest use [of repurchased shares] will be for M&A” (Jenkins & Ovtchinnikov, 2010, p. 2).

Companies may use treasury stock for stock or scrip dividends. Stock dividends are no longer popular in the U.S., as it is more of a small stock split than a return of capital to shareholders. Some firms still argue that stock dividends are a useful tool. By issuing a stock dividend, the firm keeps its per-share price lower. Additionally, many recipients of the stock dividend will sell off the newly acquired shares to other investors to get cash, hypothetically increasing the number of shareholders in the firm. Combining the lower per-share price and a broader shareholder base, managers argue they will find it easier to float new sales of equity to the market used to seeing new shares (Eisemann & Moses, 1978). Scrip dividends are not precisely the same as stock dividends, as scrip dividends give the investor a choice between a cash dividend or a similar value in stock. This results in something closer to a small IPO rather than a stock split. Scrip dividends are a use of treasury stock but are not available in the United States. Research in the U.K., found scrip dividends do not save taxes, signal future prospects, or improve cash flow (Lasfer, 1997a). Scrip dividends are also not considered substitutes for cash dividends (Lasfer, 1997b), suggesting that they are also not a good use of treasury stock.

Finally, companies can reissue treasury stock in a seasoned equity offering. While transactions in a company’s own shares will never result in a profit impact (Brigham, 1964), the acquisition of its shares and subsequent reissue of the shares creates an opportunity for a company to buy low and sell high. However, there is little evidence of a company’s actual ability to generate profits this way. There does appear though to be some benefits to repurchasing shares and then reissuing them. Bond and Zhong (2016) found that when companies engage in a seasoned equity offering, the price of the stock does not drop as much when the company had previously repurchased its shares than when it had not. The subsequent performance of the stock does not result in any abnormal return (Abdou & Gupta, 2019).

With a variety of methods to buy, report, and use share repurchases, forward-looking investors should weigh the likelihood of each when determining a market impact of a share repurchase. This study will investigate if adjusting the book value to reflect the various uses is mirrored in the movements of the stock price.

Section 2: The Market Impact of Share Repurchases

The finance and accounting literatures include much research related to the market impact of share repurchases. The literatures have identified several sources of market impact including market signaling, market timing, the relationship between share repurchases and insider trading, and the subsequent market performance of firms after announcing and executing a share repurchase plan.

Signaling in Share Repurchases

In 1977, Stephen Ross was one of five scholars (Bhattacharya, 1979; Brealey, Leland, & Pyle, 1977) who postulated that since firm insiders possess more knowledge than outsiders, financial structure decisions act as a signal to the market that the firm is undervalued. This signaling theory was quickly applied to share repurchases. Vermaelen (1981) found a positive relationship between the size of the buybacks and the increase in share price on the day of the announcement. Dann (1981) found share price increases the day share repurchase plans are announced. This benefits current shareholders as the announcement (compared to the act) signals undervaluation. A decade later, Comment and Jarrell (1991) compared three methods of share repurchases – Open Market, Dutch auction, and Fixed-Price Tender offers. They found the fixed-price tender offer announcement gave the strongest positive signal to the market, resulting in the largest return the day it was announced. The results are logical and consistent with signaling theory, as a fixed-price tender offer is the only one that gives a firm price the company is willing to repurchase shares at – lending insight into the firm's self-valuation. Fixed-priced tender offers had a median 16% premium over pre-announcement price, while Dutch auction offers result in a median 12.5% premium (Ikenberry & Grullon, 2000). Dutch auctions provide a stronger signal to the market than open market repurchase plans, which have no incremental pricing disclosure beyond the current market price (Comment & Jarrell, 1991).

Open market offers may be weakest because of fear of completion. Firms can announce share repurchase plans, but then not execute them (Ikenberry & Vermaelen, 1996). Bonaimé (2012) found that firms can create a reputation for either completing or not completing their announced repurchase plans. When firms do not reliably use their announced authorization, the signaling power of a new announcement is significantly weaker than firms with a history of completion. However, firms worried about their prior signaling can announce an accelerated share repurchase plan to mitigate the completion fear and strengthen the signal of the repurchase announcement (Bonaimé, 2012).

Whatever repurchase method a company chooses, there has been consistent evidence that merely the announcement of a repurchase plan – the signal that the firm believes its shares are a bargain – is enough to move the stock price up the day it is released. Open market program day-of returns average between 2% and 4%, depending on the period measured (Grullon & Michaely, 2002, 2004). Fixed price tender-offers result in excess stock returns of 11% around the three days of and after the announcement, while Dutch auction offers result in an 8% excess return (Comment & Jarrell, 1991).

Market Timing of Share Repurchases

Moving beyond the announcement, the next question to answer is, do managers time the market when making their share repurchases? Brav, Graham, Harvey, and Michaely's (2005) survey showed that 80% of corporations initiate a share repurchase plan when they believe the stock is a good investment compared to alternatives, suggesting market timing. Ikenberry and Vermaelen (1996) argued that managers repurchase their stock when it is undervalued and would refuse to repurchase shares when their stock is overvalued, again suggesting that managers can time the market. Assuming the managers can time the market, then each company should be able to earn abnormal returns following the share repurchase as the market corrects the mispricing. Note, these articles were published prior to the major stock repurchase booms of recent years. More recent findings are mixed, with Gunn (2017) finding only small and mid-sized firms show evidence of positive timing, while large firms do not.

However, Fama (1998), Brav and Gompers (1997), and Mitchell and Stafford (2000) suggest that the methodology employed by researchers like Ikenberry and Vermaelen (1996) is flawed. These papers concluded there are problems with appropriate benchmarks and how to measure the abnormal return required to show market timing can be misleading. Additionally, Schultz (2003) hypothesized the existence of pseudo-market timing concerning I.P.O.s but could also exist for share repurchases. Pseudo-market timing is the appearance of market under/over-performance after a corporate finance decision because managers base their decisions on past stock market performance. The evidence of market timing disappears when calendar-time returns replace event-time methods (Schultz, 2003). Following Schulz's hypothesis, Chan, Ikenberry, and Lee (2007) used calendar-time methodology and continued to find evidence of actual market timing and no evidence of pseudo-market timing.

The Link Between Share Repurchases and Insider Trading

Based on the idea that managers time the market when repurchasing shares and can use the same knowledge when trading the same stock for their portfolio. It would seem logical to find a significant link between insider trading and share repurchase activity. Nevertheless, Chan, Ikenberry, Lee, and Wang (2012) found that insiders were more likely to sell after announcing a repurchase program, even after controlling for option-related selling. Bonaimé and Ryngaert (2013) confirmed that the results in the other direction; the odds of high net repurchases are greater when insiders are selling, not buying stocks. These conflicting signals result in mixed messaging for the market and result in the market ignoring the positive signaling of the share repurchases. However, when both insiders and the firm are net buyers (resulting in two signals, both suggesting the stock is undervalued), the signal is powerful. It results in significantly higher returns in the quarter of the repurchase activity and the following three years.

Both studies above looked at simultaneous signals. Cziraki, Lyandres, and Michaely (2019) studied insider trading and share repurchases on a lagged basis and discovered that insiders tend to be net buyers *before* open market repurchase plans are announced, and net sellers before seasoned equity offerings (which typically drive the stock price down) are announced. Babenko, Tserlukevich, and Vedrashko (2012) found that when C.E.O.s purchase stock *before* announcing an open market share repurchase program, the signaling power of the program announcement is more robust, resulting in a larger bump to share price.

Post-Repurchase Firm Performance

Having looked at market returns on the day-of announcement (signals) and when executed (market timing), researchers have also studied the long-term effects of share repurchases on firm performance. There have been two main definitions of performance – operating performance measured in various income statement related metrics and market performance measured as cumulative abnormal stock returns.

Operationally, share repurchases allow earnings per share to grow faster than net income, creating the “EPS bump” (Ikenberry & Grullon, 2000). An EPS bump assumes that whatever funding mechanism it uses (idle cash or borrowings) does not decrease earnings a larger percentage than the share count falls. While this does not improve operations, it may affect the share price, assuming a constant multiple (Ikenberry & Grullon, 2000).

A popular metric to judge abnormal operational returns is increases in return on assets. There are two hypotheses related to improved return on assets. First, using excess cash to repurchase stock puts an idle or under-performing asset to use in its highest return (Wansley, Lane, & Sarkar, 1989), reducing total assets while not impacting net income, resulting in a higher return on assets. The second hypothesis is that management purposefully manipulates earnings before the share repurchase. By using excess accruals, management can temporarily reduce operating profit before the repurchase announcement, only to show improvement after the announcement. Gong, Louis, and Sun (2008) found evidence of abnormal accruals the quarter-before and quarter-of a new repurchase plan announcement, which resulted in post-repurchase operational improvement in the one and two-year periods when the accruals reverted to normal levels. Chen and Huang (2013) looked at similar evidence five years later and determined Sarbanes-Oxley (SOX) was able to limit this management manipulation. Using a long-term data set divided into Pre- and Post-SOX, the duo confirmed Gong et al.'s results for Pre-SOX manipulation, but saw the abnormal accruals disappear Post-SOX.

Long-term firm outperformance due to share repurchases has been a hotly contested set of finance literature over the past 30 years. The idea of cumulative abnormal returns (C.A.R.) goes against the Efficient Market Hypothesis (Peyer & Vermaelen, 2009). Ikenberry, Lakonishok, and Vermaelen (1995) found not only an initial bump in the stock price after open market repurchases discussed earlier (signaling) but a lasting effect. Firms who repurchased shares reported abnormal stock returns of 2.9% annually over the four years following the announcements. Using Fama and French's Book-to-Market ratio as a proxy, the authors found that value stocks earned a 6.4% annual abnormal return over four-year periods. The same researchers followed up their study five years later (Ikenberry, Lakonishok, & Vermaelen, 2000) with new data

(1990s Canadian data vs. 1980s U.S. data) and came to similar conclusions. Other researchers have found similar supporting evidence (e.g., Gong et al., 2008; Lie, 2005; Peyer & Vermaelen, 2005). Using a different metric (buy and hold returns vs. C.A.R.), Chan et al. (2007) also found abnormal performance for up to four years after repurchase announcements using data that spanned 1980 to 1990.

In 2009, Peyer and Vermaelen re-tested the evidence from above to see if it persists as Efficient Market Hypothesis proponents suggest that anomalies should disappear after they are well-advertised. Additionally, they calculated the outperformance metrics three different ways to address concerns that C.A.R. and Buy and Hold metrics were fundamentally flawed. They found continued support that before repurchase announcements, stock prices are un-justifiably beat down and that management takes advantage of this relative underpricing when repurchasing shares. Using data from 1991 to 2001, they find cumulative abnormal returns of 24.25% after four years. Peyer and Vermaelen found that with alternative measures, like calendar-weighted results, the outperformance decreases somewhat, but remained statistically significant and positive.

McNally and Smith (2007) also confirmed the cumulative abnormal returns for firms who repurchased shares in the Canadian market but found that when adding in transaction costs, individual investor trading strategies did not yield abnormal returns. The two found median abnormal returns of the firm’s actions of 3.31% after one year and 4.22% after two years but found when an individual attempted to capture the same additional returns by purchasing shares immediately after the announcement; transaction costs ate up enough of the return to wipe out the excess return.

All the previously discussed returns are based on open market repurchase plans. Michel et al. (2010) looked specifically at post-repurchase market performance for the increasingly popular accelerated stock repurchase method. They did not find the same post-repurchase price drift as earlier researchers did for other forms of repurchasing. Using 15 days post announcement to 9 months later, the average C.A.R. was -8.5% relative to its value on Day 15 after the announcement, using data from 2004-2007, suggesting value destruction.

Finally, Abdou and Gupta (2019) explored whether the announced purpose of the share buyback would affect the cumulative abnormal return. The team ended up finding it did not. Interestingly, they also found that all repurchase techniques (open market, fixed-price tender, Dutch auction, or accelerated repurchase), negatively contributed to cumulative abnormal returns when controlling for company size, risk, and revenue. It is unclear if the efficient market has finally eliminated the excess return from earlier data sets or prior research confused correlation with causation.

While the theories about the how and the why are mixed and the size of the impact have potentially changed, adding up all the research suggests that the growing share repurchase activity does impact accounting metrics and share price.

Section 3: The Role of Book Value Per Share in Firm Valuation Models

The number of shares outstanding and book value of a company are factors in most models of firm value and market performance. Since share repurchases affect the reported diluted shares outstanding and book value of the corporation, we must understand the role of book value per share in these models to understand the impact share repurchase accounting and activities have on theory and practice.

Capital Structure on the Value of the Firm

In 1958, Modigliani and Miller (M&M) published their widely cited theorem that capital structure is irrelevant to the value of the firm. The underlying assumptions allowed for a simplified theory (i.e., no transaction costs and that individuals and corporations can borrow at the same cost). Consequently, various capital structure theories emerged to adjust M&M's theory to include the impact of taxes related to debt and equity securities at the individual and corporate levels (e.g., Modigliani, 1982), the cost of financial distress (e.g., Kim, 1978; Scott Jr, 1977), agency costs (e.g., Jensen & Meckling, 1979) and tax shields on non-interest items like accelerated depreciation (e.g., DeAngelo & Masulis, 1980). Bradley, Jarrell, and Kim (1984) combined these items to support Trade-Off Theory. They conclude optimal debt levels – those that will maximize the value of the firm -- increase as the cost of financial distress (both agency and bankruptcy risk) decreases. Optimal leverage is also inversely related to the amount of non-debt tax shields. Managers must balance the risk of financial distress with the tax savings of additional debt. However, Trade-Off Theory does not appear to hold over extended periods. For example, the theory would suggest that as the cost of financial distress increases, debt would fall. However, long-run leverage ratios have been mostly static from 1900 to 2002, despite swings in economic health and cost of bankruptcy and debt (Frank & Goyal, 2008).

An alternative to Trade-Off Theory is the Pecking Order Theory (Myers & Majluf, 1984). This theory suggests that debt is issued (increasing leverage) due to internal cash demands that cannot be met by internally generated cash and because it is cheaper than equity. Pecking Order Theory states that immediate internal concerns, rather than a goal of an elusive optimal debt ratio, drive capital structure. Shyam Sunder and Myers (1999) demonstrate that the Pecking Order Theory appears to explain corporate actions better when a financial deficit is present than Trade-Off Theory. However, the theory can break down, and analysts can reject it when firms choose to issue equity over debt, which happens frequently (Frank & Goyal, 2003).

Since both significant theoretical streams have short comings, there is no unifying capital structure theory that can explain all firm actions. While imperfect, both conclude that capital structure can impact the value of the firm. To adjust capital structure quickly, a firm can issue or pay off debt, or issue or buy back shares. Consequently, one can assume that share buybacks, which alter the leverage ratio, will impact the value of the firm due to the impact on the capital structure of the firm.

Capital Asset Pricing Models

There are dozens of theoretical models for valuation. They generally fall into a couple of categories – discounted flows-based models (discounted dividends, discounted free cash flows, and discounted abnormal earnings), multiples-based models (price as a multiple of accounting measures including but not limited to earnings, book value, EBITDA, and revenues), and capital asset pricing models. Number of shares outstanding and/or book values are critical to the output of all of these models, and their estimates of value will be highly correlated. This dissertation focuses on capital asset pricing models because of their wide acceptance as theoretical pricing models and their use of market-driven valuation in conjunction with some accounting to obtain a return.

Sharpe-Lintner-Black CAPM

The most high-profile pricing model is the Capital Asset Pricing Model (CAPM). This model was developed by Sharpe (1964), Lintner (1965), and Black (1972). The model, shown below, assumes individual corporate returns are a function of their risk relative to the overall market (Bodie, Kane, & Marcus, 2005)[4].

$$r_{jt} - r_{ft} = \alpha_j + \beta_{jt}(r_{mt} - r_{ft}) + \epsilon_{jt}$$

The impact of share repurchases is not readily apparent in the CAPM model in its original form. When share repurchases are used to change the capital structure of the company, however, the risk level of equity compared to the market will change, which will affect the beta of the CAPM formula.

Fama-French 3-Factor Model

Fama and French (1993) presented a 3-Factor version of CAPM to enhance its explanatory power, displayed below.

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

The original beta on the market risk premium was maintained. The SMB term represents small-minus-big (the difference in monthly average returns of small companies based on market capitalization to large companies based on market cap). This factor compensates for the size effects witnessed in the market. According to Fama and French (1995), small

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[4] For an explanation of the inputs, mechanics, and uses of CAPM, see Bodie, Kane and Marcus (2005).

firms in the 1980s showed lower returns on assets than large firms, even when controlling for other factors. Consequently, small firms must share some common risk factor that adds explanatory power of their stock returns.

The second new factor was high-minus-low (HML). Firms with high book value to market value of equity have a low stock price relative to their book value per share. This lower stock price reflects lower earnings expectations on the book equity (Fama & French, 1995). On the flip side, low BE/ME firms have higher earnings power on their book equity. In short, low BE/ME firms tend to be growth stocks while high BE/ME firms are often financially distressed firms (Fama & French, 1995) or value firms (Davis, Fama, & French, 2000).

Note that Fama and French (1992) stated: “We do not use negative-BE firms, which are rare before 1980, when calculating the breakpoint for BE/ME or when forming the size-BE/ME portfolios” (p.8), later stating these firms show signs of financial distress (Fama & French, 1995). This omission is critical, as more and more companies have low or negative shareholders’ equity as a result of share repurchases and are not financially distressed. Indeed, it is the opposite in several cases. The negative book value firms are firms that have used significant positive cash from operations over several years to buy back shares. As of April 6, 2021, applying Fama and French’s Model using their methodology will exclude 23 members of the S&P 500 (Bloomberg, 2021a), and potentially reduce its explanatory power. Considering Fama and French (2004) state that the HML factor “does the heavy lifting in the improvements to the CAPM” (p.40), the potential reduction in its explanatory power is problematic.

The application and explanatory power of the Fama-French Model, when applied in the original method, is robust. In 1993, Fama and French reported R^2 ranging from 0.82 to 0.97 depending on the portfolio measured when looking at U.S. Stocks from July 1963 to December 1991. In 2000, Davis, Fama, and French use the Model on NYSE listed stocks and compared periods between July 1929 and June 1997. The results show that the 3-Factor Model has an R^2 between 0.90 and 0.98, depending on the period and portfolio. In yet another test on North American stocks from November 1990 to March 2011, the R^2 continued to be a strong 0.93 when regressed against only local factors (Fama & French, 2012). This consistently strong result suggests the 3-Factors do help explain price volatility. However, the impact of the rapidly changing book values per share due to share repurchases has yet to be explored, and the possible adjustments outlined below may bring the Model even stronger results.

Section 4: Five Views of Repurchased Shares

The generally accepted accounting treatment for share repurchases and treasury stock has been mostly stable for several decades. However, historically there was some variation. According to Fjeld (1936), 221 of the 404 NYSE listed firms with treasury stock in 1932 classified at least part of their holdings as assets. This practice was partially a strategy to avoid the reduction in shareholders' equity (Rueschhoff, 1978). The current treatment was driven by the U.S. Internal Revenue Service (I.R.S.) as much as the financial accounting regulators. The I.R.S. decided on the current accounting method that treats share repurchases as a return on capital. In 1933, the I.R.S. changed its rules and suggested that any difference in price between the purchase and sale of treasury stock was income to the corporation. This rule resulted in most companies retiring their treasury stock and merely issuing new shares when needed, no longer labeling the repurchased shares as assets. Twenty years later, the I.R.S. reversed its stance and stopped labeling the reissue as income, but verified it was an owner's equity transactions, which mainly stuck. By 1975, only 5 of 600 companies accounted for treasury shares – specifically for the reissue related to stock options – as an asset (Rueschhoff, 1978). Today, share repurchases, retired or held as treasury stock, are considered a reduction in shareholders' equity.

Share Repurchases are a Return of Capital

Paton argued that share repurchases are a return of capital to shareholders as early as 1919, but he addressed the issue again 50 years later (Paton, 1969). Paton posits that repurchased shares are economically equivalent to shares that have never been issued. Even when ultimately reissued, there is no meaningful difference to newly created shares. Repurchased shares have no voting rights or dividend rights – the same as authorized, but not issued shares. The accounting for both should be consistent. Paton rejected the notion that there is any asset value to be shown on the balance sheet related to the option to reissue by pointing out that it is equivalent to a bank line of credit that a company can establish. The potential cash from a bank line of credit does not appear until the company draws on the line; the same should be true for repurchased shares.

Assuming repurchased shares are a return on capital also evens the playing field between treasury and retired shares. While individual line items vary, the net effect on total assets and total shareholders' equity remains the same between retired shares and treasury shares (Banyi & Caplan, 2016). As a company retains the right to reissue treasury shares or issue new shares to replace the retired shares, this consistent accounting of equivalent maneuvers is optimal.

Finally, share repurchases are viewed as substitutes for dividends as both are a use of cash that goes directly to shareholders (Grullon & Michaely, 2002). This rationale supports the existing accounting methodology and leads to the first hypothesis.

H1: The market treats share repurchases as a return of capital to shareholders, such that the current accounting methods without adjustment will have the greatest explanatory power in the Fama-French 3-Factor Model.

Share Repurchases are a Prepaid Cash Expense

The basic definition of an asset in accounting is "probable future economic benefits obtained or controlled by a particular entity as a result of past transactions or events" (Weygandt, Kimmel, & Kieso, 2015, p. 48). Share repurchases bought with the intent to reissue as a form of compensation fits this definition. Companies control treasury shares after using cash (a past transaction) and expect to economically benefit the corporation in the form of the efforts and retention of the employees paid via stock.

It is the intent of management that makes the acquisition of shares an asset (Horwitz & Young, 1975). Equity compensation is also a significant use of the repurchased form. Liang and Sharpe (1999) estimated that about half of repurchased shares are reissued for stock options. As stated earlier, Bonaimé et al. (2019) show that the shift to restricted stock grants rather than options has not altered the positive relationship between the equity grants and stock repurchases. Consequently, this portion of share repurchases bought with the intent to reissue as compensation appear to meet the AICPA's rules surrounding assets.

Accounting for stock options is a complicated issue (Hall, 2000). Stock option expense is a non-cash charge based on the Black-Scholes-Merton or Lattice option pricing model (Baril, Betancourt, & Briggs, 2007). It is reversed in adjustments in cash flow from operations because it is a non-cash expense in that period (Weygandt et al., 2015). However, most companies use cash to buy back shares and then award at least a portion of those treasury shares to their employees. Bens et al. (2003) found the market impact of shares repurchased to fulfill employee stock options occur when the stock options are issued to the employee rather than when the options are exercised by the employee. Hence, the market assigns a high probability to their ultimate exercise. There is a real cash outlay behind the expense. The fact that these are two separate transactions does not negate the real cash outflow. By reversing the "non-cash" charge for stock option expense and instead recognizing the cash outlay and accompanying inflow from exercise in cash flow from financing, existing accounting overstates both cash flow from operations and free cash flow. Kahle (2002) found evidence that the market reacts less favorably to share repurchase announcements when a company has a large volume of stock options outstanding – a signal that the market may see through the accounting.

To adjust for the cash nature of stock compensation, analysts can make the following adjustments. First, the portion of share repurchases that offset stock grants could be moved from a negative contra-equity account to an asset account – current or long-term depending on expiration, at cost. This adjustment would effectively raise book value of equity temporarily until the real expense is recognized through in the income statement – which will eventually flow into retained earnings. These adjustments are not a part of existing accounting but may reflect how the market thinks about share repurchases.

H2: The market treats share repurchases as a pre-paid cash expense, such that recording repurchased shares as an asset valued at the net cash of unexercised stock options, with a corresponding increase to book value will have the greatest explanatory power in the Fama-French 3-Factor Model.

Repurchasing Shares is the Monetization of Internally Generated Goodwill

When initially justifying the asset treatment of treasury stock, Bentley (1911) and Montgomery (1912) noted that the transactions required firms to spend cash for an object that could be sold (had monetary value) or retained by the firm at the firm's option. Since there was real value related to the repurchased share, it was viewed as an asset (Sheldahl, 1982). This treatment was popular until the 1930s when legal restrictions were put in place that limited distributions beyond current retained earnings (Rueschhoff, 1978). This notion generally did not find favor with the accounting profession (Paton, 1969).

Behind the idea that a repurchased share has value is the assumption that the company is a going concern with a profitable future. The company merely decides the best use of its money is not to buy a new piece of equipment or hire a new employee, but to invest it into its stock, similar to any other acquisition (Paton, 1969). If one looks at a repurchased share as a partial acquisition of itself, several interesting implications arise.

The most significant implication is the potential to recognize goodwill. Internally generated intangible assets are not capitalized under generally accepted accounting principles. Only when a company is sold will identified intangible assets be written up to their fair value and/or goodwill be recognized. Each are part of the cost basis of the acquiring company (Weygandt et al., 2015). In a sign of recognizing that goodwill can, in many instances, have an indefinite useful life, the FASB discontinued the amortization of goodwill in 2001 (Statement 142, 2020). [5] Goodwill and appreciated intangible assets (e.g., Sinclair & Keller, 2014; Corrado, Hulten & Sichel, 2009), are not reported on the balance sheet. But, when a company repurchases its shares, it is acquiring a small portion of a going concern – a partial acquisition, usually at a value higher than book value. Corrado, Hulten, and Sichel (2009) posit that unrecognized goodwill meets all the criteria of intangible capital – since it was created through investment to yield future returns. A share repurchase is thus a combination of a return of accounting recognized capital (book value) to shareholders and a related recognition of internally generated goodwill (Zhang, 2013). As with other forms of goodwill, the new intangible asset is subject to impairment tests and should be written-off when its fair value is less than its value in the financial statements.

H3: The market views share repurchases as a de facto partial acquisition of the firm and the monetization of internally generated goodwill such that the adjustment is the recognition of the cost of repurchased shares in excess of the book value as an

[5] The adoption and procedures in SFAS 142 resulted from a significant amount of political influence on the independent accounting standards setting board. For a good review of the background related to this standard see Ramanna (2008).

intangible subject to impairment testing. H3 posits that this adjustment will have the greatest explanatory power in the Fama-French 3-Factor Model.

Repurchasing Shares is a Prepaid Cash Acquisition Asset

In 1975, Horwitz and Young argued that the intent of management should be considered when determining the accounting treatment of share repurchases. One intended use of repurchased shares is the acquisition of other companies. Exxon Mobil has explicitly stated such an intent, buying shares over the years, storing them in treasury stock, and then reissuing them when it finds an attractive acquisition (Sanati, 2009). Evidence shows that the market treats acquisitions made with treasury shares like cash rather than stock-based acquisitions (Jenkins & Ovtchinnikov, 2010). With this economic equivalency to cash, shares repurchased for the intent to reissue to acquire another company should be treated as a cash equivalent.

H4: The market views share repurchases as a prepaid acquisition, such that recording repurchased shares as a cash equivalent asset of the firm, with a corresponding increase to book value will have the greatest explanatory power in the Fama-French 3-Factor Model.

Treasury Stock is a Put Option on Company Shares

Until retired, companies can reissue treasury shares for a variety of purposes, including compensation, acquisition, and seasoned equity offerings, most of which are at or near current market value (Bond & Zhong, 2016; Jenkins & Ovtchinnikov, 2010;

Liang & Sharpe, 1999). In other words, the company has the economic equivalent of a put option at market price with no expiration date. While most of the funds used in the repurchase program are a return on capital, the company retains this option value, which should be recorded on the asset side of the balance sheet.

H5: The market recognizes the embedded option inherent in a firm's decision to repurchase shares. Consequently, the company retains the option value to reissue the shares, at or near the current market price, which, when recorded as an asset and a corresponding increase to book value, will have the greatest explanatory power in the Fama-French 3-Factor Model.

These five hypotheses were based on prior evidence. When a firm decides to repurchase shares, it must make several choices, all of which can affect its stock price differently. The firm must choose how to repurchase the shares and how to record the repurchase on their books. Then, a firm has many choices of what to do with the repurchased shares – many of which can signal to the market something about the prospects of the company. This dissertation attempts to use the Fama-French 3-Factor Model to bring all of these possibilities together and find evidence of how the market interprets these management choices.

Chapter 3: Methodology

This study has two primary steps. The first is to make the adjustments to the book values of the S&P 500 to reflect the various hypothesized treatments of share repurchases. The second step is to estimate the Fama-French 3-Factor model based on the adjusted book values.

The Sample

The final sample-set used in this study is all NYSE, Nasdaq and AmEx listed stocks from 1994 to 2019. While share buybacks have been a topic of conversation for more than 100 years, less than 30% of companies used share buybacks in any form in 1980. This usage rate dropped to a low of 25% by 1992-1993, before rapidly growing in popularity. In 1997, share repurchases first exceeded dividends on a dollar basis and number of companies and that has mostly been the case since (Zeng & Luk, 2020). Thus, data from 1994 forward is used in this study.

The Adjustments to Book Value

Four of the five treatments of share repurchases require adjustments to book value per current U.S. GAAP. This section will go into detail and use McDonald’s 2019’s balance sheet as an example for each adjustment. Table 1 shows all the inputs and results of the adjustments for three companies with different financial situations. This study chose McDonald’s because its heavy use of share repurchases reduced its total shareholders’ equity to negative. MasterCard is aggressive with share repurchases but still has positive shareholders’ equity. Finally, Lowe’s repurchases a significant number of shares, but it retires the shares rather than holding the stock as treasury stock. The multiple examples shown demonstrate that companies' accounting and strategic decisions impact their book values in different ways, which should result in different book-to-market value rankings depending on the hypothesis tested.

H1: The market treats share repurchases as a return of capital to shareholders, such that the current accounting methods without adjustment will have the greatest explanatory power in the Fama-French 3-Factor Model.

This hypothesis uses current accounting standards. No adjustments are necessary. For our example company, McDonald's, its FY 2019 book value was ($8.213) billion, with a market-cap on December 31, 2019, of $147.476 billion, rendering the book-to-market value (-.056) meaningless, as it will drop out of the sample set.

H2: The market treats share repurchases as a pre-paid cash expense, such that recording repurchased shares as an asset valued at the net cash of unexercised stock options, with a corresponding increase to book value will have the greatest explanatory power in the Fama-French 3-Factor Model.

Since Bens et al. (2003) found that share repurchases are tied to the issuing, not exercising of stock option grants, this study chose to base the value of the asset on the total number of stock options issued, rather than exercised. This choice will slightly inflate the number as not all issued options will be exercised. A practitioner study by Charles Schwab found that 76% of recipients of stock options never exercised them. However, it should be noted that this finding skewed by the many individuals that receive small stock grants (O'Brien, 2018). In the sample company, McDonald’s, 500,000 shares, or 3% of stock options and RSUs were either forfeited or expired unexercised during the 2019 fiscal year (McDonald's Inc, 2020).

The adjustment to book value would create a new asset called “Treasury Stock Held for Equity Compensation.” Support for this adjustment comes from the McDonald’s 2020 10-K stated which stated, “the Company uses treasury shares purchased under the Company’s share repurchase program to satisfy share-based exercises” (p.53). The asset amount is calculated using a non-cumulative LIFO method (meaning it would be re-calculated every year in the sample).

While it would be better in practice to create a system where options granted in year *t* were matched with repurchases made in the same year, company disclosures concerning stock option exercise do not provide sufficient detail to enable such matching. The remaining options are the LIFO, FIFO, and weighted-average cost assumptions.

LIFO is the choice of this study because it has the advantage of finding data for companies that subsequently retire the shares. Additionally, using the most recent data helps when an acquisition or spin-off results in substantial changes to the number of options outstanding. However, note that since share prices tend to rise over time, the value of the prepaid asset will likely be higher than the preferred matching method. Any repurchased shares not needed to fund equity compensation will remain recorded under the existing accounting treatment.

FIFO suffers from the inability to trace what shares were “used up” and what is left and would require an arbitrary starting point for creating the treasury balance. The weighted-average cost method is an attractive alternative and easy to calculate in firms that have treasury stock. Treasury stock is a fungible item, without expiration, leading strength to this treatment. Interestingly, due to the strong market over the past ten years, the weighted average price of treasury stock can be below the average strike price of stock options. This scenario creates an unusual situation where the company is making a non-income statement capital gain when the options are exercised. However, in order to apply a weighted average method to companies that retire repurchased shares will require additional assumptions, including how long to create a pool of stock that would not be required for LIFO.

To calculate the book value adjustment, the study uses fiscal year end stock options and restricted stock units issued, but not exercised. Using average stock prices over the fiscal year as a proxy for repurchase price for FY_t and working backwards, the study records the average cost of satisfying those issued grants with treasury stock. The value of the asset is the repurchase price minus the exercise price of the option.[6] The resulting adjustment would be a debit to increase the asset "Treasury Stock Held for Equity Compensation" asset and a credit to eliminate the Treasury Stock contra-equity amount. This adjustment serves to raise book value.

	Treasury Stock Held for Equity Compensation	XXXX	
	Treasury Stock		XXXX
OR			
	Treasury Stock Held for Equity Compensation	XXXX	
	Common Stock		XXXX
	Retained Earnings		XXXX

For example, in FY19, McDonald's had 16.0 million shares reserved for issued, but not exercised options (14.6 million with a weighted average strike price of $124.21).

[6] Note: this study ignores the tax implications, which would just be a timing difference rather than an economic difference.

In 2019, the company repurchased 19.6 million shares with an average price of $198.28 (McDonald's Inc., 2020). Consequently, the LIFO-based treasury stock average price to cover the 16.0 million shares would be $198.28. The pre-paid asset would then be: (198.28-124.21) * 14.6 options = $1.081 billion. This new asset would increase total assets and shareholders' equity, leaving McDonald's with a book value of ($7.132) billion and the same market capitalization of $147.48 billion, giving the company a book-to-market value of -0.0483.

H3: The market views share repurchases as a de facto partial acquisition of the firm and the monetization of internally generated goodwill such that the adjustment is the recognition of the cost of repurchased shares in excess of the book value as an intangible subject to impairment testing. H3 posits that this adjustment will have the greatest explanatory power in the Fama-French 3-Factor Model.

To calculate the asset of internally generated goodwill, this study will use Zhang's (2013) method as follows:

$$\textit{Intangible Asset}_{12/31/t} = [\textit{Market Value}_{12/31/t} - \textit{Book Value}_{FYt}].$$ [7]

This formula will generate a total value for internally generated goodwill that will need to be reduced to the percentage of shares repurchased compared to issued. For company's using the treasury stock method, applying the percentage of treasury shares available on the balance sheet to total shares issued will provide the needed percentages. For companies that choose to retire their shares, this study will take the net difference between the number of shares outstanding at t_0 and t_{-8} as a percentage of shares at t_{-8}. Any

[7] Ideally, the model would use the fair value of identifiable net assets rather than book values. However, without the ability to revalue the assets on a company's balance sheet, this is the best alternative available.

reduction is considered net share repurchases, and that percentage is applied. Note that the number of shares outstanding at t_{-8} will be adjusted for any subsequent stock splits. This metric implicitly assumes that any stock-based acquisition was the result of re-issuing formerly retired shares when the difference is still positive. Companies with a higher share count at n_0 will have no adjustments made.

	Internally Generated Goodwill	XXXX	
	Treasury Stock		XXXX
OR			
	Internally Generated Goodwill	XXXX	
	Common Stock		XXXX
	Retained Earnings		XXXX

The t_{-8} cut off is a research design judgment. No previous literature was found that made these sorts of adjustments. Consequently, the average economic cycle during the period studied is used as the time horizon. According to the National Bureau of Economic Research, there were five complete economic cycles between 1979-2019, making it an average of 8 years (National Bureau of Economic Research, 2020). If 8 years is too brief of a time horizon, the buyback activity of the firm will be understated. If 8 years is too high, a significant acquisition would result in a longer than necessary zero balance for internally generated goodwill.

McDonald's had a total market capitalization of $157.7 billion and a book value of ($8.21) billion, resulting in the internally generated goodwill of $165.91 billion. At fiscal year end, the company's treasury stock account holds 914.3 million of the 1,660.6 million shares issued or 55%. These figures result in an internally generated goodwill asset value of $91.35 billion, increasing its book value to $83.13 billion, and making its book-to-market value 0.526.

H4: The market views share repurchases as a prepaid acquisition, such that recording repurchased shares as a cash equivalent asset of the firm, with a corresponding increase to book value will have the greatest explanatory power in the Fama-French 3-Factor Model.

This method is simple, rather than recording treasury stock at cost in a contra-equity account, treasury stock is treated as an asset, at lower of cost or market value. The short-term asset would be subject to impairment tests, which would be required if the market value of the shares was less than the book value recorded. Consequently, when recording this asset, the asset would be the lesser of the recorded treasury stock book value or the number of shares multiplied by the share price at year-end.

Based on this assumption, adjustments are required for companies that choose to retire their shares. To find the net number of shares repurchased, the same calculation as for the prior hypothesis is applied (i.e., take the difference between n_0 and n_{-8} shares outstanding). This number of shares is multiplied by the weighted average repurchase price over the same 8-year period, proxied as the average share price in the year of repurchase. This process generates an approximation of the book value of retired shares. Like the treasury share adjustment, this book value will be subject to an impairment test equal to the number of net repurchased shares calculated multiplied by the year end share price.

Treasury Stock Asset	XXXX	
Treasury Stock		XXXX

OR

Treasury Stock Asset	XXXX	
Common Stock		XXXX
Retained Earnings		XXXX

The cost of McDonald's treasury stock was $66.33 billion in FY19. With 914.3 million shares of treasury stock and a share price of $197.61, the hypothetical value of the stock is $180.7 billion. This result suggests the book value is not impaired, and the $66.33 billion can be recorded as an asset in this adjustment. Adding the $66.33 billion to the ($8.21) billion book value creates an adjusted book value of $58.12 billion. This adjustment increases the book-to-market value to 0.369.

H5: The market recognizes the embedded option inherent in a firm's decision to repurchase shares. Consequently, the company retains the option value to reissue the shares, at or near the current market price, which, when recorded as an asset and a corresponding increase to book value, will have the greatest explanatory power in the Fama-French 3-Factor Model.

Using the Black-Scholes-Merton Option Pricing Model and the assumptions the companies make to value their stock options, as disclosed in the notes to the financial statements, the put option value can be calculated for the potential to reissue treasury stock. While the other four hypotheses will use data from 1979-2019, H5 will use data only from 2003-2019 when sufficient disclosure of the option-pricing model assumptions began, due to the rules of Fama-French, the sample will start in 2005. Up until 1995, investors did not have a ready source of information to analyze the company's assumptions on its stock option value, which makes it unlikely the market implicitly adjusted for this option.

This study has chosen to use the Black-Scholes-Merton option pricing model (Merton, 1973) to correspond with the method used by most S&P 500 firms. Rather than attempt to create the assumptions of volatility, dividend yields, and risk-free rates, it seems prudent to use the same figures the firms do when expensing their stock options. These assumptions are also the likely figures firms would choose when attempting to create a fair value for re-issuing Treasury Stock in an audit to achieve internal consistency. According to Finnerty (2014), 80% of S&P 500 companies use Black-Scholes-Merton to calculate their stock option expenses, substituting in the life of the grant for the length of the contract.

Stock option expense notes to the financial statements' information are available for most of the inputs required for the Black-Scholes-Merton model (namely the assumed risk-free rate, stock price volatility, and dividend yield). This source of data leaves three more inputs to use the formula: the underlying price, the strike price, and the length of the option.

The underlying price is assumed to be the weighted-average share price of the treasury stock. This figure is readily available on the balance sheet. It is also theoretically sound since treasury shares are fungible.

There are two main alternatives for an assumed strike price. The first is to choose the year-end stock price, which would suggest the market value is equal to the issuance value of the treasury stock. It is simple and would put the option "at the money." The second alternative the average discount of a seasoned share offering when issuing large quantities of treasury stock. Mola and Loughran (2004) used 3%. Altınkılıç and Hansen (2003) calculated a similar discount estimate of 3.2%. Thus, discounting the year-end stock price for each company by 3% would also be theoretically defensible. This study uses both but the "at the money" and 3% discount options but does not expect the adjustment to change the results materially.

Technically, the time a company can exercise this put option is infinite. However, to calculate a proxy for the typical life of this option, this study investigated the frequency of share issuance in the S&P 500. Increases in shares outstanding would indicate that a firm issued shares that fiscal year. Data shown in Figure 1 suggests that on average 47% of S&P 500 companies from 1995-2019 were net issuers of shares. With a small bit of rounding, this data would suggest an approximate 2-year life for the put option. Note, the percentage of net issuers is declining as time goes on, with an average of only 36% from 2011 to 2019. Since this is a significant assumption in this hypothesis, a sensitivity analysis will be conducted to show the robustness of this assumption.

Figure 2: Percent of Companies with Weighted Average Share Count Increases

Year	% of S&P 500 Companies with Increasing Share Count	Year	% of S&P 500 Companies with Increasing Share Count
1995	61%	2008	40%
1996	55%	2009	66%
1997	54%	2010	54%
1998	51%	2011	36%
1999	52%	2012	45%
2000	51%	2013	38%
2001	67%	2014	33%
2002	62%	2015	30%
2003	66%	2016	37%
2004	58%	2017	37%
2005	46%	2018	31%
2006	39%	2019	36%
2007	32%	Source: Bloomberg, 2020b	

While companies that retire shares are shown statistically to issue new shares at a slightly higher frequency as those who hold them in treasury (Banyi & Caplan, 2016), other research shows that treasury shares are considered closer to cash than newly issued shares in acquisitions (Jenkins & Ovtchinnikov, 2010). This finding suggests the two forms of issues are not economically equivalent. Since retired shares require the company to create new shares to re-issue, this study will assume that retired shares do not create the same option value as treasury shares.

Treasury Stock Put Option	XXXX	
Treasury Stock		XXXX

For McDonald's, the company stated its expected dividend yield was 2.7%, its expected stock price volatility was 18.9%, and its expected risk-free rate was 2.5%. As a default, primarily to force the companies to re-assess the option value frequently, a one year expected life was assumed. Finally, the exercise price was set to be equal to the 12/31 price used in the market value above ($197.61), and the underlying price was determined to be the average price paid for the treasury stock ($72.55) – since that would represent any gain the company would have had if they reissued the shares. These assumptions generated a $140.55 value for a put option of 100 shares, valuing all treasury stock options at $1.29 billion (the adjustment to book value). This adjustment brought McDonald's book-to-market value at -0.044.

Table 3: Three Examples of Adjustments to Book Equity to Market Equity for each Hypothesis

	McDonald's	Mastercard	Lowe's
FY19 Book Value ($b)	$ (8.21)	$ 5.89	$ 1.97
12/31/19 Market Capitalization ($b)	$ 147.48	$ 300.68	$ 94.11
H1:			
No Adjustments			
Book-to-Market Value	-0.056	0.020	0.021
H2:			
# of Stock Options Granted	14.6	6.6	2.343
Average Strike Price of Options	$124.21	$117.00	$86.01
LIFO Price of Repurchased Shares	$198.28	$249.58	$104.68
Increase to Book Value Adjustment ($b)	$1.08	$0.88	$0.04
Book-to-Market Value	-0.048	0.023	0.021
H3:			
Total Internally Generated Goodwill	$155.69	$294.79	$92.14
Total # of Repurchased Shares	914.3	395	592
# of Shares Issued	1660.6	1402	1403
% of Issued Shares Repurchased	55%	28%	42%
Increase to Book Value Adjustement ($b)	$85.72	$83.05	$38.88
Book-to-Market Value	0.526	0.296	0.434

Summary of Book-to-Market

	MCD	MA	LOW
H1	-0.056	0.020	0.021
H2	-0.048	0.023	0.021
H3	0.526	0.296	0.434
H4	0.394	0.127	0.295
H5	-0.047	0.022	0.021

H4:	McDonald's	Mastercard	Lowes
Weighted Avg. Price Paid, 8 years			$43.64
Total # of Treasury Shares	914.3	395	592
Book Value of Repurchased Shares ($b)	$66.33	$ 32.21	$ 25.83
Increase to Book Value Adjustement ($b)	$66.33	$ 32.21	$ 25.83
Book-to-Market Value	0.394	0.127	0.295
H5:			
Expected Dividend Yield	2.70%	0.60%	
Expected Stock Price Volatility	18.90%	19.60%	
Risk-Free Interest Rate	2.50%	2.60%	
Expected Life	1 year	1 year	
Exercise Price (6/30 Price)	$197.61	$269.99	
Stock Price (Avg. Price of Treasury Share	$72.55	$ 81.53	
Black-Scholes Value per Option	$140.55	$190.55	
Increase to Book Value Adjustement ($b)	$1.29	$0.75	
Book-to-Market Value	-0.047	0.022	0.021

Fama-French 3-Factor Model

To determine which method of accounting for share buybacks the market appears to use, this study will apply the methodology used by Fama and French (1992, 1993, and 1995) in testing the 3-Factor Model. This method classified NYSE, Nasdaq and AmEx listed stocks into six sub-portfolios to determine if different sized or type firms use share repurchases differently. Models based on Fama and French's 30 industry break down (French, 2021) was also run to determine if different industries use share repurchases differently.

Fama and French (1993) presented the following regression that can explain between 80% and 95% of stock price movements.

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

The HML variable will vary as a result of the share repurchase adjustments to book value previously discussed. First, using June 30 of year *t* for each year from 1979-2019, sample set stocks will be ranked by market capitalization. The median value will be used to separate the high market cap stocks (Big) vs. the lower market cap stocks (Small). The breakpoint between small and big will be the median market cap of NYSE listed stocks. Since the NYSE is dominated by large-cap stocks, the "small" market cap portfolios will be significantly larger than the "big" portfolios. Second, the sample set of stocks will be broken into three groups based on the book-to-market values calculated for each company (this will be repeated multiple time for the various hypotheses). Following Fama and French's (1993) acknowledged arbitrary group rankings, the low group will have the bottom 30% of BE/ME companies, the middle group will have the next 40% of stocks, and the high group will have the top BE/ME companies. Note, since the primary focus of the study is share repurchases, which can drive total common shareholders' equity below zero, negative book value companies may be added back to the sample set due to the adjustments made, since Fama and French excluded negative book value companies in their methodology. Book value is defined as the book value of shareholders' equity minus any reported book value of preferred equity at the end of *F.Y. t-1*. The market capitalization used for this metric will be December 31 of *t-1*, consistent with Fama & French's methodology. The lag in the accounting-based figures is to allow the model to predict the return. Finally, using the two groups of SMB and three groups of HML, six initial portfolios (Small/Low, Small/Medium, Small/High, Big/Low, Big/Medium, Big/High) will be generated.

The value-weighted, monthly returns of the six portfolios, from July 1 of year t to June 30, t+1 will be run through the Fama-French 3-Factor Model. SMB will be calculated as the difference, each month, between the simple average of the value-weighted monthly average returns of the small portfolios (Small/Low, Small/Medium, Small/High) minus the big portfolios (Big/Low, Big/Medium, Big/High). HML is defined as the difference between the monthly average value-weighted returns of the high portfolios (Small/High, Big/High) and the low portfolios (Small/Low, Big/Low); the middle 40% is excluded in calculating this input. Note, while SMB and HML both use market capitalization as a part of their metric, the correlation between the two measures have historically been negligible (Fama & French, 1993), reducing the chance of multi-collinearity. Value-weighted returns of all stocks in the sample set is the proxy for the market return. The one-month T-bill rate is the proxy for the risk-free rate metric to be consistent with industry standards and Fama and French's methodology.

With six portfolios and five methods to value book-value, the overall and incremental R^2s of the HML variable was be compared to try and determine which book value treatment yields the greatest explanation of the stock price movements of the portfolios.

One additional set of secondary data was also evaluated. To determine if different industries may use share repurchases differently, 30 industry portfolios from French's website (2021) was analyzed using the Fama-French 3 Factor model.

Chapter 4: Results

The first hypothesis (H1) evaluates the status quo. As such, the Fama-French 3-factor model is replicated using the data from 1994-2019. This replication sets a benchmark upon which the upcoming adjusted equity measures will be compared. Using data from Compustat and CRSP, the model was replicated with insignificant differences from Fama and French (1993). Table 4 presents the correlations. Observed correlations between the replicated model and data from French's website (French, 2021) is 97.8% on the "Small Minus Big" (SMB) factor and 94.5% on the "High Minus Low" (HML) factor for the 40-year period. The correlation has generally increased over time. For example, SMB's correlations are 99.1% and HML's 96.6% for the most recent five years (2014-2019). The main difference between French's (2021) method and the replication is the use of CUSIPs as a matching devise in the replication study, which reduces the number of observations compared to French's use of the CRSP/Compustat Merge tables available on WRDS. Over time, the difference between the number of observations in the two methodologies narrow, which likely accounts for the improvement in the correlation coefficient.

Table 4: Correlations of Betas of Factors in replication of Fama-French 3-Factor Model vs published factors from French's (2021) data website

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

	Correlation of β_{j2}	Correlation of β_{j3}	Avg. N/yr French	Avg. N/yr Replication
1994-2019	0.983	0.945	4,753	3,204
1994-1999	0.978	0.942	6,603	3,799
1999-2004	0.983	0.943	5,484	3,559
2004-2009	0.976	0.961	4,421	3,091
2009-2014	0.988	0.980	3,685	2,757
2014-2019	0.991	0.966	3,572	2,812

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

Next, the identical six size portfolios used in the original study were replicated. The firms are categorized based on size (big or small) and based on their book-to-market ratios (high, medium, and low). Hence, six portfolios result - Big/High, Big/Medium, Big/Low, Small/High, Small/Medium, and Small/Low. Recall that the high book-to-market firms are “value” firms (i.e., low market to book ratio) and the low book-to-market firms are “growth” firms (i.e., high market to book firms). The six portfolios are re-formed each year (July t-1 to June t). For the size distinctions (i.e., small/big), the market value of equity at June t is used to rank the firms, with all ranked largest to smallest. The median size value of the NYSE is used as the break point. Due to size differences between NYSE-, Amex- and NASDAQ-listed stocks, with the latter two having a greater number of small-cap and micro-cap stocks, a majority of firms end up in the small portfolios (an average of 2,557 firms per year are categorized as small out of an average 3,204 total firms per year). Additionally, all firms are ranked by their book equity to market equity. Breakpoints are created at the 30th and 70th percentile each year and the pool of stocks are divided accordingly. The six portfolios are then created based on the cross section of the two metrics.

Table 5: Results of replication regressions (H1) of monthly returns of six portfolio on excess market returns, size and book-to-market factors from July 1994 to June 2019

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

	β_{j1} Small	β_{j1} Big	$t(\beta_{j1})$ Small	$t(\beta_{j1})$ Big
High	0.964	1.017	103.35	65.12
Medium	0.953	0.984	70.87	53.95
Low	1.032	0.948	67.23	97.64

	β_{j2} Small	β_{j2} Big	$t(\beta_{j2})$ Small	$t(\beta_{j2})$ Big
High	0.837	0.016	63.74	0.72
Medium	0.820	-0.138	43.29	-5.36
Low	1.037	-0.184	47.93	-13.43

	β_{j3} Small	β_{j3} Big	$t(\beta_{j3})$ Small	$t(\beta_{j3})$ Big
High	0.737	0.804	57.10	37.19
Medium	0.458	0.422	24.61	16.70
Low	-0.214	-0.244	-10.07	-18.17

	Adj. R^2 Small	Adj. R^2 Big	$s(\varepsilon)$ Small	$s(\varepsilon)$ Big
High	0.984	0.942	0.0067	0.0111
Medium	0.972	0.908	0.0110	0.0130
Low	0.970	0.974	0.0112	0.0069

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year $t-1$. Market equity was measured on Dec 31, $t-1$.
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July t to June $t+1$.
R^2 and the standard error are adjusted for degrees of freedom.

See table 5 for results. The three Fama French factors explain a significant portion of the variance for all six portfolios. Coefficients of determination (i.e., R-squareds) range from a low of 0.908 for the big/medium portfolio to a high of 0.984 for the small/high portfolio. The market beta coefficient was statistically significant in all cases with a t-value range of 53.95 for the big/medium portfolio to a high of 103.35 for the small/high portfolio. The market beta coefficient hovered near 1 for all portfolios. The SMB variable was statically significant for all portfolio at the 95% level except for the big/high portfolio. The coefficient for the SMB factor was large and positive for the small portfolios, but small and negative for the big portfolios suggesting that the factor does successfully capture the difference in the variation of returns by size. The HML factor was also statistically significant for all six portfolios. The coefficient was meaningful and positive for the high portfolios and went down incrementally, turning negative for the low portfolios. This relationship is consistent with the suggestion that HML captures the risk factor difference between the high book-to-market portfolios (a proxy for value stocks) and low book-to-market portfolios (a proxy for growth stocks).

Table 6: Incremental Validity of the HML Factor in the Replication Model (H1)

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_j$

	S/H			B/H	
	2 Factor	3 Factor		2 Factor	3 Factor
R^2	0.804	0.984	R^2	0.674	0.942
ΔR^2		0.179	ΔR^2		0.267
F		3260.196	F		1383.061
p-value		0.00	p-value		0.00

	S/M			B/M	
	2 Factor	3 Factor		2 Factor	3 Factor
R^2	0.895	0.965	R^2	0.822	0.908
ΔR^2		0.070	ΔR^2		0.086
F		605.80	F		279.057
p-value		0.00	p-value		0.00

	S/L			B/L	
	2 Factor	3 Factor		2 Factor	3 Factor
R^2	0.962	0.972	R^2	0.945	0.974
ΔR^2		0.010	ΔR^2		0.029
F		101.36	F		330.27
p-value		0.00	p-value		0.00

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year $t-1$. Market equity was measured on Dec 31, $t-1$.

The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July t to June $t+1$.

R^2 is adjusted for degrees of freedom.

In Fama and French (2004), the authors argue that "HML does the heavy lifting" in the improvement of the model over the Black-Fisher Capital Asset Pricing Model. Table 3 confirms that HML's addition to the model does improve its explanatory power by a statistically significant amount for each of the six portfolios, with improvements in R^2 ranging from 0.010 for the small/low portfolio (the small cap growth portfolio) to a high of 0.267 for the big/high portfolio (the large cap value portfolio).

Table 7: Incremental Validity of the HML Factor in the Replication Model (H1) by Five Year Periods

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$

ΔR^2	S/H	S/M	S/L	B/H	B/M	B/L
1994-1999	0.110*	0.026*	0.007*	0.203*	0.049*	0.038*
1999-2004	0.332*	0.157*	0.002*	0.412*	0.250*	0.016*
2004-2009	0.074*	0.014*	0.006*	0.120*	0.011*	0.030*
2009-2014	0.059*	0.004*	0.010*	0.082*	0.006*	0.024*
2014-2019	0.076*	0.022*	0.027*	0.129*	0.016*	0.041*

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year $t-1$. Market equity was measured on Dec 31, $t-1$.
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July t to June $t+1$.
* $p<0.05$

As shown in Table 7, the relative contribution of the HML factor has changed greatly during the 15-year period. During the internet bubble, the HML factor was one of the largest components of explaining the variation in returns, especially in the high book-to-market (value) portfolios. There is no clear sustained pattern of strengthening or weakening across time although movements up and down are found across the six portfolios.

H2: HML Adjusted for Prepaid Stock Option Expense Asset

Table 8: Descriptive Statistics of Book Values used in the Replicated Fama-French 3-Factor Model (H1) and the Book Value adjusted for the Capitalization of Repurchased Shares used to fund Stock Options (H2)

	N	Mean (BV)	St. Dev (BV)	t(BV)
1994-2019				
H1	105,857	2,026	9,691	
H2	106,573	2,028	9,683	-0.04
1994-1999				
H1	22,858	483	2,006	
H2	23,212	482	2,007	0.04
1999-2004				
H1	22,490	957	3,816	
H2	22,692	971	3,878	-0.39
2004-2009				
H1	19,683	1,937	7,785	
H2	19,740	1,953	7,815	-0.20
2009-2014				
H1	17,825	3,046	12,243	
H2	17,866	3,054	12,254	-0.06
2014-2019				
H1	23,001	3,892	15,433	
H2	23,063	3,892	15,428	-0.01

Book equity (H1) was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* .

Book equity (H2) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus calculated pre-paid option expense at the end of fiscal year t-1.

Pre-paid option expense asset is calculated as the number of unexercised but outstanding stock options times the difference between the average price of repurchased shares - the average exercise price.

H2 evaluates the model with treasury stock costs capitalized as an asset to fund future share issuances to fulfill the exercise of stock options. Heightened correlations with share price would suggest the market appears to value share repurchases consistent with this logic.

	Treasury Stock Held for Equity Compensation	XXXX	
	Treasury Stock		XXXX
OR			
	Treasury Stock Held for Equity Compensation	XXXX	
	Common Stock		XXXX
	Retained Earnings		XXXX

This treatment resulted in an increase in the number of observations (106,573 compared to 105,857) because formerly negative book value companies shifted to positive because of the addition of the Treasury Stock Held for Equity Compensation asset. This resulted in very small changes in book value with the mean for the entire sample set increasing from $2,026 million to $2,028 million. The resulting recorded equity adjustments did not create statistically significant changes in mean book values according to a t-test, $t(212{,}416) = -0.04$, $p=0.969$.

Table 9: Descriptive Statistics of Book Equity-to-Market Equity ratios of the original Fama-French 3-Factor Model (H1) and the Book Value adjusted for the Capitalization of Repurchased Shar used to Fund Stock Options (H2)

	Entire Sample				High						Medium						Low					
	N	Mean	St. Dev	t-score	N	Mean	St. Dev	Min	Max	t-score	N	Mean	St. Dev	Min	Max	t-score	N	Mean	St. Dev	Min	Max	t-sco
1994-2019																						
H1	105,819	3.03	72.53		39,362	7.47	118.78	0.62	17942.17		36,274	0.56	0.14	0.2779	1.17		30,183	0.21	0.10	0.00	0.54	
H2	106,534	3.06	73.02	-0.09	39,811	7.52	119.32	0.62	17942.17	-0.05	36,334	0.56	0.14	0.2827	1.18	-4.16	30,389	0.22	0.10	0.00	0.54	-4.3
1994-1999																						
H1	22,854	3.10	89.95		8,296	7.88	140.87	0.62	10719.04		7,639	0.53	0.11	0.3095	0.80		6,919	0.22	0.10	0.00	0.43	
H2	23,207	3.22	87.17	-0.15	8,451	8.18	144.32	0.62	10719.04	-0.14	7,733	0.53	0.11	0.3160	0.80	-1.05	7,023	0.22	0.10	0.00	0.43	0.3
1999-2004																						
H1	22,484	4.76	126.83		8,856	11.43	201.92	0.75	17942.17		7,612	0.61	0.14	0.3457	0.91		6,016	0.21	0.11	0.00	0.46	
H2	22,686	4.76	126.28	0.01	8,957	11.37	200.79	0.75	17942.17	0.02	7,613	0.61	0.14	0.3534	0.92	-3.37	6,116	0.22	0.11	0.00	0.47	-3.7
2004-2009																						
H1	19,673	2.46	25.82		6,628	6.58	44.20	0.63	2072.52		7,043	0.50	0.09	0.3320	0.73		6,002	0.21	0.09	0.00	0.36	
H2	19,730	2.46	25.79	-0.02	6,681	6.55	44.03	0.63	2072.52	0.04	7,059	0.50	0.09	0.3359	0.73	-4.20	5,990	0.22	0.09	0.00	0.37	-3.4
2009-2014																						
H1	17,815	2.35	19.70		7,007	5.22	31.19	0.77	1300.71		5,873	0.66	0.17	0.39	1.17		4,935	0.26	0.12	0.00	0.54	
H2	17,856	2.36	19.68	-0.06	7,082	5.21	31.03	0.77	1300.71	0.02	5,866	0.67	0.17	0.39	1.18	-1.19	4,908	0.27	0.12	0.00	0.54	-1.9
2014-2019																						
H1	22,993	2.29	20.76		8,575	5.53	33.75	0.64	1164.59		8,107	0.50	0.13	0.28	0.87		6,311	0.18	0.08	0.00	0.34	
H2	23,055	2.29	20.74	-0.01	8,640	5.51	33.63	0.65	1164.59	0.04	8,063	0.51	0.13	0.28	0.87	-1.31	6,352	0.18	0.08	0.00	0.35	-1.5

Book equity (H1) was computed as the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year t-1.
Book equity (H2) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus calculated pre-paid option expense at the end of fiscal year t-1.
Pre-paid option expense asset is calculated as the number of unexercised but outstanding stock options times the difference between the average price of repurchased shares - the average exercis
Market equity was measured on Dec 31, t-1.
Portfolio buckets were created as high (top 30% of book equity to market equity), medium (middle 40% of book equity to market equity) and low (bottom 30% of book equity to market equity)

A small drop in sample set size (from 106,573 book values to 106,534 book-to-market values for H2) was the result of missing market values in the larger sample. While there were no statistically significant changes to the mean book-to-market in the entire sample, the addition of prepaid share repurchases to the book value resulted in some meaningful changes to the portfolios created by the Fama-French model in the later years of the sample. From 1999-2009, statistically significant changes are observed in the mean values in the low and medium portfolios. From 2009-2019, changes in all portfolios were statistically significant at the 90% threshold.

Table 10: Correlations and Paired T-Tests of Betas of Factors in replication of Fama-French 3-Factor Model (H1) vs. Book Value adjusted for the Capitalization of Repurchased Shares used to fund Stock Options (H2)

$$H1: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

$$H2: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(adj.\ HML_t) + \varepsilon_{jt}$$

	Correlation of β_{j3}	$t(\beta_{j3})$
1994-2019	0.997	-0.708
1994-1999	0.996	-0.743
1999-2004	0.998	-0.826
2004-2009	0.997	0.397
2009-2014	0.997	0.300
2014-2019	0.999	-0.037

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year t-1 . Market equity was measured on Dec 31, t-1 .

adj. HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year t-1 . Market equity was measured on Dec 31, t-1 .

The correlation between the HML Factor generated in H1 and H2 is almost perfect. Additionally, a paired t-test shows no statistical difference in the measured factors across all periods. The small difference is unlikely to generate a statistically significant change in the regressions.

Table 11: Results of regressions of monthly returns on six portfolio on excess market returns, size and book-to-market factors from July 1994 to June 2019 adjusting Book Value adjusted for the Capitalization of Repurchased Shares used to fund Stock Options (H2)

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$$

	β_{j1}			$t(\beta_{j1})$	
	Small	Big		Small	Big
High	0.97	1.02	High	106.11	64.85
Mid	0.95	0.99	Mid	71.82	55.59
Low	1.04	0.95	Low	69.10	98.60

	β_{j2}			$t(\beta_{j2})$	
	Small	Big		Small	Big
High	0.84	0.03	High	65.06	1.26
Mid	0.81	-0.14	Mid	43.60	-5.61
Low	1.05	-0.18	Low	49.19	-13.45

	β_{j3}			$t(\beta_{j3})$	
	Small	Big		Small	Big
High	0.74	0.79	High	57.26	35.79
Mid	0.45	0.39	Mid	24.16	15.55
Low	-0.24	-0.24	Low	-11.08	-17.41

	Adj. R^2			$s(\varepsilon)$	
	Small	Big		Small	Big
High	0.984	0.942	High	0.0065	0.0113
Mid	0.966	0.913	Mid	0.0094	0.0127
Low	0.973	0.974	Low	0.0108	0.0069

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

$adj.\ HML_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July *t* to June *t+1* .

R^2 and the standard error are adjusted for degrees of freedom.

Table 11 presents the multiple regression results of the Fama-French 3 Factor Model adjusted for the pre-paid stock option asset treatment of repurchased shares and six portfolios. The three factors continue to explain a significant portion of the variance of all six portfolios (ranging from a low of 0.913 for the big/medium portfolio to a high of 0.984 for the small/high portfolio). The market beta coefficient was statistically significant in all cases with a t-value range of 55.59 for the big/medium portfolio to a high of 106.11 for the small/high portfolio. The market beta coefficient value hovered near 1 for all portfolios. The SMB variable was statically significant for all portfolio at the 95% level except for the big/high portfolio (a proxy for large cap growth stocks). The coefficient for the SMB factor was large and positive for the small portfolios, but small and negative for the big portfolios suggesting that the factor does successfully capture the difference in the variation of returns by size. Finally, the HML factor was statically significant for all six portfolios. The coefficient was significant and positive for the high portfolios and went down incrementally, turning negative for the low portfolios. This relationship is consistent with the argument that HML captures the risk factor difference between the high book-to-market portfolios and low book-to-market portfolios. These results mirror the results of H1.

Table 12: Incremental Validity of the HML Factor Book Value adjusted for the Capitalization of Repurchased Shares used to fund Stock Options (H2)

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_t) + \varepsilon_{jt}$

	S/H 2 Factor	S/H 3 Factor		B/H 2 Factor	B/H 3 Factor
R^2	0.812	0.984	R^2	0.689	0.941
ΔR^2		0.171	ΔR^2		0.251
F		3278.372	F		1281.052
p-value		0	p-value		0

	S/M 2 Factor	S/M 3 Factor		B/M 2 Factor	B/M 3 Factor
R^2	0.899	0.966	R^2	0.842	0.913
ΔR^2		0.066	ΔR^2		0.071
F		583.716	F		241.834
p-value		0	p-value		0

	S/L 2 Factor	S/L 3 Factor		B/L 2 Factor	B/L 3 Factor
R^2	0.962	0.973	R^2	0.948	0.974
ΔR^2		0.011	ΔR^2		0.026
F		122.815	F		303.176
p-value		0	p-value		0

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July *t* to June *t+1* .
R^2 is adjusted for degrees of freedom.

The overall R^2 for the six portfolios, when compared to the original Fama-French model, are either higher or the same. However, the change in each case is near zero – with the largest change appearing in the big/high portfolio – with a difference in ΔR^2 0.016 between H1 and H2. While the overall R^2 did increase, the marginal improvement in the model is not from the adjusted HML factor. The incremental improvement from the smaller 2-factor (market beta and SMB) and the 3-factor model (market beta, SMB, and HML) declined or remained equal in all cases. In other words, the small improvement in overall explanatory power is a result of higher ΔR^2 in the SMB factor, likely due to the increase in the number of observations (healthy stocks with negative book values are concentrated in the "big" portfolios, which has significantly few observations). For example, for the big/medium portfolio, the overall R^2 improved 0.005, but the HML factor for H1 produced an incremental R^2 of 0.086, while the improvement in H2 is only 0.071.

Table 13: Incremental Validity of the HML Factor Book Value adjusted for the Capitalization of Repurchased Shares used to fund Stock Options (H2) by Five Year Periods

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$

ΔR^2	S/H	S/M	S/L	B/H	B/M	B/L
1994-1999	0.100*	0.022*	0.012*	0.149*	0.035*	0.034*
1999-2004	0.322*	0.151*	0.003*	0.423*	0.211*	0.014*
2004-2009	0.069*	0.013*	0.006*	0.119*	0.007*	0.025*
2009-2014	0.056*	0.004*	0.009*	0.080*	0.006*	0.025*
2014-2019	0.076*	0.021*	0.027*	0.129*	0.014*	0.039*

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML$_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July *t* to June *t+1* .
* $p<0.05$

The relative contribution of the HML factor adjusted for the prepaid stock option asset over 5-year increments continues to show the fluctuation in relative importance. The HML factor was clearly a large portion of explanatory power around the internet bubble burst of 2000. While the incremental improvement of the HML factor is weakest in the small/low portfolio – a proxy for small cap growth stocks -- (with a total ΔR^2 of 0.011 over the 25 year period), it is the most sustained incremental improvement over the original Fama-French HML Factor – increasing ΔR^2 in two out of five 5-year period and only reducing it once (from 0.010 in 2009-2014 for H1 to 0.009 for H2). As the widely accepted Fama-French 3 Factor Model is the default baseline, the lack of sustained explanatory power for our prepaid stock option asset suggests that our adjustment does not improve the original model. The ΔR^2 for H1's replicated original Fama-French 3-Factor Model (M=0.0784, SD= 0.1014) suggest that is statistically better than H2's 3-Factor Model adjusted for prepaid stock option asset (*M*= 0.0734, SD= .0981), t (29) = 2.26, p=0.0315. Thus, H2 is rejected.

H3: HML Adjusted for Capitalization of Internally Generated Goodwill

Table 14: Descriptive Statistics of Book Values used in the replication of the Fama-French 3-Factor Model (H1) and the Book Value adjusted for the Capitalization of Internally Generated Goodwill (H3)

	Entire Sample			
	N	Mean	St. Dev	T-Score
1994-2019				
H1	105,857	2,026	9,691	
H3	106,814	2,329	11,430	-6.60
1994-1999				
H1	22,858	483	2,006	
H3	23,208	480	2,001	0.15
1999-2004				
H1	22,490	957	3,816	
H3	22,727	1,056	4,438	-2.54
2004-2009				
H1	19,683	1,937	7,785	
H3	19,777	2,174	9,123	-2.78
2009-2014				
H1	17,825	3,046	12,243	
H3	17,914	3,405	14,106	-2.57
2014-2019				
H1	23,001	3,892	15,433	
H3	23,188	4,730	18,496	-5.29

Book equity (H1) was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* .

Book equity (H3) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus internally generated goodwill at the end of fiscal year t-1.

Internally generated goodwill is calculated as the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.

H3 adjusts the Fama-French 3-Factor Model for the percent of internally generated goodwill (market equity – book equity on Dec. 31, *t-1*) asset recognized by comparing the percent of shares repurchased to total shares issued.

Internally Generated Goodwill	XXXX	
Treasury Stock		XXXX
OR		
Internally Generated Goodwill	XXXX	
Common Stock		XXXX
Retained Earnings		XXXX

This treatment resulted in an additional 957 observations (106,814 compared to 105,857) due to formerly negative book value companies turning positive with the addition of the internally generated goodwill asset. The resulting mean of the sample set increased from \$2.0 billion to \$2.3 billion, a statistically significant increase, t (207,700) = -6.60, $p<0.001$. The change in means grew over time, with the average between 2004-2009 increasing a statistically significant \$237 million, t (38,559)=-2.78, $p<0.01$, and between 2014-2019 increasing \$838 million, t(44,873)=-5.29, $p<0.001$.

Table 15: Descriptive Statistics of Book Equity-to-Market Equity ratios of the original Fama-French 3-Factor Model (H1) and the Book Value adjusted for the Capitalization of Internally Generated Goodwill (H3)

	Entire Sample				High						Medium						Low					
	N	Mean	St. Dev	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)
1994-2019																						
H1	105,819	3.03	72.53		39,362	7.47	118.78	0.62	17,942.17		36,274	0.56	0.14	0.28	1.17		30,183	0.21	0.10	0.00	0.54	
H3	106,805	3.09	74.22	-0.20	38,607	7.79	123.31	0.62	18,486.01	-0.36	34,934	0.61	0.14	0.31	1.22	-53.43	33,264	0.25	0.12	0.00	0.63	-41.87
1994-1999																						
H1	22,854	3.10	89.95		8,296	7.88	140.87	0.62	10,719.04		7,639	0.53	0.11	0.31	0.80		6,919	0.22	0.10	0.00	0.43	
H3	23,208	3.22	87.16	-0.15	8,466	8.16	144.18	0.62	10,719.04	-0.13	7,715	0.53	0.11	0.31	0.80	-0.47	7,027	0.22	0.10	0.00	0.43	0.84
1999-2004																						
H1	22,484	4.76	126.83		8,856	11.43	201.92	0.75	17,942.17		7,612	0.61	0.14	0.35	0.91		6,016	0.21	0.11	0.00	0.46	
H3	22,727	4.80	129.59	-0.03	8,875	11.56	207.20	0.79	18,486.01	-0.04	7,353	0.65	0.14	0.39	0.95	-20.05	6,499	0.25	0.12	0.00	0.52	-16.08
2004-2009																						
H1	19,673	2.46	25.82		6,628	6.58	44.20	0.63	2,072.52		7,043	0.50	0.09	0.33	0.73		6,002	0.21	0.09	0.00	0.36	
H3	19,777	2.51	26.04	-0.21	6,289	7.03	45.85	0.69	2,091.12	-0.57	6,596	0.56	0.09	0.41	0.80	-43.01	6,892	0.26	0.11	0.00	0.44	-25.81
2009-2014																						
H1	17,815	2.35	19.70		7,007	5.22	31.19	0.77	1,300.71		5,873	0.66	0.17	0.39	1.17		4,935	0.26	0.12	0.00	0.54	
H3	17,923	2.41	19.83	-0.30	6,972	5.31	31.31	0.82	1,300.71	-0.16	5,387	0.74	0.16	0.47	1.22	-25.75	5,555	0.32	0.14	0.00	0.63	-23.55
2014-2019																						
H1	22,993	2.29	20.76		8,575	5.53	33.75	0.64	1,164.59		8,107	0.50	0.13	0.28	0.87		6,311	0.18	0.08	0.00	0.34	
H3	23,170	2.33	20.60	-0.19	8,005	5.96	34.97	0.74	1,164.59	-0.81	7,883	0.61	0.13	0.38	0.98	-50.69	7,291	0.23	0.11	0.00	0.47	-32.83

Book equity (H1) was computed as the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year t-1.
Book equity (H3) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus internally generated goodwill at the end of fiscal year t-1.
Internally generated goodwill is calculated as the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.
Market equity was measured on Dec 31, t-1.
Portfolio buckets were created as high (top 30% of book equity to market equity), medium (middle 40% of book equity to market equity) and low (bottom 30% of book equity to market equity).

Per the t-scores in Table 15, there are no statically significant changes between the mean book-to-market values of the entire sample between H1 and H3. However, changes to the low portfolios, t (63,126)= -41.871, $p<0.001$, and medium portfolios t (71,085)=-53.4255, $p<0.001$) did result in statically significant changes in the mean book-to-market values. Also, other than the high portfolios in 1999-2009, all portfolios had statically significant changes in mean book-to-market values after 1999.

Table 16: Correlations and Paired T-Tests of Betas of Factors in replication of Fama-French 3-Factor Model (H1) vs. Book Value adjusted for the Capitalization of Internally Generated Goodwill (H3)

$$H1: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

$$H3: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(adj.\ HML_t) + \varepsilon_{jt}$$

	Correlation of β_{j3}	$t(\beta_{j3})$
1994-2019	0.986	0.171
1994-1999	0.999	0.918
1999-2004	0.997	1.333
2004-2009	0.949	-0.918
2009-2014	0.965	0.158
2014-2019	0.978	0.453

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

adj. HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

The correlation between the HML Factor generated in H1 and H3 is very high, ranging from 0.949 in 2004-2009 to 0.999 in 1994-1999. The fluctuation in the correlation could be the result of the increased volume of share repurchases and the increased amount of internally generated goodwill over time. A paired T-test shows no statistically significant changes in the results by 5-year period.

Table 17: Results of regressions of monthly returns on six portfolio on excess market returns, size and book-to-market factors from July 1994 to June 2019 with the Book Value adjusted for the Capitalization of Internally Generated Goodwill (H3)

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$$

	β_{j1}			$t(\beta_{j1})$	
	Small	Big	High	Small	Big
High	0.979	1.011	High	100.58	67.56
Mid	0.970	0.944	Mid	88.12	52.20
Low	1.013	0.976	Low	66.41	91.52
	β_{j2}			$t(\beta_{j2})$	
	Small	Big		Small	Big
High	0.844	0.001	High	62.62	0.05
Mid	0.796	-0.144	Mid	48.08	-5.74
Low	1.027	-0.181	Low	48.57	-12.26
	β_{j3}			$t(\beta_{j3})$	
	Small	Big		Small	Big
High	0.735	0.746	High	53.74	35.47
Mid	0.378	0.430	Mid	22.43	16.92
Low	-0.265	-0.255	Low	-12.35	-16.98
	Adj. R^2			$s(\varepsilon)$	
	Small	Big		Small	Big
High	0.983	0.943	High	0.0068	0.0105
Mid	0.965	0.902	Mid	0.0099	0.0126
Low	0.974	0.972	Low	0.0107	0.0075

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year $t-1$. Market equity was measured on Dec 31, $t-1$.
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July t to June $t+1$.
R^2 and the standard error are adjusted for degrees of freedom.

Table 17 presents the multiple regression results of the Fama-French 3-Factor Model adjusted for the capitalization of internally generated goodwill and the six resulting portfolios. The three factors continue to explain a significant portion of the variance of all six portfolios (with an adjusted R^2 ranging from a low of 0.902 for the big/medium portfolio to a high of 0.983 for the small/high portfolio). The market beta coefficient was statistically significant in all cases with a range of $t\ (299) = 52.20$, $p<0.001$ for the big/medium portfolio to a high of $t\ (299) = 100.58$, $p<0.001$ for the small/high portfolio. The market beta co-efficient hovered near 1 for all portfolios. The SMB variable was statically significant for all portfolios at the 95% level, except the big/high portfolio. The coefficient for the SMB factor was large and positive for the small portfolios, but small and negative for the big portfolios suggesting that the factor does successfully capture the difference in the variation of returns by size. Finally, the HML factor was statically significant for all six portfolios. The coefficient was significant and positive for the high portfolios and went down incrementally, turning negative for the low portfolios. This relationship remains consistent with the argument that HML captures the risk factor difference between the high book-to-market portfolios (value stocks) and low book-to-market portfolios (growth stocks).

Table 18: Incremental Validity of the HML Factor with the Book Value adjusted for the Capitalizaiton of Internally Generated Goodwill (H3)

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_t) + \varepsilon_{jt}$

	S/H			B/H	
	2 Factor	3 Factor		2 Factor	3 Factor
R^2	0.813	0.983	R^2	0.702	0.943
ΔR^2		0.169	ΔR^2		0.24
F		2888.425	F		1257.957
p-value		0	p-value		0

	S/M			B/M	
	2 Factor	3 Factor		2 Factor	3 Factor
R^2	0.898	0.965	R^2	0.807	0.902
ΔR^2		0.067	ΔR^2		0.094
F		565.246	F		286.232
p-value		0	p-value		0

	S/L			B/L	
	2 Factor	3 Factor		2 Factor	3 Factor
R^2	0.960	0.974	R^2	0.946	0.972
ΔR^2		0.013	ΔR^2		0.027
F		152.579	F		288.347
p-value		0	p-value		0

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

adj. HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year *t-1*. Market equity was measured on Dec 31, *t-1*. The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July t to June $t+1$.

R^2 is adjusted for degrees of freedom.

The R^2 for the small/medium portfolio is the only measure unchanged from H1's replication of the Fama-French 3-Factor Model. However, the incremental R^2 dropped from 0.070 for H1 to 0.067 for H3. The R^2 for small/high, big/medium and big/low portfolios dropped less than 0.01, with incremental R^2 decreasing for the small/high and big/low portfolios, but actually increasing for the big/medium portfolio compared to H1. The remaining two portfolios showed improved R^2 results. The small/low portfolio saw a small increase in R^2 from 0.972 in H1 to 0.974 H3, with the incremental R^2 increasing from 0.010 to 0.013. The big/high portfolio also saw a small increase in R^2 from 0.942 in H1 to 0.943 in H3. However, the incremental contribution of the HML factor dropped from 0.267 in H1 to 0.240 in H3. These results are consistent with the findings of H2, and suggest that the added number of "big" observations improves the explanatory power of the SMB factor in the "big" portfolios.

Table 19: Change in R^2 with the addition of HML with Book Valueadjusted for the Capitalization of Internally Generated Goodwill (H3) by 5-year period.

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$

ΔR^2	S/H	S/M	S/L	B/H	B/M	B/L
1994-1999	0.106*	0.024*	0.008*	0.202*	0.036*	0.037*
1999-2004	0.347*	0.149*	0.003*	0.382*	0.288*	0.020*
2004-2009	0.054*	0.013*	0.015*	0.074*	0.020*	0.028*
2009-2014	0.056*	0.002*	0.013*	0.078*	0.003*	0.024*
2014-2019	0.047*	0.020*	0.033*	0.096*	0.012*	0.050*

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June
adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of
The six portfolios were created from the cross section of the SMB and HML factors. Monthly
* $p<0.05$

The relative contribution of the HML factor adjusted for the internally generated goodwill asset over 5-year increments continues to demonstrate the fluctuation in relative importance. The HML factor explains a large portion of the overall variance of the high and medium portfolios during the internet bubble years, although not as much as the original Fama-French model (for instance from 1999-2004, H1's ΔR^2 0.412 for the big/high portfolio compared to H3's 0.382). Incremental improvement of the HML factor continues to be the weakest in small/low portfolio but is also the most sustained incremental improvement over the original Fama-French HML Factor – increasing ΔR^2 in every 5-year periods. While marginal improvement is found in certain portfolios, the ΔR^2 for H3 (M= 0.075, SD= .100), is not statistically different from the replicated Fama-French 3-Factor model (M=0.078, SD= 0.101), t (29) = 1.30, p=0.201. Since there is not a statistically significant improvement over the baseline model, H3 is not supported.

H4: HML Adjusted for Hypothesized Cash-Acquisition Asset

Table 20: Descriptive Statistics of Book Values used in the replication of the Fama-French 3-Factor Model (H1) and the Book Value adjusted for the Cash Acquisition Value of Repurchased Shares (H4)

	N	Mean	St. Dev	T-Score
1994-2019				
H1	105,857	2,026	9,691	
H4	107,327	2,872	15,116	-15.40
1994-1999				
H1	22,858	483	2,006	
H4	23,225	487	2,016	-0.19
1999-2004				
H1	22,490	957	3,816	
H4	22,760	1,483	9,906	-7.47
2004-2009				
H1	19,683	1,937	7,785	
H4	19,902	3,457	16,869	-11.53
2009-2014				
H1	17,825	3,046	12,243	
H4	18,053	4,195	17,468	-7.22
2014-2019				
H1	23,001	3,892	15,433	
H4	23,387	5,073	21,386	-6.83

Book equity (H1) was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* .
Book equity (H4) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus value of net shares repurchased at the end of fiscal year t-1.
Value of net shares repurchased at the end of fiscial year t-1 is either the book value of treasury stock or the net share retired from t-1 to t-8 multiplied by the weighted average price of shares over the period.

H4 record the value of net repurchased shares as an asset rather than as contra-equity. The following is the journal entries.

Treasury Stock Asset		XXXX	
	Treasury Stock		XXXX
OR			
Treasury Stock Asset		XXXX	
	Common Stock		XXXX
	Retained Earnings		XXXX

The adjustment to book value for the cash value of repurchased shares had the largest impact of any hypothesis, increasing the number of positive book value observations to 107,327, a 1,470 increase in n. The resulting mean book value of the full sample set increased from \$2.0 billion to \$2.9 billion, a statistically significant increase, $t(183,165) = -15.40$, $p<0.001$. The average book value grew a statistically significant \$1.15 billion, $t(32,369) = -7.22$, $p<0.001$, between 2009 and 2014 and an even larger \$1.2 billion, $t(42,573) = -6.83$, $p<0.001$, between 2014 and 2019.

Table 21: Descriptive Statistics of Book-to-Market ratios of the original Fama-French 3-Factor Model (H1) and the BV adjusted for the Cash Acquisition Value of Repurchased Shares (H4)

	Entire Sample				High						Medium						Low					
	N	Mean	St. Dev	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)
1994-2019																						
H1	105,819	3.03	72.53		39,362	7.47	118.78	0.62	17,942.17		36,274	0.56	0.14	0.28	1.17		30,183	0.21	0.10	0.00	0.54	
H4	107,326	3.54	75.33	-1.58	41,627	8.37	120.81	0.63	18,622.20	(1.07)	36,587	0.65	0.18	0.32	1.51	-81.89	29,112	0.25	0.13	0.00	0.70	-41.03
1994-1999																						
H1	22,854	3.10	89.95		8,296	7.88	140.87	0.62	10,719.04		7,639	0.53	0.11	0.31	0.80		6,919	0.22	0.10	0.00	0.43	
H4	23,225	3.23	87.13	-0.16	8,320	8.32	145.45	0.63	10,719.04	(0.20)	7,801	0.54	0.11	0.32	0.82	-6.56	7,104	0.22	0.10	0.00	0.43	-1.86
1999-2004																						
H1	22,484	4.76	126.83		8,856	11.43	201.92	0.75	17,942.17		7,612	0.61	0.14	0.35	0.91		6,016	0.21	0.11	0.00	0.46	
H4	22,760	5.01	130.44	-0.20	8,838	12.13	209.14	0.78	18,622.20	(0.23)	7,939	0.68	0.17	0.36	1.12	-31.23	5,983	0.24	0.13	0.00	0.55	-13.86
2004-2009																						
H1	19,673	2.46	25.82		6,628	6.58	44.20	0.63	2,072.52		7,043	0.50	0.09	0.33	0.73		6,002	0.21	0.09	0.00	0.36	
H4	19,902	3.25	29.94	-2.80	7,330	7.99	48.97	0.83	2,072.61	(1.79)	7,159	0.64	0.13	0.41	0.97	-76.75	5,413	0.27	0.11	0.00	0.45	-29.23
2009-2014																						
H1	17,815	2.35	19.70		7,007	5.22	31.19	0.77	1,300.71		5,873	0.66	0.17	0.39	1.17		4,935	0.26	0.12	0.00	0.54	
H4	18,053	3.14	25.24	-3.33	7,733	6.51	38.30	0.95	1,881.27	(2.25)	5,726	0.84	0.21	0.48	1.51	-48.83	4,594	0.34	0.16	0.00	0.70	-27.03
2014-2019																						
H1	22,993	2.29	20.76		8,575	5.53	33.75	0.64	1,164.59		8,107	0.50	0.13	0.28	0.87		6,311	0.18	0.08	0.00	0.34	
H4	23,386	2.97	26.27	-3.10	9,406	6.72	41.14	0.77	1,275.77	(2.14)	7,962	0.62	0.15	0.35	1.00	-49.69	6,018	0.22	0.10	0.00	0.43	-26.71

Book equity (H1) was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* .
Book equity (H4) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus value of net shares repurchased at the end of fiscal year t-1.
Value of net shares repurchased at the end of fiscial year t-1 is either the book value of treasury stock or the net share retired from t-1 to t-8 multiplied by the weighted average price of shares over the period.
Market equity was measured on Dec 31, t-1.
Portfolio buckets were created as high (top 30% of book equity to market equity), medium (middle 40% of book equity to market equity) and low (bottom 30% of book equity to market equity).

The significant increase in the book values of many companies resulted in meaningfully higher average book-to-market value in all the medium portfolios and all the low portfolios except for 1994-1999. Additionally, the high portfolios from 2009-2019 also saw a statistically significant increase in the mean book-to-market values. The number of firms with a high book-to-market ratio increased significantly, while the number of firms in the low portfolios dropped in all cases except 1994-1999.

Table 22: Correlations and Paired T-Tests of Betas of Factors in replication of Fama-French 3-Factor Model (H1) vs. Book Value adjusted for the Cash Acquisition Value of Repurchased Shares (H4)

$$H1: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

$$H4: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_t) + \varepsilon_{jt}$$

	Correlation of β_{j3}	$t(\beta_{j3})$
1979-2019	0.851	1.164
1994-1999	0.997	-0.570
1999-2004	0.827	1.158
2004-2009	0.645	0.679
2009-2014	0.954	-0.628
2014-2019	0.901	0.109

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .
adj. HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscal year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H4 resulted in the lowest average correlation of any hypothesis with H1, at 0.851 for the 25-year period. However, the lower results are concentrated in a relatively short time – 2001 to 2006 when the July-June correlations were -0.21, -.027, 0.40, 0.34, -0.29, -0.27, respectfully. Starting in July 2006, the correlations quickly rebound. The t-test show that despite the lower correlation, the average return was not statistically different.

Table 23: Results of regressions of monthly returns on six portfolio on excess market returns, size and book-to-market factors from July 1994 to June 2019 adjusted for the Cash Acqusition for Repurchased Shares (H4)

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$$

	β_{j1}			$t(\beta_{j1})$		
	Small	Big		Small	Big	Big
High	0.963	1.049	High	108.35	52.48	52.48
Mid	0.918	0.993	Mid	79.08	52.47	52.47
Low	1.086	0.925	Low	55.91	85.17	85.17

	β_{j2}			$t(\beta_{j2})$		
	Small	Big		Small	Big	Big
High	0.837	-0.040	High	68.27	-1.46	-1.46
Mid	0.791	-0.185	Mid	49.38	-7.09	-7.09
Low	0.971	-0.174	Low	36.23	-11.63	-11.63

	β_{j3}			$t(\beta_{j3})$		
	Small	Big		Small	Big	Big
High	0.705	0.802	High	49.27	24.92	24.92
Mid	0.395	0.263	Mid	21.15	8.61	8.61
Low	-0.265	-0.229	Low	-8.46	-13.08	-13.08

	Adj. R^2			$s(\varepsilon)$		
	Small	Big		Small	Big	Big
High	0.985	0.912	High	0.0071	0.0146	0.0146
Mid	0.972	0.902	Mid	0.0085	0.0138	0.0138
Low	0.953	0.964	Low	0.0142	0.0079	0.0079

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July *t* to June *t+1* .

R^2 and the standard error are adjusted for degrees of freedom.

The Fama-French 3-Factor model adjusted for the repurchased shares cash acquisition asset has statistical significance for all three factors across all six portfolios. The market beta factor coefficients hovers near 1.0 but has a wider spread than the replicated Fama-French traditional model – with a range of 0.918 to 1.086 for H4 compared to 0.948 to 1.032 for H1. All market beta coefficients were statistically significant with a low t (299) = 52.47, $p<0.001$ for the big/medium portfolio to a high of t (299) = 108.35, $p<0.001$ for the small/high portfolio. All SMB coefficients were also statistically significant, with coefficients positive, averaging 0.866 for the small portfolios and -0.133 for big portfolios, supporting the factor's ability to distinguish differences based on size. The HML coefficient was statistically significant in all portfolios and with a step down in the value of the coefficients as the level of the book-to-market value decreased – arguing the factor successfully captures risk associated with valuation of the stock. The overall R^2 of the regressions shows a high level of explanatory power, ranging from 0.902 for the big/medium portfolio to a high of 0.985 for the small/high portfolio.

Table 24: Incremental Validity of the HML Factor with Book Value adjusted for the Cash Acqusition Asset (H4)

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$

	S/H 2 Factor	S/H 3 Factor		B/H 2 Factor	B/H 3 Factor
R^2	0.863	0.985	R^2	0.729	0.912
ΔR^2		0.122	ΔR^2		0.183
F		2427.999	F		620.987
p-value		0	p-value		0

	S/M 2 Factor	S/M 3 Factor		B/M 2 Factor	B/M 3 Factor
R^2	0.929	0.972	R^2	0.878	0.902
ΔR^2		0.042	ΔR^2		0.024
F		447.317	F		74.217
p-value		0	p-value		0

	S/L 2 Factor	S/L 3 Factor		B/L 2 Factor	B/L 3 Factor
R^2	0.941	0.953	R^2	0.943	0.964
ΔR^2		0.011	ΔR^2		0.021
F		71.607	F		171.08
p-value		0	p-value		0

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July *t* to June *t+1* .
R^2 is adjusted for degrees of freedom.

The re-sorting of the portfolios based on the adjustment for an asset reflecting amounts available for a future acquisition resulted in lower R^2 for the 3-factor model with only the small/medium portfolio increasing more than 0.001. Similarly, lower ΔR^2 are found for the HML factor, but the adjustment did lead to a significant increase in the R^2 for the 2-factor model (with just market beta and SMB). This is likely the result of the significantly higher number of "big" companies recognized in the adjusted model. For the small/high portfolio, the R^2 for the 3-factor model increased from 0.984 in H1 to 0.985 for H4, but the incremental R^2 from HML declined from 0.179 to 0.122. Instead, the 2-Factor model R^2 improved from 0.804 in H1 to 0.863 in H4. The data for the small/medium portfolio is similar. Total R^2 improved to 0.972 from 0.965, while the incremental R^2 declined from 0.070 to 0.042. The two-factor model's R^2 grew from 0.895 in H1 to 0.929 in H4. The small/low portfolio saw a decline in R^2 for both the two and three factor models, but the ΔR^2 increased from 0.010 in H1 to 0.011 in H4. The big/high and big/medium portfolio trends were similar, with an improvement in the 2-factor model, but slightly lower overall R^2 resulting in a lower ΔR^2 for the HML factor. Finally, the big/low portfolio saw declines in all metrics.

Table 25: Change in R^2 with the addition of HML Book Balue adjusted for the Cash Acqusition Asset (H4) by 5-year period.

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$

ΔR^2	S/H	S/M	S/L	B/H	B/M	B/L
1994-1999	0.104*	0.023*	0.008*	0.193*	0.037*	0.035*
1999-2004	0.255*	0.105*	0.001*	0.303*	0.032*	0.019*
2004-2009	0.019*	0.003*	0.009*	0.023*	0.004*	0.013*
2009-2014	0.036*	0.003*	0.008*	0.073*	0.001	0.022*
2014-2019	0.039*	0.016*	0.031*	0.068*	0.004*	0.028*

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .
The six portfolios were created from the cross section of the SMB and HML factors. Monthly value-weighted returns represent July *t* to June *t+1* .
* $p<0.05$

The relative contribution of the HML factor with book value adjusted for the cash acquisition of repurchased shares asset over 5-year increments continues shows different time periods of importance and strength between the portfolios. Incremental R^2 is lowest in the low book-to-market portfolios and grows as the book-to-market value increases. The adjusted HML factor does not explain as much of the overall variance of the high book-to-market and medium book-to-market portfolios during the internet bubble years as the replicated Fama-French model (for instance from 1999-2004, H1's ΔR^2 0.412 for the big/high portfolio compared to H4's 0.303. Overall, the ΔR^2 for H4 (*M*=0.051, SD= .074) is statistically worse than H1 (M=0.078, SD=0.101), t (29) = 3.26, *p*=0.0029. It lowers the overall explanatory power of the entire model and the incremental explanatory factor of HML in H4 relative to the baseline replicated original Fama-French 3-Factor model. Thus, H4 is not supported.

H5: HML Adjusted for Put Option Value of Share Repurchases

Table 26: Descriptive Statistics of Book Values used in the replication of the Fama-French 3-Factor Model (H1) and the Book Value adjusted for the Put Option Value of Treasury Shares (H5)

	Entire Sample			
	N	Mean	St. Dev	T-Score
2005-2019				
H1	56,454	3,110	12,794	
H5	56,500	3,133	12,839	-0.30
2005-2009				
H1	15,685	2,045	8,239	
H5	15,690	2,049	8,247	-0.02
2009-2014				
H1	17,805	3,040	12,243	
H5	17,815	3,064	12,312	-0.19
2014-2019				
H1	22,964	3,892	15,442	
H5	22,994	3,925	15,484	-0.23

Book equity (H1) was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* .

Book equity (H5) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black and Scholes model value of the put option to re-sell Treasury Shares at the end of fiscal year t-1.

By capitalizing the put option value of re-issuing treasury stock and adding it to book value, the mean book value of H5 increased by $22 million to $3,133 million, increasing the number of positive book value observations to 56,500, an increase in n of 46. Here is the journal entry to show the manipulation:

Treasury Stock Put Option	XXXX	
Treasury Stock		XXXX

The sample time for H5 is much shorter at only 14 years. Information needed to perform the Black-Scholes model to calculate the put option value was not disclosed until

FY2003/2004 depending on the company. The 70 basis point increase in the mean of the average book value is not statistically significant, t (112,951) = -0.30, p=0.382.

Table 27: Descriptive Statistics of Book-to-Market ratios of the original Fama-French 3-Factor Model (H1) and the BV adjusted for the Put Option of Treasury Shares (H5)

	Entire Sample				High						Medium						Low					
	N	Mean	St. Dev	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/ME)	N	Mean	St. Dev	Min	Max	t(BE/M
2005-2019																						
H1	56,454	2.28	21.66		20,865	5.49	35.40	0.63	2072.52		19,623	0.55	0.15	0.03	1.17		15,996	0.213	0.103	0.000	0.535	
H5	56,499	2.29	21.71	-0.03	20,914	5.49	35.46	0.63	18622.20	-0.003	19,477	0.55	0.15	0.28	1.17	-2.56	16,108	0.216	0.104	0.000	0.536	2.23
2005-2009																						
H1	15,685	2.20	24.82		5,323	5.76	42.39	0.63	2072.52		5,644	0.49	0.10	0.03	0.73		4,768	0.211	0.087	0.000	0.351	
H5	19,353	2.32	24.71	-0.01	5,334	5.76	42.62	0.63	2093.61	-0.003	6,843	0.49	0.17	0.33	1.17	-1.59	5,334	0.230	0.107	0.000	0.536	4.89
2009-2014																						
H1	17,805	2.35	19.70		7,003	5.23	31.20	0.77	1300.71		5,888	0.66	0.17	0.39	1.17		4,919	0.261	0.120	0.000	0.535	
H5	17,815	2.35	19.71	-0.02	7,012	5.23	31.19	0.77	1300.71	-0.096	5,854	0.67	0.17	0.39	1.17	-1.19	4,949	0.265	0.120	0.000	0.536	-1.68
2014-2019																						
H1	22,964	2.29	20.77		8,559	5.54	33.78	0.64	1164.59		8,096	0.51	0.13	0.28	0.87		6,310	0.177	0.084	0.000	0.622	
H5	22,993	2.29	20.78	-0.02	8,568	5.54	33.79	0.65	1164.59	-0.011	8,042	0.51	0.13	0.28	0.87	-2.30	6,384	0.181	0.085	0.000	0.435	-3.15

Book equity (H1) was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* .

Book equity (H5) was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at the end of fiscal year t-1.

Market equity was measured on Dec 31, t-1.

Portfolio buckets were created as high (top 30% of book equity to market equity), medium (middle 40% of book equity to market equity) and low (bottom 30% of book equity to market equity).

Small differences seen in the mean book-to-market ratios are nonetheless statistically significant for the full sample set in the medium and low portfolios, but not necessarily in each five-year increment. Overall, the adjustment of adding the put value of treasury shares did not move the book value mean of the entire sample in a statistically significant way $t\,(112{,}951) = -0.03$, $p=0.975$ or move the mean of any high portfolio.

Table 28: Correlations and Paired T-Tests of Betas of Factors in replication of Fama-French 3-Factor Model (H1) vs. Book Value adjusted for the Put Option value of Treasury Stock (H5)

$$H1: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$$

$$H5: r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_t) + \varepsilon_{jt}$$

	Correlation of β_{j3}	$t(\beta_{j3})$
2005-2019	1.000	-1.14
2005-2009	1.000	-0.43
2009-2014	1.000	-0.03
2014-2019	0.999	-1.28

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was computed by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1*. Market equity was measured on Dec 31, *t-1*.
adj. HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1*.

The relatively small size of the put option asset and small number of new observations makes this adjustment almost meaningless. The correlation between the HML factors for H1 and H5 is nearly perfectly positive. The t-score reveals no statistical difference between the factors of H1 and H5.

Table 29: Results of regressions of monthly returns on six portfolio on excess market returns, size factor and book-to-market factors from July 2005 to June 2019 adjusted for the Put Option Asset of Treasury Shares (H5)

$$r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$$

	β_{j1} Small	β_{j1} Big		$t(\beta_{j1})$ Small	$t(\beta_{j1})$ Big
High	0.954	1.054	High	93.58	51.75
Mid	0.983	0.985	Mid	71.76	60.95
Low	1.056	0.952	Low	56.70	85.41

	β_{j2} Small	β_{j2} Big		$t(\beta_{j2})$ Small	$t(\beta_{j2})$ Big
High	0.890	-0.025	High	47.14	-0.66
Mid	0.888	-0.122	Mid	34.99	-4.07
Low	0.970	-0.105	Low	28.13	-5.09

	β_{j3} Small	β_{j3} Big		$t(\beta_{j3})$ Small	$t(\beta_{j3})$ Big
High	0.656	0.753	High	37.42	21.50
Mid	0.252	0.167	Mid	10.71	6.01
Low	-0.289	-0.301	Low	-9.03	-15.71

	Adj. R^2 Small	Adj. R^2 Big		$s(\varepsilon)$ Small	$s(\varepsilon)$ Big
High	0.992	0.961	High	0.005	0.010
Mid	0.984	0.963	Mid	0.007	0.008
Low	0.972	0.979	Low	0.009	0.006

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML$_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1*.
The six portfolios were created from the cross section of the SMB and HML factors.
Monthly value-weighted returns represent July *t* to June *t+1*.
R^2 and the standard error are adjusted for degrees of freedom.

Table 29 shows the results of the multiple regression performed with the adjusted factors for the put option asset value related to treasury stock. The results are as expected and due to the time change (2005-2019 for H5 compared to 1994-2019 for the similar tables for the other four hypotheses), show the Fama-French 3-Factor model has a higher adjusted R^2 in recent times. The three factors together explained a significant portion of the variance of all six portfolios (ranging from a low of 0.961 for the big/high portfolio to a high of 0.992 for the small/high portfolio). The market beta coefficient was statistically significant in all cases with a range t (164) = 51.75, $p<0.001$ for the big/high portfolio to a high of t (164) =93.58, $p<0.001$ for the small/high portfolio. The market beta coefficient hovered near 1 for all portfolios. The SMB variable was statically significant for all portfolio at the 95% level except for the big/high portfolio. The coefficient for the SMB factor was large and positive for the small portfolios, but small and negative for the big portfolios suggesting that the factor does successfully capture the difference in the variation of returns by size. Finally, the HML factor was statically significant for all six portfolios. The coefficient was meaningful and positive for the high book-to-market portfolios and went down incrementally, turning negative for the low book-to-market portfolios. This relationship is consistent with the suggestion that HML captures the risk factor difference between the high book-to-market portfolios (value stocks) and low book-to-market portfolios (growth stocks).

Table 30: Incremental Validity of the HML Factor with the Book Value adjusted for the Put Option Asset of Treasury Shares (H5)

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$

	S/H 2 Factor	S/H 3 Factor		B/H 2 Factor	B/H 3 Factor
R^2	0.921	0.992	R^2	0.852	0.961
ΔR^2		0.07	ΔR^2		0.108
F		1400.256	F		462.085
p-value		0	p-value		0

	S/M 2 Factor	S/M 3 Factor		B/M 2 Factor	B/M 3 Factor
R^2	0.972	0.984	R^2	0.956	0.963
ΔR^2		0.011	ΔR^2		0.008
F		114.736	F		36.157
p-value		0	p-value		0

	S/L 2 Factor	S/L 3 Factor		B/L 2 Factor	B/L 3 Factor
R^2	0.958	0.972	R^2	0.949	0.979
ΔR^2		0.014	ΔR^2		0.03
F		81.482	F		246.817
p-value		0	p-value		0

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on
$adj.\ HML_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of
The six portfolios were created from the cross section of the SMB and HML factors. Monthly R^2 is adjusted for degrees of freedom.

Table 30 confirms that HML's addition to the model does improve its explanatory power by a statistically significant amount for each of the six portfolios, with ΔR^2 ranging from 0.008 for the big/medium portfolio to a high of 0.108 for the big/high portfolio. The results are almost identical for every portfolio, with a small difference noted in the big/medium portfolio. For that portfolio, the 3-factor R^2 increased from 0.959 in H1 to 0.963 in H5, but the ΔR^2 declined from 0.012 in H1 to 0.008 in H5.

Table 31: Change in R^2 with the addition of HML with Book Value adjusted for the Put Option Asset of Treasury Shares (H5) by 5-year period.

2 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \varepsilon_{jt}$

3 Factor Model: $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. HML}_t) + \varepsilon_{jt}$

ΔR^2	S/H	S/M	S/L	B/H	B/M	B/L
2005-2009	0.070*	0.012*	0.005*	0.113*	0.006*	0.022*
2009-2014	0.059*	0.004*	0.010*	0.084*	0.005*	0.025*
2014-2019	0.073*	0.021*	0.027*	0.124*	0.015*	0.040*

r_{jt} is the value-weighted monthly return of a designated portfolio.
r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.
r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.
SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).
adj. HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1* .
* $p<0.05$

The relative contribution of the HML factor adjusted for the hypothesized put option asset of treasury stock over 5-year increments shows small but meaningful contributions throughout all six portfolios from 2005 to 2019. Incremental R^2 is lowest in the medium book-to-market portfolios. However, the adjusted HML factor is not statistically different from the replicated Fama-French 3-Factor Model, which is the baseline. In a paired T-test of the ΔR^2 for H5 (M=0.040, SD= .038), the results are not statistically different from H1 (M=0.040, SD=0.040), t (17) = -1.4, p=0.176. Thus, H5 is not supported since it did not improve the explanatory power of the model.

H1: Replicated Fama-French 3-Factor Model

Since the replicated Fama-French model, representing the return of capital treatment of repurchased shares either was better or statistically equivalent to all other hypothesized treatments H1 is supported.

Industry-Level Data

Table 32a: Industry Level Adjusted R^2 for each hypthosis

H1 (Replicated Fama-French 3 Factor): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$

H2 (Fama French adjusted for Prepaid Stock Options): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t2}) + \varepsilon_{jt}$

H3 (Fama French adjusted for Internally Generated Goodwill): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t3}) + \varepsilon_{jt}$

H4 (Fama French adjusted for Cash Acqusition Asset): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t4}) + \varepsilon_{jt}$

H5 (Fama French adjusted for Put Option repuchased shares): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t5}) + \varepsilon_{jt}$

R^2 for each regression, all $p<0.001$ * notes $p < 0.05$ for HML variable, ** for $p < 0.01$ for HML variable

Food	994-2019	005-2019	014-2019
H1	44.6%**	57.8%	47.6%
H2	44.2%**	57.9%	47.7%
H3	45.8%**	58.0%	47.8%
H4	39.4%**	58.0%	47.8%
H5		57.8%	47.9%

Hshld	979-2019	005-2019	014-2019
H1	41.6%**	52.4%	43.0%
H2	41.4%**	52.5%	42.9%
H3	42.2%**	52.6%	42.4%
H4	39.7%*	52.6%	43.6%
H5		52.5%	42.9%

Cnstr	979-2019	005-2019	014-2019
H1	74.0%**	84.0%**	82.7%
H2	73.9%**	84.0%**	82.7%
H3	74.3%**	84.1%*	82.8%
H4	72.7%**	84.3%*	82.6%
H5		84.0%**	82.7%

Beer	994-2019	005-2019	014-2019
H1	27.8%*	44.3%	44.8%
H2	27.4%*	44.4%	45.0%
H3	29.1%*	44.1%	45.1%
H4	24.8%*	44.8%*	45.7%
H5		44.3%	44.9%

Clothes	994-2019	005-2019	014-2019
H1	52.7%**	60.1%	43.0%
H2	52.5%**	60.1%	42.9%
H3	53.0%**	60.1%	42.4%
H4	53.1%**	60.0%	43.6%
H5		60.1%	42.9%

Steel	994-2019	005-2019	014-2019
H1	67.7%**	67.8%	59.7%**
H2	67.7%**	67.8%	59.8%**
H3	67.7%**	67.7%	58.9%**
H4	67.4%*	68.0%	57.3%*
H5		67.8%	59.5%**

Smoke	994-2019	005-2019	014-2019
H1	14.2%**	28.0%	23.9%
H2	14.2%**	28.1%	24.2%
H3	14.7%**	28.2%	25.3%
H4	12.1%**	28.1%	25.2%
H5		28.0%	24.1%

Health	994-2019	005-2019	014-2019
H1	48.1%	63.9%**	71.1%**
H2	48.0%	64.0%**	71.1%**
H3	48.4%	63.9%**	69.1%**
H4	47.7%	63.8%**	76.2%**
H5		64.0%**	71.2%**

FabPr	994-2019	005-2019	014-2019
H1	75.4%**	79.8%	77.5%**
H2	75.4%**	79.8%	77.5%**
H3	75.5%**	79.8%	77.8%**
H4	75.6%**	80.1%	77.1%**
H5		79.8%	77.5%**

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, t greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

H1: HML $_t$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H2: adj. HML $_{t2}$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H3: adj. HML $_{t3}$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H4: adj. HML $_{t4}$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H5: adj. HML $_{t5}$ the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1* .

R^2 is adjusted for degrees of freedom.

Table 32b: Industry Level Adjusted R^2 for each hypthosis

H1 (Replicated Fama-French 3 Factor): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$

H2 (Fama French adjusted for Prepaid Stock Options): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t2}) + \varepsilon_{jt}$

H3 (Fama French adjusted for Internally Generated Goodwill): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t3}) + \varepsilon_{jt}$

H4 (Fama French adjusted for Cash Acqusition Asset): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t4}) + \varepsilon_{jt}$

H5 (Fama French adjusted for Put Option repuchased shares): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t5}) + \varepsilon_{jt}$

R^2 for each regression, all $p<0.001$ * notes $p < 0.05$ for HML variable, ** for $p < 0.01$ for HML variable

Carry	1979-2019	2005-2019	2014-2019
H1	62.1%**	74.1%	64.6%
H2	62.0%**	74.1%	64.7%
H3	63.0%**	74.2%	64.7%
H4	60.7%**	74.0%	64.3%
H5		74.1%	64.7%

Telcm	1979-2019	2005-2019	2014-2019
H1	64.9%	72.6%	58.0%
H2	65.0%	72.5%	58.1%
H3	64.8%	73.2%	59.0%
H4	65.1%	72.3%	55.0%
H5		72.6%	58.1%

Whlsl	1979-2019	2005-2019	2014-2019
H1	70.6%**	86.1%*	82.2%
H2	70.7%**	86.1%*	82.2%
H3	71.0%**	86.0%*	82.3%
H4	69.8%**	86.0%*	82.6%
H5		86.0%*	82.1%

Mines	1994-2019	2005-2019	2014-2019
H1	30.7%**	36.2%	28.9%*
H2	30.8%**	36.2%	29.1%*
H3	31.1%**	36.2%	28.7%*
H4	28.7%*	36.8%	25.7%
H5		36.2%	28.7%*

Servs	1994-2019	2005-2019	2014-2019
H1	85.8%**	84.0%**	84.0%**
H2	85.7%**	86.1%**	84.1%**
H3	85.9%**	86.3%**	84.9%**
H4	81.1%**	83.5%**	82.5%*
H5		86.2%**	84.1%**

Rtail	1994-2019	2005-2019	2014-2019
H1	59.9%	69.0%*	74.0%**
H2	59.9%	69.2%*	74.1%**
H3	60.0%	68.7%	73.9%**
H4	60.1%	68.3%	75.8%**
H5		69.0%*	74.1%**

Coal	1994-2019	2005-2019	2014-2019
H1	19.0%**	22.2%	12.1%
H2	19.0%**	22.2%	12.1%
H3	18.5%**	22.0%	9.9%
H4	18.1%*	22.5%	10.9%
H5		22.2%	11.8%

BusEq	1994-2019	2005-2019	2014-2019
H1	80.4%**	82.2%**	74.7%**
H2	79.7%**	82.0%**	74.6%**
H3	80.7%**	82.5%**	76.1%**
H4	72.1%**	78.1%	69.6%
H5		82.2%**	74.7%**

Meals	1994-2019	2005-2019	2014-2019
H1	50.9%**	63.4%	52.3%
H2	50.7%**	63.4%	52.4%
H3	52.1%**	63.1%	52.3%
H4	51.0%**	63.1%	52.7%
H5		63.4%	52.4%

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

H1: HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H2: adj. HML_{t2} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H3: adj. HML_{t3} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H4: adj. HML_{t4} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H5: adj. HML_{t5} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1* .

R^2 is adjusted for degrees of freedom.

Table 32c: Industry Level Adjusted R^2 for each hypthosis

H1 (Replicated Fama-French 3 Factor): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$

H2 (Fama French adjusted for Prepaid Stock Options): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t2}) + \varepsilon_{jt}$

H3 (Fama French adjusted for Internally Generated Goodwill): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t3}) + \varepsilon_{jt}$

H4 (Fama French adjusted for Cash Acqusition Asset): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t4}) + \varepsilon_{jt}$

H5 (Fama French adjusted for Put Option repuchased shares): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt} - r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t5}) + \varepsilon_{jt}$

R^2 for each regression, all $p<0.001$ * notes $p < 0.05$ for HML variable, ** for $p < 0.01$ for HML variable

Games	994-2019	2005-2019	2014-2019	Chems	1994-2019	005-2019	2014-2019	ElcEq	1994-2019	2005-2019	2014-2019
H1	64.8%**	69.8%	58.0%*	H1	68.4%**	77.3%	73.0%	H1	72.3%**	80.5%	81.6%
H2	64.7%**	69.8%	58.0%*	H2	67.9%**	77.3%	72.9%	H2	72.3%**	80.5%	81.6%
H3	64.7%**	69.8%	59.0%*	H3	68.5%**	77.3%	73.5%	H3	72.4%**	80.3%	81.9%
H4	65.1%**	69.8%	57.2%	H4	67.3%**	77.3%	72.7%	H4	72.4%**	80.6%	81.9%
H5		70.6%	58.1%*	H5		77.3%	73.0%	H5		80.5%	81.7%

Books	994-2019	2005-2019	2014-2019	Txtils	1994-2019	005-2019	2014-2019	Autos	1994-2019	2005-2019	2014-2019
H1	68.7%**	75.7%**	73.0%*	H1	57.2%**	60.6%**	72.6%	H1	60.8%**	68.1%*	68.7%*
H2	68.4%**	75.5%**	73.1%*	H2	56.4%**	60.3%**	72.5%	H2	60.7%**	68.0%*	68.7%*
H3	68.7%**	76.0%**	73.5%*	H3	56.8%**	60.4%**	73.2%	H3	61.2%**	68.2%*	68.8%*
H4	66.0%**	75.0%*	72.4%	H4	55.8%**	59.9%**	72.2%	H4	61.6%**	68.1%	69.3%**
H5		75.6%**	73.0%*	H5		60.6%**	72.6%	H5		68.1%*	68.6%*

Oil	994-2019	2005-2019	2014-2019	Paper	1994-2019	005-2019	2014-2019	Fin	1994-2019	2005-2019	2014-2019
H1	44.3%**	49.5%	62.0%**	H1	67.3%**	79.4%	75.0%	H1	85.1%**	87.1%**	84.0%**
H2	44.0%**	49.6%	62.0%**	H2	66.8%**	79.4%	75.0%	H2	85.0%**	87.2%**	83.8%**
H3	44.9%**	50.0%*	62.0%**	H3	68.1%**	79.5%	74.9%	H3	84.1%**	85.8%**	83.2%**
H4	38.7%**	48.4%	59.6%**	H4	65.8%**	79.3%	75.2%	H4	81.0%**	84.7%**	82.9%**
H5		49.5%	62.0%**	H5		79.4%	75.0%	H5		84.7%**	83.9%**

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

H1: HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H2: adj. HML_{t2} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H3: adj. HML_{t3} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H4: adj. HML_{t4} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H5: adj. HML_{t5} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1* .

R^2 is adjusted for degrees of freedom.

Table 32d: Industry Level Adjusted R^2 for each hypthosis

H1 (Replicated Fama-French 3 Factor): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt}-r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(HML_t) + \varepsilon_{jt}$

H2 (Fama French adjusted for Prepaid Stock Options): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt}-r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t2}) + \varepsilon_{jt}$

H3 (Fama French adjusted for Internally Generated Goodwill): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt}-r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t3}) + \varepsilon_{jt}$

H4 (Fama French adjusted for Cash Acqusition Asset): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt}-r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t4}) + \varepsilon_{jt}$

H5 (Fama French adjusted for Put Option repuchased shares): $r_{jt} - r_{ft} = \alpha_j + \beta_{j1}(r_{mt}-r_{ft}) + \beta_{j2}(SMB_t) + \beta_{j3}(\text{adj. } HML_{t5}) + \varepsilon_{jt}$

R^2 for each regression, all p<0.001 * notes p < 0.05 for HML variable, ** for p < 0.01 for HML variable

Util	1994-2019	2005-2019	2014-2019	Trans	1994-2019	2005-2019	2014-2019	Other	1994-2019	2005-2019	2014-2019
H1	31.5%**	33.4%	10.5%*	H1	66.3%**	73.5%*	71.8%	H1	60.0%**	75.8%**	76.0%**
H2	30.6%**	33.4%	10.5%*	H2	66.3%**	73.2%*	71.8%	H2	59.6%**	75.3%**	76.0%**
H3	31.3%**	33.5%	10.5%*	H3	67.0%**	73.4%*	72.2%	H3	59.8%**	75.2%**	77.4%**
H4	27.0%**	33.5%	10.6%	H4	67.4%**	73.5%*	71.2%	H4	58.5%**	72.9%**	72.9%*
H5		33.4%	10.5%*	H5		73.2%*	71.7%	H5		75.8%**	76.1%**

r_{jt} is the value-weighted monthly return of a designated portfolio.

r_{ft} is the monthly risk-free return proxied by the one-month Treasury bill, taken at the first day of the month.

r_{mt} is the value-weighted monthly return of all NYSE, AmEx, and NASDAQ stocks with at least two years of trading data and recorded book value.

SMB_t the difference in monthly, value-weighted returns of big stocks (market capitalization on June 30, *t* greater than the median of the NYSE listed firm) and small stocks (market capitalization below the median of the NYSE listed stocks).

H1: HML_t the difference in monthly, value-weighted returns of stocks ranked high (top 30% of book equity to market equity) and stocks ranked low (bottom 30% of book equity to market equity). Book equity was comuted by the book value of shareholder's equity minus any reported book value of preferred equity at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H2: adj. HML_{t2} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for pre-paid option expense to market equity) and stocks ranked low (bottom 30% of adjusted book equity for pre-paid option expense to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the number of unexercised but outstanding stock options times the difference between the average price of repurchased at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H3: adj. HML_{t3} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the capitalization of internally generated goodwill to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the percentage of repurchased shares to shares issued (in treasury stock for treasury stock reporters or over the past 8 years for retirement accounting) multiplied by the difference of market value at December 31 t-1 and book value in FY t-1.end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H4: adj. HML_{t4} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the cash acquisition value of repurchased shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the value of net shares repurchased at the end of fiscial year t-1 (either the book value of treasury stock or the net share retired from *t-1* to *t-8* multiplied by the weighted average price of shares over the period) at the end of fiscal year *t-1* . Market equity was measured on Dec 31, *t-1* .

H5: adj. HML_{t5} the difference in monthly, value-weighted returns of stocks ranked high (top 30% of adjusted book equity for the put option value of treasury shares to market equity) and stocks ranked low (bottom 30% of adjusted book equity for the put option value of treasury shares to market equity). Adjusted book equity was computed as the book value of shareholder's equity minus any reported book value of preferred equity plus the Black Scholes model value of the put option to re-sell Treasury Shares at market value at the end of fiscal year t-1. Market equity was measured on Dec 31, *t-1* .

R^2 is adjusted for degrees of freedom.

While the data for market-wide data suggests that none of the hypothesized treatments of repurchased shares dominate, industry-data shows a slightly different story. Using French's data for 30 industries (French, 2021), multiple regression for the five of the hypothesized treatments of share repurchases from 1994-2019, 2005-2019 and 2014-2019. For the 1994-2019 period, the HML factor was a non-statistically significant variable in 3 of the 30 industries across all hypotheses (Beer, Telecom, and Retail). From 2005-2019, HML was not statically significant in 16 of the 30 industries across all 5 hypotheses (Food, Smoke, Games, Chemicals, Clothes, Household, Steel, Fabrication Production, Electrical Equipment, Utilities, Coal, Mines, Carry, Telecom, Paper, and Meals). Finally, from 2014-2019, 16 industries were not statistically significant at the 5% level (Food, Beer, Smoke, Household, Clothes, Textiles, Chemicals, Electric Equipment, Construction, Carry, Coal, Telecom, Paper, Transportation, Meals, and Wholesale).

For most industries, the relative change in the explanatory power of the of various hypothesis varied minorly. However, for one industry in the most recent period, H4 (book value adjusted for the cash asset value of repurchased shares), dominated the other hypotheses. In the Health industry, the adjusted R^2 for the cash asset value of repurchased shares was 76.2%, compared to a range of 69.1% to 71.2% for the remaining hypothesis. The incremental R^2 for the HML variable was .133 from .628 for the two-factor regression (market beta and SMB) to .762 (market beta, SMB and HML). This is a significant improvement over the Fama-French 3-Factor replication when the two-factor model explained 62.7% of the variability of returns and the 3-Factor model explained 71.1% of the variability of returns, a change in R^2 of 0.086. As the Healthcare industry is one of the most active in the mergers and acquisition market with more than 12,000 acquisitions between 2014-2019 (Institute of Mergers, Acquisitions, and Alliances, 2021), the implication that share repurchases are treated like a cash-like asset is meaningful.

H4 also was noticeably better for the Auto and Retail industries in the most recent period. As the most active repurchasers of shares for both of these industries are “older technology” (brick and mortar for retail and combustion engines for auto), this is an interesting finding without an easy explanation.

Finally, both Books (mainly publishing companies) and the catch-all “Other” industry show more than 1% improvement under the capitalization of internally generated goodwill hypothesis H3 in the most recent period. Correspondingly, the asset treatment of repurchased shares (H4) is significantly worse in these cases as well.

Chapter 5: Discussion

Two Aspects of the Study

This study is relevant to both accounting and finance. From a finance perspective, this study explores the possibility that excessive share repurchase activity caused measurement problems in the HML factor within the Fama-French 3-Factor Model. More importantly, the study addresses how to correct the measurement problem. From an accounting point of view, this study serves to inform the question of market perception of treasury stock transactions, which should drive the accounting for the transaction. First, I will discuss the finance implications and results. Finally, I will discuss the accounting perspective.

The Variability of HML

The HML factor's influence on the explanatory ability of the Fama-French 3-Factor Model has fluctuated dramatically over the past twenty-five years. The factor is incrementally more critical in explaining value portfolios (high book-to-market portfolios) with an average incremental R^2 of 0.223 from 1994-2019 than growth portfolios (low book-to-market portfolios), which had an average incremental R^2 of .020 across the 25 years. HML's role in explaining portfolio returns fluctuated significantly, with a low of 0.031 from 2009-2014 across the six portfolios to a high of 0.194 during 1999-2004. The dot-com bubble and its subsequent recovery resulted in vastly different returns between growth and value companies, and the HML factor became highly influential in explaining the resulting returns. These results show that the HML factor is necessary to explain the difference between value and growth companies.

HML and Share Repurchases

Unlike dividends, which come with an implicit promise to continue and can signal maturation of the company's growth prospects, share repurchases are a more flexible form of returning cash to shareholders. Share repurchases are widespread across both value and growth stocks. In 2018, 53% of all companies and 89% of the S&P 500 engaged in share repurchase activity (Zeng & Luk, 2020). Additionally, based on Standard & Poor's buyback index and its labeling style methodology, value stocks tended to be only slightly more active in repurchasing shares – representing on average 56% of the index between 1996 and 2020 (Zeng & Luk, 2020).

For the Fama-French method of distinguishing style (book-to-market equity), share repurchases manipulate book value which can cause “value” companies to be viewed by the model as “growth” companies because of the reduced book equity. High volumes of share repurchases lower the book value. Indeed, the model becomes irrelevant if companies repurchases shares and take recorded book value to negative. In the S&P 500, 23 stocks have negative book value (S&P, 2021). These stocks will be eliminated from the portfolios necessary to create the factors. The negative book value list is dominated by value, retail-based companies with low growth prospects. They generate significant cash and have extensive undervalued real estate holdings on their balance sheets (companies like McDonald's, Starbucks, and Home Depot) and are not the "financial distressed" companies that Fama and French eliminated (Fama & French, 1993). While this hurts the "n" related to creating the factors, the companies that buy back significant quantities of shares and maintain a "near" zero book value are mislabeled in the Fama-French factor. This study's results did not find a consistent improvement in the R^2 in any hypothesized treatments. However, instances of improved results suggest that the book value manipulation of share repurchases affects the HML factor's ability to explain returns in all cases. As share repurchases continue to grow, especially considering the near-zero cost of borrowings and the acceptance by the market of negative shareholder's equity, the quantitative approach of proxying value and growth will likely continue to get worse. However, this research was unable to find a silver bullet to find consistent improvement in the metric.

Due to the 30% and 70% breakpoints in HML, many of the manipulations changed a company's book value, but did not change their style portfolio. The "error" of labeling value stocks as growth stocks did not dominate the changes in the style portfolios. Since all manipulations would have only increased book value, negative book value companies could go into any of the three portfolios (growth, neutral, or value). Growth stocks (low book-to-market) could be moved into the neutral or value portfolios. Neutral stocks could tip over into value. Finally, value stocks would not move portfolios despite the adjustment.

Therefore, if the majority of the "error" was value stocks masquerading as growth stocks, we should observe the changes in book value, thus increasing the number of high book to market (value) stocks and reducing the number of growth (low book to market companies). However, the dominating move was bringing more companies into the sample set across the spectrum of all styles. As shown in Table 33, the percentage of stocks in each portfolio is not consistently changing, partially due to the breakpoints' moving target.

Table 33: Percent of observations in HML style portfolios

1994-1999	High	Medium	Low
H1	36.3%	33.4%	30.3%
H2	36.4%	33.3%	30.3%
H3	36.5%	33.2%	30.3%
H4	35.8%	33.6%	30.6%

1999-2004	High	Medium	Low
H1	39.4%	33.9%	26.8%
H2	39.5%	33.6%	27.0%
H3	39.1%	32.4%	28.6%
H4	38.8%	34.9%	26.3%

2004-2009	High	Medium	Low
H1	33.7%	35.8%	30.5%
H2	33.9%	35.8%	30.4%
H3	31.8%	33.4%	34.8%
H4	36.8%	36.0%	27.2%
H5*	27.6%	35.4%	27.6%

2009-2014	High	Medium	Low
H1	39.3%	33.0%	27.7%
H2	39.7%	32.9%	27.5%
H3	38.9%	30.1%	31.0%
H4	42.8%	31.7%	25.4%
H5	39.4%	32.9%	27.8%

2014-2019	High	Medium	Low
H1	37.3%	35.3%	27.4%
H2	37.5%	35.0%	27.6%
H3	34.5%	34.0%	31.5%
H4	40.2%	34.0%	25.7%
H5	37.3%	35.0%	27.8%

*Data from 2005-2009 when the sample set for H5 begins
Style portfolios were created as high (top 30% of book equity to market equity), medium (middle 40% of book equity to market equity) and low (bottom 30% of book equity to market equity).

H1: Return of Capital

The traditional accounting method suggesting that repurchased shares are a permanent return of capital is a struggle for practitioners to accept. Despite nearly 90% of firms in the S&P 500 having active repurchase programs in 2019, weighted average share counts have increased every other year for the last 20 years (Bloomberg, 2020b). There appears to be nothing permanent about the return of capital – with acquisitions being the primary reason for the increases, followed by stock compensation. Nevertheless, it has some significant advantages. This form of accounting can be applied to both treasury and retired shares with equal impact; it is reliable, objective, and verifiable; finally, there is no use of estimates in the figures. In today's world of financial engineering, firms have taken share buybacks to the extreme, returning capital that was never recorded (resulting in negative book value). The billions of dollars used in this form of shareholder returns have attracted political attention. For example, Senators Elizabeth Warren and Bernie Sanders have advocated banning or significantly curtailing the activity.

Surprisingly, despite the practical problems with the accounting method, the manipulation has not gotten to a point where it has impaired the distinction of value vs. growth in the Fama-French 3 -Factor model. The replication of the original methodology resulted in either higher or statistically similar explanatory results each time compared to a diversified portfolio.

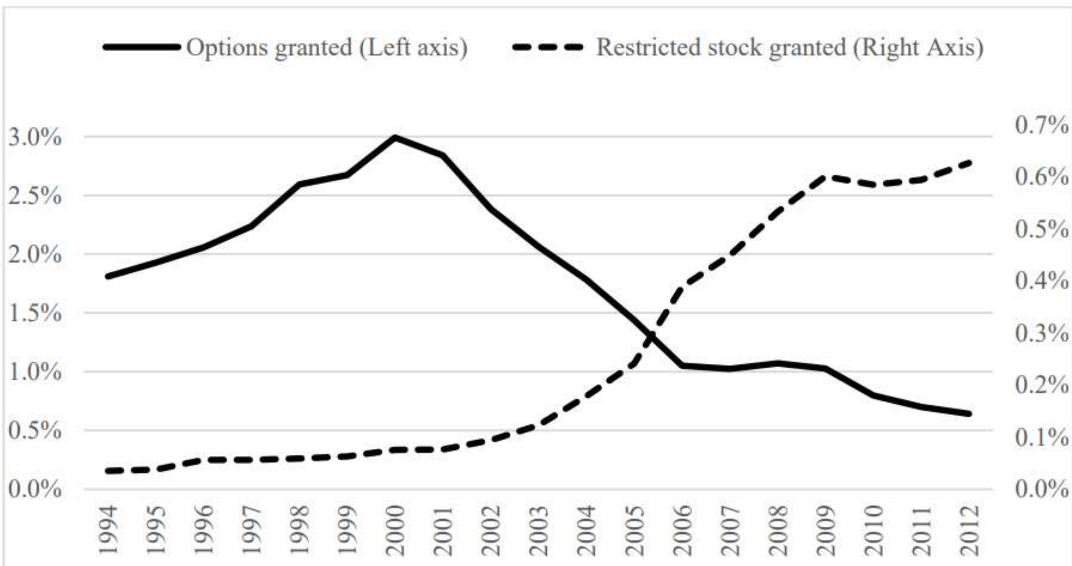
Brick-and-mortar retail is a mature industry that has seen large share repurchases. Retail stocks account for about half of the 23 negative shareholder equity firms in the S&P 500. This industry becomes a sample of convenience for examining the philosophy behind accounting for share repurchases. Of course, the artificially small accounting capital (book value) relative to market-based capital (stock price) will continue to be a problem.

H2: Stock Option Evidence

Due to data limitations, this study only uses stock options for its equity-based compensation hypothesis. However, over time, stock options have become less relevant. Sammer (2014) explained stock options as a form of performance-based compensation have declined in popularity over time, overtaken by whole share forms like restricted stock and performance-based stock. Bonaimé, Kahle, Moore, and Nemani (2020) hand-collected data to show the drop in stock options and rise in whole-share compensation units, as shown in Figure 1. As the logic applied to stock options (share repurchases are used as a tool to offset compensation-based issuance) extends to whole-share costs, these should have been incorporated into the analysis in the ideal case. Based on the impact of the number of shares awarded, this study likely under-counted the impact of pre-paid stock compensation expense by more than half. Consequently, significant limitations were placed upon the information, to be gained by the value of the adjustment.

Figure 1: Stock-based compensation grants collected by Bonaime, Kahle, Moore, and Nemani (2020, p. 40)

"Annual average restricted stock and option grants, scaled by the number of shares outstanding, from 1994 to 2012 for our sample of 1,000 firms (Bonamie et al., 2020, p.40)."



Differentiated results of this adjustment were almost non-existent. Young technology companies tend to be the most generous with stock-based compensation, but due to their insatiable need for cash to fuel growth, they are also the least likely to repurchase shares. More mature companies use share repurchases to fund stock options and restricted stock grants. However, the difference, likely more than cut in half, was not so significant as to easily force a low book-to-market ratio stock to become a high book-to-market stock. Consequently, while H2 was not supported, the question lingers, nevertheless. Accounting for the repurchase of shares and the issuance of those shares for compensation continues to be disconnected.

H3: Internally Generated Goodwill

Return on equity is designed to help measure a company's capital allocation decisions. However, excessive share repurchases and the disconnect between historical value-based and market-value-based assessments have allowed companies to register a "return of capital" of capital it never recorded. Recording the repurchase of shares as a return of capital at market value lowers the book value of the remaining shares and distorts capital allocation assessment. As a result, users of financial data often turn to "invested capital" or "tangible invested capital" to assess a company's use of resources. Nevertheless, if a company uses the same cash to buy the shares of a separate legal entity, it gets to recognize the difference between the book value and the market value of the assets acquired as goodwill. The internally generated goodwill hypothesis attempts to level these two similar transactions and leaves a permanent record (rather than one hidden through the selective retirement of shares) for users of the financial statements to assess management's capital allocation decisions.

While the internally generated goodwill was not a universal improvement over the traditional Fama-French model, this treatment showed a stronger (i.e., less than 0.001) difference in ΔR^2 in portfolios with a low market-to-book ratio. This is evidence that some value stocks are tainting the growth stock portfolios. One commonly accepted definition of "growth stocks" is firms whose growth opportunities outweigh their ability to generate funding internally. In other words, growth stocks are a consumer of capital, not a generator of it. Companies labeled traditionally as growth stocks tend to be in markets like technology, financial services, and business services where the physical asset bases shown on the balance sheet (and reflected in book value) are much smaller than the company's market value. This would suggest these types of companies would likely show a significant change in their book values if internally generated goodwill is capitalized. However, since the mechanism employed in this study is share repurchases, and growth companies have greater demands on their capital than the repurchasing of shares, most will remain low book-to-market companies. The slight improvement in the explanatory power of the adjusted Fama French model for growth portfolios suggests that some value companies may have been masquerading as growth before the adjustment. The internally generated goodwill adjustment had a higher R^2 from 2014-2019 for 19 of the 30 industries versus the original Fama-French treatment. However, its improvement was typically slight. The most significant improvements can be seen in the Business Equipment and Services industries – both of which house technology-based growth stocks.

Interestingly, this adjustment performs significantly worse in the same fields where the Cash Value of Repurchased Shares works much better (and vice versa). Returning to the example of the Business Equipment and Services industries, while the internally generated goodwill treatment results in the highest R^2 for the 2014-2019 period, the cash value of repurchased shares drops significantly. Moreover, it is not statistically significant in the Business Equipment field and only significant in the Services industry for $p<.05$. This suggests that it is the capture of goodwill and not the full dollar value of money spent that is lending strength to the explanatory power of the model. On the flip side, the Health industry is better explained by the cash-value of acquisitions than the internally generated goodwill treatment, with a 76.2% R^2 for the cash value and a 69.1% R^2 for the goodwill treatment. This is solid evidence that the market is more nuanced in its beliefs than a single accounting treatment for share repurchases would suggest. In other words, the market does not necessarily treat repurchased shares as a permanent return of capital.

H4: Cash Acquisition Asset

GAAP treatment of repurchased shares was debated well into the 1970s. The current return of capital method treatment of share repurchases was rapidly adopted when the IRS proposed taxing companies on gains from buying back and subsequently re-issuing their own stock. By treating it as a return of capital, and its subsequent re-issue as a new capital raise, no taxes were incurred (Horwitz & Young, 1975). The current method completely ignores future use. However, treasury shares are routinely re-issued for compensation and acquisition. Jenkins & Ovtchinnikov (2010) found that when a company used treasury stock to make an acquisition, the market reaction was similar to cash-based rather than newly issued share-based acquisitions. An argument can be made that, although fungible, the market perceived the treasury stock as worth more than the newly issue stock because a concreate financial transaction occurred to value the treasury stock, and management may have shown greater capital allocation discipline in line with Jensen's agency theorem (1986).

Results from this hypothesis were significantly worse overall. The market, for the most part, does not treat share repurchases as assets. However, there was one major exception. The “Health” industry had a significantly higher R^2 than any other treatment from 2014-2019. This period in the Health industry was characterized by significant acquisitions coupled with relatively low repurchase activity (when compared to other sectors). Consequently, this result suggests that investors are willing to treat repurchased shares as a temporary holding to be used later for acquisitions. A quick study of the health sector members of the S&P 500 showed that weighted average share counts increased in 46% of companies in the sector during the five years studied due to acquisition (Bloomberg, 2021b).

H5: Put Option Hypothesis

With so many options available for the use of treasury shares, the recording of a put-option value as an asset would appear to be the logical compromise to all the aforementioned treatments of repurchased shares. It does not require any single use; retired shares would reduce the put option value; and it would be the closest estimate of the economic cost of repurchasing shares with the power to either benefit or punish managers for poor market timing. However, this hypothesis never improved explanatory value over the original Fama French model. Most of the time, the adjustment did not make a significant difference in the book value of companies. It may be because the adjustment is not big enough. To wit, approximately 20 companies represented more than half of the repurchased shares in 2018 and 2019 (S&P, 2020), suggesting any changes would have only affected relatively few observations. Additionally, this required the use of the "treasury stock" rather than "retirement" method of accounting – further reducing its impact. In the end, the adjustments were just too small to make a difference. While this alternative treatment of repurchased shares has the benefit of being able to be consistently applied and does not require an auditor to presume what a company would do with the shares, no evidence was found to support it.

Study Limitations

There are several potential limitations to this study. First, this study employed the Fama-French 3-Factor model to explain stock market returns. While this is a well-known and accepted method, the required division at the 30% and 70% breakpoints of the HML factor may not have been sensitive enough to detect the methodologies' differences. Like a residual income-based model, other models, where book value is a more sensitive input, may show different results.

Additionally, this study relied on CUSIP matching rather than CCM matching to create the Fama French factors. This reduced the "n" by a statistically significant amount. Using a more precise matching method may result in different results.

For the second hypothesis, this dissertation could only obtain information about stock options rather than all stock-based compensation. This likely reduced the impact of the adjustment by more than half its actual implication. Additionally, due to disclosure, stock options could not match with their repurchased shares each year they were issued but instead were clumped together at year-end pricing.

To optimally identify internally generated goodwill and the cash acquisition asset, the repurchased shares' timing would need to be more precise than this dissertation was able to do. While quarterly data of the amount and price paid for repurchased shares are available in 10-Ks and 10-Qs, this data was not available in CompStat. Consequently, this dissertation had to use a proxy of the average share price during the year and re-price the entire amount of treasury shares or eight years of net retired shares each year. In contrast, a multi-year approach would have reflected the projected treatment more accurately.

Future Studies

Given the continued high explanatory ability of the unaltered Fama-French 3-Factor Model, we conclude that share repurchases have not yet impaired its ability to explain variabilities in returns. However, there is evidence that the model is missing some potential explanatory power. While the differences are usually relatively small over the entire sample set (1994-2019), the original Fama-French model had the highest explanatory power in 9 of the 30 industries, but that has dropped to 3 of 30 in the most recent five year period. It is possible that this study is too early in the cycle to see the ultimate deterioration of the Fama-French 3-Factor Model's explanatory power.

One interesting implication that warrants future study is the SMB factor's improvement under several of the hypothesized treatments. This study often noted that total R^2 remained steady or declined, but R^2 for a two-factor model of just market beta and the SMB factor improved. This phenomenon may result from fewer "big" companies being excluded from the same set because of negative book value. A study separating the creation of the SMB and HML factors should be considered.

Additionally, there may be alternative methods that are not subject to the account vagaries of share repurchases to isolate the growth vs. value stock returns that HML is supposed to proxy. Potential substitutions could be a Market Value to Enterprise Value approach or a free cash flow-based approach to identify nets users or generators of capital.

The use of share repurchases has escalated far beyond the level when most of the research surrounding the signaling effects and market timing of the purchases was conducted. Has management behavior and market reaction changed as share repurchases become ever more extensive?

Finally, based on logic, recognizing a put-option value of repurchased shares would seem to be the most robust economic cost argument. This author could not find any evidence of this model in academic or practitioner literature and should be studied.

Conclusion

Like many things, the answer to the fundamental question, “how does the market think about share repurchases?” is “it depends.” The market seems to recognize multiple reasons to repurchase and re-issue shares. It is more nuanced in its thinking than a blunt object like the Fama-French 3-Factor Model can tease out. However, the possible recognition of internally generated goodwill and the cash-like asset treatment of treasury shares may result in higher explanatory power as more and more companies leverage their balance sheets to new heights.

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