Deep into Negative Territory: Who Negative Book Equity Stocks Are and Their Risk-Return Implications

Abstract

The common practice in asset pricing modeling is to omit negative book equity stocks from the data samples. This creates a paradox; if we interpret the value premium as a proxy for distress risk, it makes no sense to exclude these negative book equity stocks since they are, prima facie, most prone to distress risk. This paper extends the risk-based interpretation of the value premium by incorporating negative book equity stocks into the study. It begins with an investigation of the nature of negative book equity stock and follows with a study of their relationship to distress risk and returns. We find that negative book equity stocks do carry higher default risks than their positive book equity counterparts. However, whether the higher risks are compensated by higher returns is conditional on firm size and book-to-market ratio. Our findings further confirm that book-to-market ratio acts as a proxy for default risk not only for positive book equity stocks, but for negative book equity stocks as well.

1 Introduction

The common practice in asset-pricing modelling is to omit negative BE stocks from the data samples used in their estimation. Fama and French exclude negative BE firms because they "*are rare before 1980*" (Fama and French (1993), p. 8). Because of their influence, others follow suit. Chui and Wei (1998) state that the exclusion of negative BE stocks "*is a requirement that one generally finds in previous research on book-to-market equity*" (p. 280). Although it is practised commonly, not everyone is silent on why they should be excluded in the first place. Davis, Fama, and French (2000) report that "*it should be noted that no firms in the sample has a negative book value of equity. Accordingly, the treatment of negative book values is not an issue in this study*" (p. 1583). They argue that because they omit negative BE stocks they do not have to worry about them. They do not elaborate on their reasons for omitting them and what the right treatment is for them.

Superficially, there are strong grounds for such omission. Part of the reason is the belief that such stocks are too few to influence any modelling outcomes (Fama and French (1993)). Another reason is that negative BE has no intuitive interpretation (Collins, Pincus, and Xie (1999)), since limited liability means that shareholders cannot have negative value. Further, negative BE stocks also have no intuitive interpretation in terms of "value". If high (low) BE/ME stocks represent value (growth) stocks respectively, what do these negative BE/ME stocks represent?

We believe that the omission of negative BE stocks is a mistake. Firstly, indeed, negative BE stocks were rare prior to 1980. However, since the mid-1980s, their numbers have gradually increased and stabilised to approximately 5% of all traded stocks (Brown, Lajbcygier, and Li

(2008), Givoly and Hayn (2000)). Their sheer number warrants a study in their own rights. On top of that, negative BE stocks are genuinely expected to constitute a much greater percentage of stocks that fall into the extremes of the value-growth spectrum. Consequently, these stocks inevitably exert significant influence on any value-based asset pricing models, such as Fama-French-three-factor model (FF3). However, they are arbitrarily excluded. Subsequently, such omission in the FF3, and other value-based models for that matter, creates a paradox. Fama and French advocate a risk premium-based explanation for the value premium anomaly (e.g. value stocks earn higher returns than growth stocks). They postulate that that value stocks are those firms that are in financial distress and vulnerable to bankruptcy, and suggest that BE/ME acts as a proxy for default risk. As a result, higher BE/ME stocks are associated with greater risk and hence risk premiums are required by the investor to bear these risks. Following this argument, a paradox becomes apparent. Stocks' book equities can become negative if they experience persistently negative earnings (Fama and French (1992)). Consequently, these stocks represent those that are potentially most distressed. Thus, how can these distressed negative BE stocks be excluded from the value premium estimation where the value premium is interpreted to represent default risk?

Following the FF3, most value-based empirical research in accounting and finance excludes negative BE stocks (e.g. Griffin and Lemmon (2002), Vassalou and Xing (2004)). Chan, Hamao, and Lakonishok (1991) is one of the few studies that includes negative BE stocks, but arbitrarily group them into the lowest value category due to practical reasons - these stocks cannot be readily accommodated in the conventional method of sorting stocks into portfolios according to their BE/ME values. We believe that it is also a mistake. There are many potential causes to a firm to have negative book equity. For instance, one potential cause can be accumulated negative retained earnings. Negative book equity can also occur when start-up

firms who do not have substantial tangible assets but rich in patents or new ideas "eat" into their equity. Negative book equity can also occur with firms being involved with bad debts which have to be written off. Therefore, negative BE stocks are not homogenous asset category and they differ markedly with regard to their risk and return characteristics. Given this, grouping these stocks together in one category would "homogenise" these stocks in a fashion that is too simplistic that it would mask their unique characteristics. Moreover, grouping negative BE stocks together into the lowest BE/ME ratio also creates a dilemma. This is because stocks in the bottom BE/ME ratio represent growth stocks. This implies that negative BE stocks are growth stocks with higher past earnings and the higher earning growth potential. However, many of the negative BE stocks are the most financially distressed, which implies that they should belong to the value. Consequently, it is mistaken to arbitrarily group these negative BE stocks into any particular BE/ME category.

Further, a few recent studies (Brown, Lajbcygier, and Li (2008) and Jan and Ou (2012)) find that the new value premium with inclusion of negative BE stocks is significantly different from the old value premium with exclusion of them. Their finding highlights the importance of inclusion of negative BE stocks in the modern asset pricing modelling.

The combination of the above factors makes it apparent that the days that researchers are accustomed to conducting their studies and drawing conclusions in the absence of or with little attention paid to negative BE stocks are over. This is not only due to the increasing weight of negative BE stocks, but also owing to the fact that the current debate about the interpretation of the value premium anomaly is restricted to positive BE stocks only. Therefore, an investigation of negative BE stocks, their role in the value premium debate in the precinct of default risk and return in a manner that negative BE stocks are assessed in their

own rights, parallel with their positive BE counterparts, is urgently needed. This motivates this research.

The remainder of the paper proceeds as follows. Section 2 discusses the data. Section 3 investigates the nature of negative BE stocks. Section 4 incorporates negative BE stocks into the investigation of the validity of risk based explanation for the value premium in terms of default risk and return. Finally, Section 5 concludes.

2 Data

In this section, the book equity is firstly defined. Then the dataset details are followed. The period of our study is discussed and concludes the section.

2.1 Definition

Book equity can be simply defined as the accounting value of the firm's net assets (assets minus liabilities). In this study, book equity, as defined by Brown, Lajbcygier, and Li (2008), is the COMPUSTAT book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. The book value of preferred stock is estimated based on its redemption, liquidation, or par value (in this order), subject to availability.

2.2 Dataset

The dataset consists of firms traded on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX) and the National Association of Securities Dealers Automated Quotations System (NASDAQ) recorded on the Centre for Research in Security Prices (CRSP) and COMPUSTAT. CRSP is the source for stock daily and monthly prices and

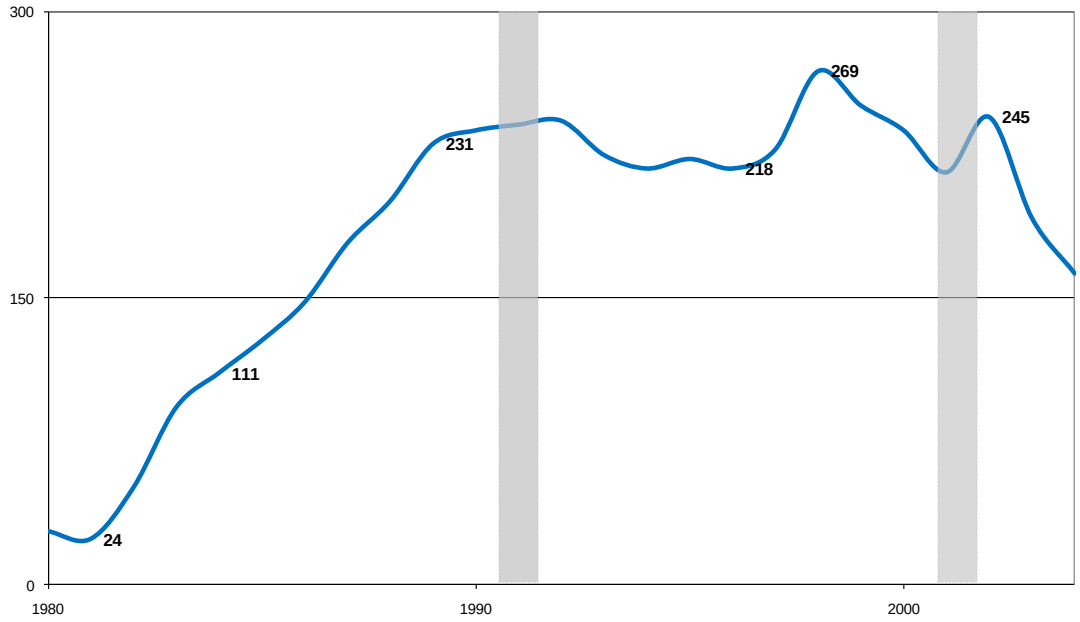
returns and COMPUSTAT is the source for relevant accounting data. To be selected into the dataset, a stock (a) must have COMPUSTAT book common equity for year *t*-1; (b) must have appeared on COMPUSTAT for at least two years in order to avoid the survival bias inherent in the way COMPUSTAT add firms to their database (Banz and Breen (1986)); (c) must have CRSP monthly prices for December of year *t*-1 and June of year *t*, and (d) must be an ordinary common equity (Share Type of 10 or 11 in the CRSP datafile), which means American Depository Receipts, Real Estate Investment Trust and units of beneficial interest are excluded.

Fama and French (1992, 1993, 1996) focus on the non-financial stocks. We include financial stocks in our study. Barber and Lyon (1997) find that the inclusion of financial stocks has minimum impact on Fama and French's value premium, this justifies the inclusion of financial stocks in the dataset.

2.3 Period of the Study

The study period is from June 1986 to June 2005. As depicted in Figure 1, negative BE stock were rare before 1980 (as Fama and French (1993) claim). The number of negative BE stock does not exceed 100 until 1984, and dramatically increases from 1986. Hence, the years prior to that are relatively unimportant in the context of the study. To be consistent with Brown, Lajbcygier, and Li (2008), we chose 2005 as the last year of the study.

Figure 1. Number of Negative Book Equity Stocks



Note: The shaded areas denote recession periods as defined by The National Bureau of Economic Research (NBER).

Across the period of this study, on average negative BE stocks account for 4.6% of all traded stocks, varying from 3.5% (1986) to 5.7% (1991, 1992). There were only 24 stocks with negative book equity in 1981. This number peaked at 269 in 1998. Conventional wisdom indicates that negative BE stocks are distressed, and hence, their numbers would be expected to increase in recessions. However, this is not always the case as shown in the shaded areas in Figure 1. The figure seemingly indicates the increasing number of negative BE stocks coincides with the advent of the "new economy" (listed on NASDAQ). Is this the case?

3 Negative BE Stocks

Figure 1 shows that there might be a close correlation between negative BE stocks and the new economy. Thus we firstly examine their location among 3 exchanges. We then answer whether certain industries are more prone to generating negative BE stocks. If so, what are they? Finally, we assess the relationship between negative BE/ME ratios and stock returns. Answers to these questions will help us to understand the nature of negative BE stocks.

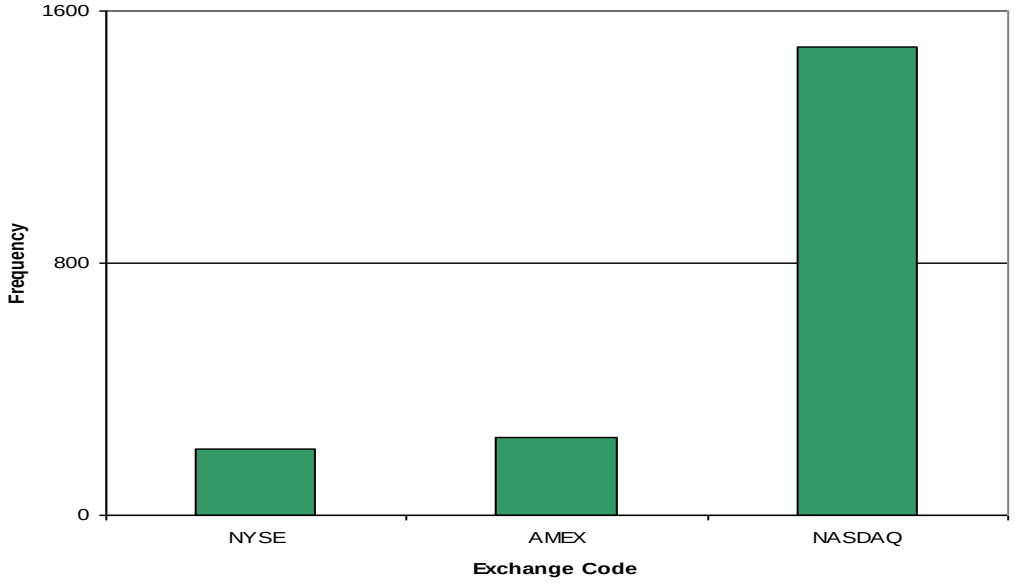
3.1 Negative BE Stocks and Stock Exchanges

To depict the overall relationship between negative BE stocks and the three stock exchanges, all negative BE stocks are sorted according to the CRSP exchange codes (EXCHCD). To prevent multiple entrants for the same stock, if a stock has negative BE on multiple occasions during the period of the study, it is regarded to have negative BE only once. The distribution of negative BE stocks among three stock exchanges is depicted in Figure 2.

The figure clearly shows that the majority of negative BE stocks are located on the NASDAQ exchange (77%). The New York Stock Exchange and American Stock Exchange account for only 11% and 12% of all negative BE stocks respectively. This result suggests that the emergence of negative BE stocks coincides with the advent of NASDAQ, which suggests that many negative BE stocks bear new economy characteristics.

Figure 2. Negative Book Equity Stocks and Stock Exchanges

From 1986 to 2005, all common equity stocks with negative book equity are sorted based on the exchange codes. A stock's book equity is its book common equity for the fiscal year ending in calendar year *t*-1, and is defined as the COMPUSTAT book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. The book value of preferred stock is estimated based on the redemption, liquidation, or par value (in this order), subject to availability.



Why are over three quarters of negative BE stocks listed on the NASDAQ exchange? The primary reason is the relaxed listing requirements for NASDAQ. For instance, the initial listing standard for net tangible asset is $40m on the NYSE. On the contrary, there is no specific requirement in this item under NASDAQ.[1] Fama and French (2001) find that the rate of new listings, largely on NASDAQ, explodes after 1979, from about 140 per year to more than 500 per year. Ritter and Welch (2002) show that the percentage of "tech" stocks[2] increases from about 25% of the IPO market in the early 1990s to an amazing 72% during the "internet bubble" (1999-2000). Fama and French (2001) further reveal that the nature of new lists also changes. New lists always tend to be growth firms; they have high asset growth rates and low BE/ME. They also report that new lists tend to be more profitable than previously listed firms before 1981, however, after 1981, the growth rates of new lists remain high, but their profitability declines. This illustrates that there is a change in the market for new lists after 1980, allowing firms to list earlier in their life cycles, when they are smaller and financially unstable, growing rapidly, but still relatively unprofitable.

Are negative BE stocks in different stock exchanges concentrated in different industry divisions? To answer this question, we sort negative BE stocks according to their exchange and the Standard Industrial Classification (SIC) codes.[3] As 42% of industry divisions in the

[1] As of 1997. other requirement difference includes: NYSE requires 4000 public shareholders and NASDAQ requires 300, etc (The Nasdaq Stock Market 1997 FactBook).

[2] *Tech stocks* are defined by them as internet stocks, computer software and hardware, communications equipment, electronics, navigation equipment, measuring and controlling devices, medical instruments, telephone equipment, and communications services, but do not include biotechnology.

[3] The SIC code system was developed in the 1930's. It contains four digit numerical codes assigned by the U.S. government to business establishments to identify the primary business of the establishment. Over the last 70 years, it has served as the structure for the collection, aggregation, presentation, and analysis of the US economy. It also promotes uniformity and comparability in the presentation of statistical data collected by various agencies of the federal government, state agencies and private organizations.

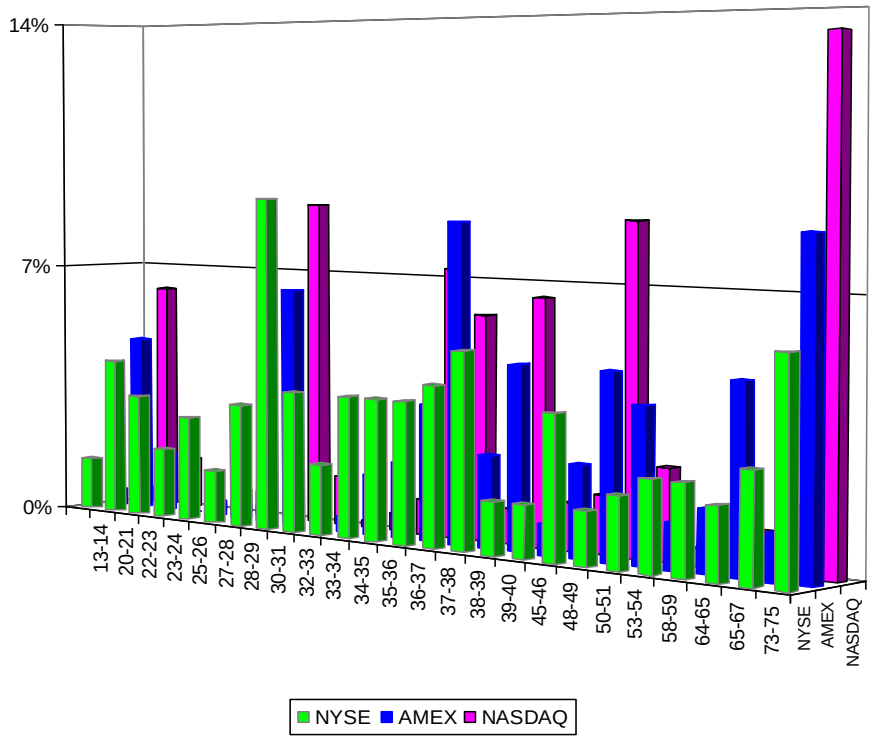
Among the SIC four-digit numerical codes, the first two digits of the code identify the industry division or major industry group, the third digit identifies the industry group and the fourth digit identifies the specific industry. For example: number 36 represents electronic & other electric equipment; 367 represent electronic components

New York Stock Exchange and the American Stock Exchange have no negative BE stocks (27% in the NASDAQ), we only present industries which have negative BE stocks.

Figure 3 shows that there is little discrepancy in the number of negative BE stocks across the three stock exchanges for most industry divisions. For example, percentages of negative BE stocks in the Oil and Gas Extraction (SIC code 13-14) industry division are 4.3, 4.9 and 6.3 respectively for the NYSE, AMEX and NASDAQ.

Figure 3. Industry Divisions of Negative Book Equity Stocks and Three Stock Exchanges

From 1986 to 2005, all common equity stocks with negative book equity are sorted according to the exchange and SIC industry division codes. To eliminate repeated records, if a stock has negative book equity on more than one occasion, it is regarded to have negative BE only once. A stock's book equity is its book common equity for the fiscal year ending in calendar year *t*-1, and is defined as the COMPUSTAT book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. The book value of preferred stock is estimated based on the redemption, liquidation, or par value (in this order), subject to availability.



Note: SIC Division Code details: 20-21 Food And Kindred Products; 23-24 Apparel And Other Finished Products Made From Fabrics And Similar Materials; 27-28 Printing, Publishing, And Allied Industries; 30-31 Rubber And Miscellaneous Plastics Products; 33-34 Primary Metal Industries; 35-36 Industrial And Commercial Machinery And Computer Equipment; 37-38 Transportation Equipment; 39-40 Miscellaneous Manufacturing Industries;

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and accessories; 3672 represent printed circuit boards. The digit 9 is used in the third or fourth digit position of the classification code to designate miscellaneous industries not elsewhere classified (NEC). These miscellaneous classifications are not comprised of homogeneous primary activity groups.

48-49 Communications; 53-54 General Merchandise Stores; 64-65 Insurance Agents, Brokers, And Service and 73-75 Business Services.

Similarly, negative BE stocks in the Chemical and Allied Products industry division (SIC 28-29) in the three stock exchanges are 9.0%, 6.5% and 8.9%. The greatest discrepancy is the Business Services industry group (SIC 72-73) where negative BE stocks account for 5.7%, 8.5% and 13.7% respectively for the three stock exchanges. One should not be surprised by this as negative BE stocks in this group are mainly from the computer programming and software services sector, in which the NASDAQ specialises.[4]

Since negative BE stocks are not stock exchange-specific for most industries, we can group them together and assess the overall relationship between negative BE stocks and specific industries.

3.2 Negative BE Stocks at Industries

To answer whether certain *specific* industries are more prone to negative BE, we group all negative BE stocks according to the full four-digit SIC code and report the results in Table 1. It shows that negative BE stocks do cluster around certain industries. The IT industry has the highest proportion of negative BE stocks, with over 14% of total negative BE stocks (combination of SIC code 7370-7380 and 3570-3580).

The next largest proportion of negative BE stocks is in the pharmaceutical industry, which accounts for approximately 7% (11% if surgical, medical and dental instruments are added) of all negative BE stocks. The next industry contains the third largest proportion of negative BE

[4] Technology companies dominate NASDAQ, representing 25% of listed companies in 2001, the largest single segment.

stocks is telecommunication, as around 6% of all negative BE stocks are from this industry (combination of SIC code 3660-3670 and 4810-4820).

Table 1. Location of Negative Book Equity Stocks at Specific Industry

From 1986 to 2005, all common equity stocks with negative book equity are sorted according to full four digits of SIC codes. To eliminate repeated records, if a stock has negative book equity on more than one occasion, it is regarded to have negative BE only once. A stock's book equity is its book common equity for the fiscal year ending in calendar year *t*-1, and is defined as the COMPUSTAT book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. The book value of preferred stock is estimated based on the redemption, liquidation, or par value (in this order), subject to availability.

SIC Code	Description of Industry	% (of Total negative BE Stocks)
1300-1400	Oil and Gas Extraction	5%
2830-2840	Pharmaceutical/Drugs	7%
3570-3580	Computer and Office Equipment	4%
3660-3670	Communication Equipment	2%
3840-3850	Surgical, Medical, And Dental Instruments	4%
4512, 4522	Air Transportation	2%
4822, 4832, 4833, 4841, 4899	Television Broadcasting Stations, Cable & Other Pay Television Services, etc	3%
4810-4820	Telephone Communications	4%
7370-7380	Computer Programming, Data Processing	10%

The above findings confirm that negative BE stocks are closely associated with the new economy, and the top three industries containing the highest number of negative BE stocks are synonymous with the new economy. Considering that 77% of all negative BE stocks are

NASDAQ-listed, it appears that many negative BE stocks have a common characteristic: they belong to a category of start-up firms with little tangible assets but which are rich in patents. At least to begin with, they have to eat into their equity to survive. If they can easily raise capital and successfully turn their patents into assets, they can survive and flourish on their own merits with significant growth potential, or they can become take-over targets by larger companies. If they are unsuccessful during this process, it is expected that they become illiquid, even insolvent and face the possibility of being delisted. Therefore, the stakes are high and consequently so too are the distress risks.

Finance, Insurance, And Real Estate division accounts for 7% of all negative BE stocks. On the surface, such a finding is surprising as it seems inconsistent with the conventional wisdom that the book equity rarely turns negative in the finance industry. A closer examination into the specific industry level finds that only 9% of negative BE stocks in this division are from traditional financial institutions, i.e. National Commercial Banks (6020). A further 18% of negative BE stocks in this division belong to the Real Estate Group (SIC code 65). The majority of these negative BE stocks (23%) are from Holding And Other Investment Offices, which comprises Venture Capital Companies (6799), Patent Owners And Lessors (6794) and Oil Royalty Traders (6792). Consequently, they also have a strong tendency to eat into capital to sustain themselves early in their lives.[5]

This investigation so far shows that negative BE stocks are more prone to the "go well or go bust" cycle. If they succeed to turn their intangible assets (for instance, patents) into

[5] For instance, venture capital investors place money into high-risk, seed- or early-stage firms usually in exchange for a substantial or majority ownership stake. It is not uncommon that particularly during the period of high-tech boom a venture capital investor might invest millions of dollars in a company in a week's time based on a two-page outline of a business concept. Many technology companies rely on venture capitals to fund their growth even with very little prospect of actually making money. If all investments for a investor within a timeframe failed, such loss has to be written off from which could result in a negative book equity (investors would invest in 10 firms, positing that nine would teeter or fall while the one that succeeded would do so phenomenally, erasing the written-down or written-off investments of the rest.).

cashflows, they will survive and perhaps flourish. Otherwise, they face bankruptcy as they can not eat their equity forever. Therefore, a detailed discussion of survival and delisting has to be conducted prior to any investigation of the role played by negative BE stocks as the issue related to the delisting returns has to be addressed.

3.3 Negative BE Stocks, Survival and Delisting

Fama and French (2004) report that an increased death rate of firms in the 1990s, in which the five-year delist rate for the new lists of 1991 to 1995 is 17.8% (the ten year delist rate is nearly 30% for 1981 to 1990). They argue that this is at least partially related to changes in listing standards that allowed weaker firms to enter the markets. Schultz and Zaman (2001) also report the low profitability of the internet-related lists and indicate that low profitability persists for some years after listing.

To better facilitate the examination of negative BE stocks' survival and delisting details, we divide negative BE stocks into two groups. Group 1 represents those delisted while their book equities are still negative and Group 2 represent all others. The results are presented in Table 2.

The table shows that the length of time that negative BE stocks remains negative are almost the same for both groups. On average, negative BE stocks remain negative for two and half years until delisted (Group 1), whilst negative BE stocks remain negative for almost the same time and survive (Group 2).[6]

[6] It is worth noting two extreme cases. One is that a negative BE stock can remain negative for as long as 16 years before being delisted, whilst some other stocks can stay negative for the whole period of the study.

Table 2. Negative Book Equity Stocks Data Summary

From 1986 to 2005, all common equity stocks with negative book equity are sorted into two groups. Group 1 contains stocks whose book equities are negative when they are delisted from stock exchanges while Group 2 contains all other negative BE stocks. A stock's book equity is its book common equity for the fiscal year ending in calendar year *t*-1. To eliminate repeated records, if a stock has negative book equity on more than one occasion, it is regarded to have negative BE only once.

Year	Group 1	Group 2
Average	2.5	2.4
Median	2.0	2.0
Minimum	1	1
Maximum	16	19
Standard Deviation	2.1	2.0
Skewness	2.3	2.4
Number of Stocks	344	1462

Note: For the sake of calculation, if a stock stays active, we assume that it is delisted at the end of the data sample period.

There are 344 stocks delisted due to various reasons, which accounts for 19% of all negative BE stocks. Such a high percentage of delisting verifies the vulnerability of negative BE stocks, which confirms that negative BE stocks are indeed the potentially most distressed of all listed stocks. The next question which therefore arises is: what causes the delisting? Table 3 provides the answers.

Panel A of this table shows that 41% of the delisting occurs within a year after a stock's book equity turns negative, and over three quarters of delisted negative BE stocks occur within three years. Only 8% of delisted negative BE stocks stay negative more than five years. In regard to the delisting reasons (Panel B), 82% of delisted negative BE stocks are due to performance-related reasons, from which insufficient capital (CRSP code of 560), failure to meet the exchange's financial guidelines for continued listing (CRSP code of 584) and

bankruptcy/declared insolvent (CRSP code of 574) are the top three culprits, occupying 23%, 14% and 12% respectively. This finding is very important as it confirms the conjecture that negative BE stocks are more likely to be under financial distress. In addition, the delisting frequency due to mergers is about 15%, which may also result from financial distress.

Table 3. Delisted Negative Book Equity Stocks Summary

Panel A. Length of Time/Percentage before Delisting

Year	Percentage
=1	41%
1 - 3	36%
3 - 5	15%
5 - 7	4%
7 - 9	2%
9 - 11	1%
>=11	1%

Panel B. Reason for Delisting

CRSP Codes	Explanation	Percentage
200-240	Merger	15%
300-390	Exchange	2%
400	Liquidation	0%
501-519	Change Exchange	0%
500, 520-584	Performance Related*	82%

* Performance-related delisting includes reason unavailable, insufficient capital, insufficient (or non-compliance with rules of) float or assets, bankruptcy/declared insolvent, failure to meet the exchange's financial guidelines for continued listing.

As 82% of delisted negative BE stocks are due to performance-related reasons, this raises an important issue: how to deal with the missing returns for delisted firms. Typically, there are four ways to handle missing returns for delisted stocks in the literature. The first method assumes a negative 100% as the missing delisting return (DeBondt and Thaler (1985)). The second method is to assume a negative 30% when delisting returns are missing for performance-related delisting (Hecht and Vuolteenaho (2006)). The third method assumes that all delisting returns are zero (Piotroski (2000)). Many are simply silent on this issue (Thomas and Zhang (2002), Desai, Rajgopal, and Venkatachalam (2004)). Beaver, McNichols, and Price (2007) find that returns based on anomaly variables, such as BE/ME,

increase due to the exclusion of missing delisting returns as a disproportionate number of delisting stocks are in the lowest BE/ME group. To eliminate the "delisting bias," the delisted stocks are included in the holding portfolios and no additional returns are attributed to that stock for its missing delisting return for the balance of its holding period. This is the most conservative method of handling delistings without introducing a selection bias. Thus, we adopt this approach in this study.

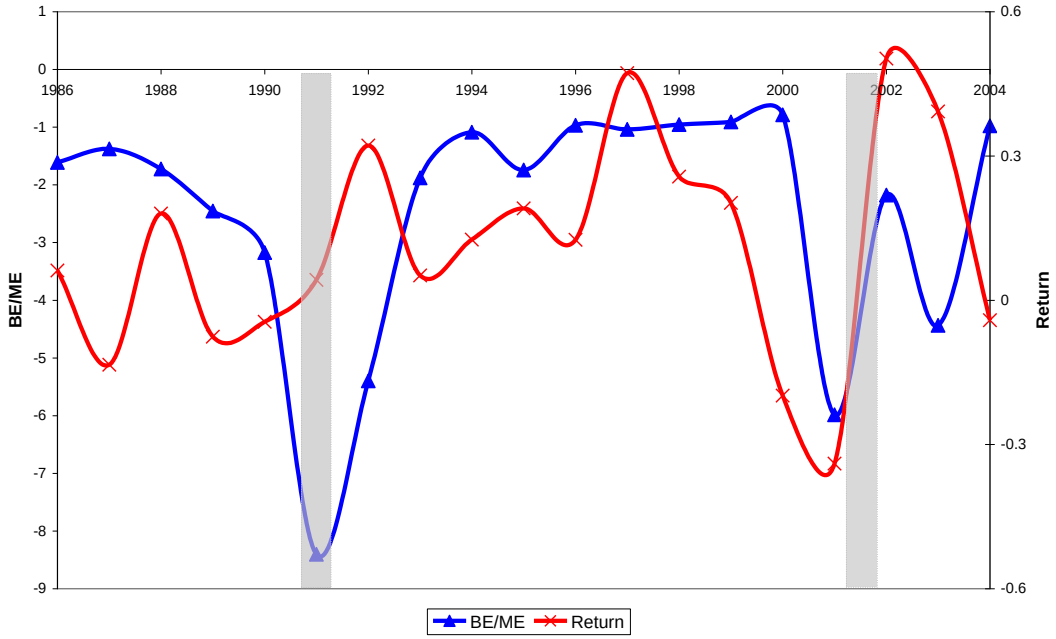
3.4 Negative BE Stocks and Returns

Fama and French (1993) identify the value premium, which is that high BE/ME stocks earn higher average returns than low BE/ME stocks. They advocate a risk-return explanation for this premium such that high BE/ME proxies for high distress risk. But their finding is restricted to positive BE stocks. In this subsection, we examine the relationship between BE/ME and returns for negative BE stocks.

The overall relationship between BE/ME and returns for negative BE stocks is depicted in Figure 4. It shows that the two deep dips are associated with two recessions and the average negative BE/ME of all negative BE stocks reaches its lowest in the early 1990s recession. Overall, there is no simple relation between negative BE stocks' BE/MEs and returns. On average, BE/ME is –2.4 over the study period, and the average return is 11%. Negative BE/ME reaches its highest point in 2000 at –0.79, with a corresponding return of –20%. The lowest return occurs in 2001 at –35%, which coincides with the second lowest dip where BE/ME is –5.99. The lowest BE/ME occurs in 1991 (–8.4) which coincides with the early 1990s recession, but it generated a positive return (4%). On the other hand, the highest return happens in 2002 at 50%, but the corresponding BE/ME is the fourth lowest, at –2.17.

Figure 4. Negative BE/ME and Return

A stock's book equity is its book common equity for the fiscal year ending in calendar year *t*-1. ME, market equity, is obtained by multiplying a stock price in December of year *t*-1 with its shares outstanding. The study period is from 1986 to 2005. To eliminate repeated records, if a stock has negative book equity on more than one occasion, it is regarded to have negative BE only once. Returns reported here are annualised value-weighted returns.



Note: The shaded areas denote recession periods as defined by The National Bureau of Economic Research (NBER).

The relationship between negative BE/MEs and returns shown in the figure is ambiguous. This has ramifications for the Fama and French conjecture that the value premium is a financial distress factor. If Fama and French's conjecture is correct, one would observe the two lines in Figure 4 during the recessions should deviate extremely. However, the evidence from the figure stands in sharp contrast to this conjecture.

What causes this deviation? One possible explanation would be that at this point it is uncertain whether a negative BE firm becomes financial riskier as its BE/ME becomes more negative, which is equivalent to a positive BE firm becomes a more value stock. The other potential explanation would be that Figure 4 depicts the aggregate results between negative BE/MEs and returns, more detailed examination over the relationship among negative

BE/ME, default risk and return is required. More importantly, if the vale premium is interpreted as a kind of default premium, then the paradox of excluding negative BE stocks in the previous studies should be broken, and to the extent that negative BE stocks should have higher default risk than other stocks.

4 Negative BE Stock, Default Risks and Returns

In their series of works, Fama and French (1992, 1993, 1995, 1996) interpret the value premium as a proxy for a state variable associated with relative financial distress. As a proxy for this risk, we adopted an options-based default risk model, the Merton model (Merton (1974)) to predict the probability of default. Recent related work has tended to use either traditional accounting-based default models (Dichev (1998), Griffin and Lemmon (2002)) or the option-based Merton model (Hillegeist et al. (2004), Vassalou and Xing (2004), Da and Gao (2005), Campbell, Hilscher, and Szilagyi (2008) and Garlappi, Shu, and Yan (2007)). The preference of an options-based default risk model over accounting-based default risk models, either Altman's Z-score (Altman (1968)) or Ohlson's O-score (Ohlson (1980), is because that many studies find that the former outperforms the latter in terms of default predictive power (e.g. Hillegeist et al. (2004)). Also, the Merton model (Moody's KMV-Merton model) is widely used by both academics and practitioners (Kealhofer, Kwok, and Weng (1998), Delianedis and Geske (2003), Hillegeist et al. (2004)). Nevertheless, we use an accounting-based default risk model to check the robustness of our results.

4.1 Methodology

The option-based default model is developed based upon two assumptions. One is that the market value of a firm is assumed to follow a geometric Brownian motion (GBM) which takes the form:

$$dV_A = \mu V_A dt + \sigma_A V_A dW \quad \textbf{(1)}$$

where V_A is the total value of the firm, μ is the expected continuously compounded return on V_A, σ_A is the volatility of firm value, and dW is a standard Weiner process. Second, the firm issues just one discount bond and its maturity period is T. Based on the above two assumptions, the market value of the equity can be expressed as a call option on the underlying value of the firm, whose strike price equals the book value of the debt and time to expiration is T. In other words, the shareholders would only exercise this option if the total value of the firm is greater than the value of the firm's debt since only under this condition would their equity have any value. Symbolically, the market value of the equity can be represented as a function of the total value of the firm by the Black and Scholes (1973) equation for a call option:

$$V_E = V_A N(d_1) - Be^{-rT} N(d_2) \quad \textbf{(2)}$$

where B is the book value of the debt maturing at time T, T is the time to maturity, r is the risk-free rate. $N(d)$ is the cumulative standard normal distribution function, d_1 is given as:

$$d_1 = \frac{\ln(\frac{V_A}{B}) + (r + \frac{1}{2}\sigma_A^2)T}{\sigma_A \sqrt{T}} \quad \textbf{(3)}$$

d_2 is given by $d_2 = d_1 - \sigma_A \sqrt{T}$.

Together in Equation (2) and Equation (3), there are six variables. Among them, four variables are directly observable and they are (i) book value of debt maturing at time T[7] or

[7] In our modeling, T is set to one year. This one year maturity period is consistent with the one year portfolio construction period.

strike price B[8]; (ii) risk free rate r[9]; (iii) time-to-expiration T and (iv) value of equity V_E, which is given by a stock's shares outstanding number timing its share price. The rest two are unobservable variables. One is the underlying asset V_A, which must be inferred. The other unobservable variable is σ_A. From a mathematical perspective, two unknown variables in one equation can result in an infinite number of solutions. To overcome this dilemma, an iterative procedure is adopted to find their values, which is the same procedure used by Moody's-KMV, Vassalou and Xing (2004) and Bharath and Shumway (2008).

The first step of the iterative process is to use daily stock prices over the past 12 months to estimate the volatility of equity σ_E, and then use this estimated value as an initial value of σ_A. The next step is to use σ_A as well as daily market equity in the past 12 months V_E, to get the daily firm asset value V_A by the Black-Scholes formula in Equation (2). The last step is to estimate the new σ_A by taking the standard deviation of those newly obtained V_A, and then use this new σ_A for the next iteration. This process is repeated until the value of σ_A from two consecutive iterations converges to 10E-4 or less. With the converged σ_A, final V_A can be backed out through the Black-Scholes formula in Equation (2). This process is repeated at the end of every month resulting in monthly value of σ_A for each firm. The estimation window is a rolling 12 months.

With daily estimation of V_A, the drift μ in Equation (1) can be obtained by calculating the mean of the change in $\ln V_A$. After obtaining the value of underlying asset V_A, and the drift μ,

[8] B equates debt in current liabilities (COMPUSTAT data item 34) plus half of long-term debt (COMPUSTAT data item 9). The reason to include long term debt in calculating a stock's face value of the debt is that interest payments on the long term debt are part of a firm's short term liabilities, which in turn affects its face value of debt. The size of the long term debt inevitably influences a firm's ability to roll over its short-term debt, which results in influencing its default probability.

[9] The risk free rate r used is the 1-Year Treasury Constant Maturity Rate obtained from the Board of Governors of the Federal Reserve system. Downloadable from the website http://research.stlouisfed.org/fred2/data/GS1.txt.

the default probability is then computed as the probability that a firm's asset, V_A, is less than its book value of liabilities *B*.

$$P_{def,t} = \Pr ob(V_{A,t+T} \le B_t \left| V_{A,t} \right.) = \Pr ob(\ln(V_{A,t+T}) \le \ln(B_t) \left| V_{A,t} \right.) \qquad \textbf{(4)}$$

As the firm's asset follows the geometric Brownian motion, Equation (4) can be expressed as:

$$P_{def,t} = \Pr ob[(\ln(V_{A,t}) - \ln(B_t) + (\mu - 0.5\sigma_A^2)T + \sigma_A \sqrt{T}\varepsilon_{t+T} \le 0]$$

$$\textbf{Or } P_{def,t} = \Pr ob\left[-\frac{\ln(\frac{V_{A,t}}{B_t}) + (\mu - 0.5\sigma_A^2)T}{\sigma_A \sqrt{T}} \ge \varepsilon_{t+T} \right] \qquad \textbf{(5)}$$

The distance to default (DD) is then defined as:

$$DD_t = \frac{\ln(\frac{V_{A,t}}{B_t}) + (\mu - 0.5\sigma_A^2)T}{\sigma_A \sqrt{T}}$$

Thus, the corresponding implied probability of default ρ_{PD} is:

$$\rho_{PD} = N(-DD) = 1 - N\left(\frac{\ln(\frac{V_{A,t}}{B_t}) + (\mu - 0.5\sigma_A^2)T}{\sigma_A \sqrt{T}} \right) \qquad \textbf{(6)}$$

It is worth pointing out that ρ_{PD} obtained from the above equation is not a default probability per se whilst default probabilities obtained from Moody's KMV-Merton model are. The reason for the difference is primarily due to the scale of the model itself[10] (Vassalou and Xing (2004) and Bharath and Shumway (2008)). No attempt is made to claim that the default probabilities obtained from this model would be equivalent to those of the KMV-Merton model. However, the spirit of this study is not to obtain the "real" default probabilities for stocks per se, but rather to investigate the distress premium for negative BE stocks and the

[10]Moody's KMV has a much larger database which contains more than 2,000 default incidents and over 100,000 data points, their default probabilities are calculated using the empirical distribution of defaults. We only have a much more limited database, thus our model is a simpler and smaller replica of the KMV-Merton model.

relationship between positive BE and negative BE stock default risks and returns. Therefore, rankings of stocks based on default distress, and not actual predictions of default distress, is more important for our purpose. Consequently, this difference does not affect the substance of our study.

4.2 Results

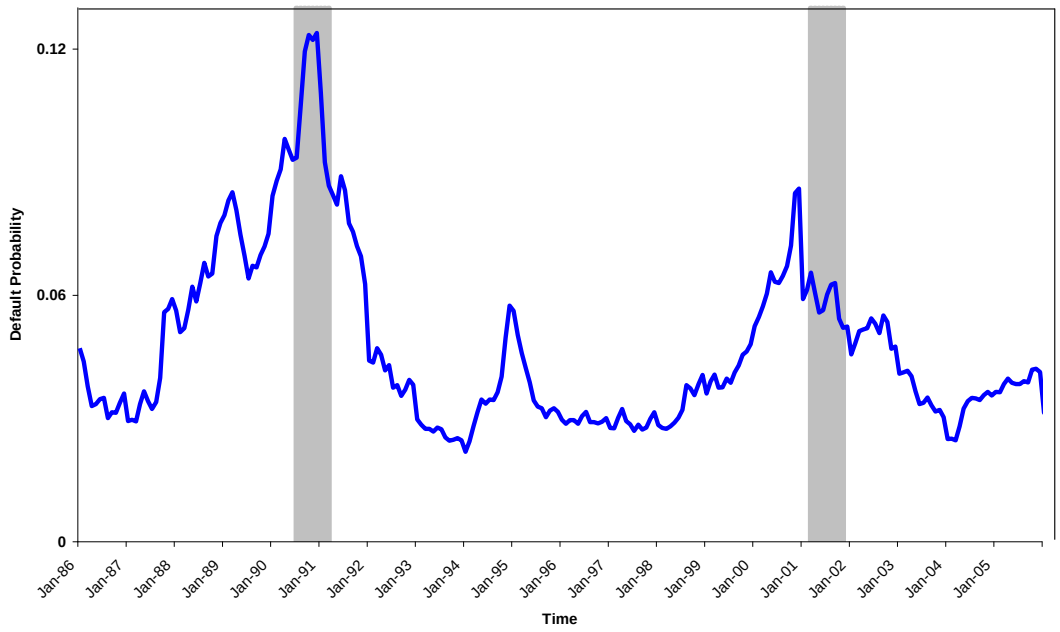
Prior to conduct the option-based default risk modelling, one concern has to be addressed, which is whether negative BE stocks are thinly traded because negative BE stocks are relatively small in size compared to their positive BE counterparts (Brown, Lajbcygier, and Li (2008)), and small-cap firms are more prone to thin trading (Heinkel and Kraus (1988) and Dimson, Nagel, and Quigley (2003)). If this is the case, it can potentially affect empirical studies, by introducing biases into results due to the prevalence of thin (infrequent) and non-synchronous trading (Scholes and Williams (1977), Cohen et al. (1986), Dimson (1979) and Berglund, Liljeblom, and Loflund (1989)). We conduct a test on whether negative BE socks are traded more thinly than their positive BE counterparts and our results show that negative BE stocks are not thinly traded. Subsequently, the option-based default model is universally applicable to both positive and negative BE stocks.

The monthly average default probabilities (default risks) of all firms are depicted in Figure 5. At the end of each month starting from 1986 to 2005, every firm's default probability, ρ_{PD}, is calculated. There are two default risk peaks coinciding with the well-known recessions in 1990 and in 2001. Noticeable, the magnitude of the second spike of default risk is smaller than the 1990, given the fact that the 2001 recession is extremely mild[11] (Nordhaus (2002))

[11] Nordhaus (2002) categorizes the 2001 recession as Category I (pause in economic activity), 1990 recession as Category III (typical recession). The highest in his scale is Category V, which is the depression in the 1930s.

compared to the 1990 recession and the downturn was relatively brief[12] (Kliesen (2003)). Different from the 1990 recession which was caused by the tightening monetary policy designed to release inflation pressures, the 2001 recession is attributable to the "reversed wealth effect" resulting from the deflation of the dot-com bubble (Greenspan (2004)).

Figure 5. Default Probability, by Month



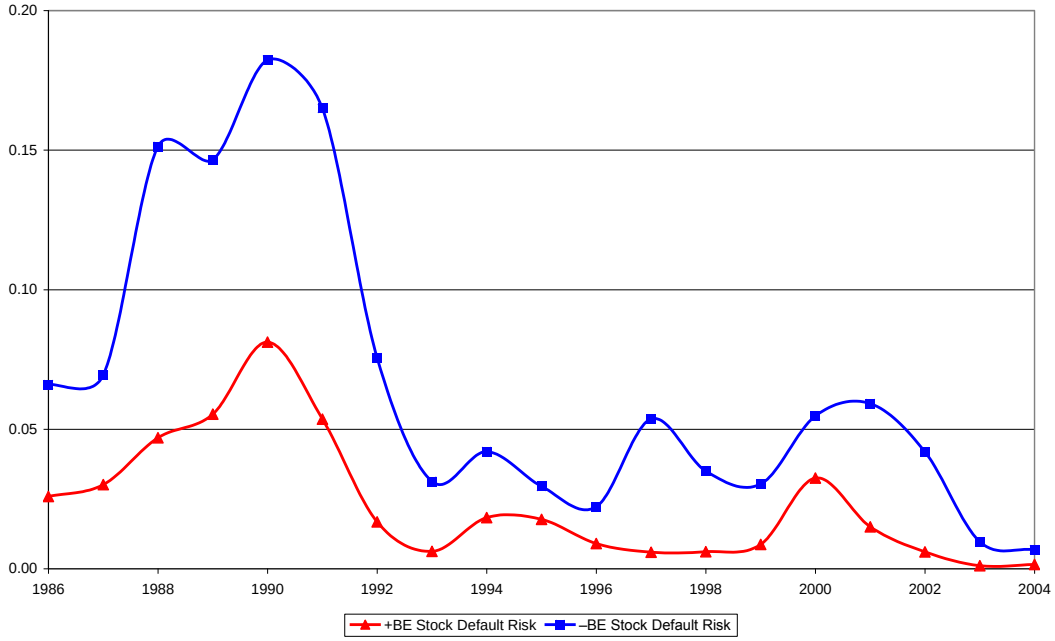
Note: The shaded areas denoted as recession periods, as defined by the National Bureau of Economic Research[13] (NBER).

[12] According to the NBER's Business Cycle Dating Committee (see http://www.nber.org/cycles), the average recession (defined as the time from the peak to the trough) lasted 11 months during the post-World War II period.

[13] The early 1990s recession is from July 1990 to March 1991. The recent one is from March 2001 to November 2001. NBER provides the following definition: "*A recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales. A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough. Between trough and peak, the economy is in an expansion. Expansion is the normal state of the economy; most recessions are brief and they have been rare in recent decades*." (For more, see "The NBER's Recession Dating Procedure," report of the Business Cycle Dating Committee, October 21, 2003, at http://www.nber.org/cycles/recessions.html.)

The relationship of the default risk and return from both positive and negative BE stocks are illustrated in Figure 6. It shows that negative BE stocks have much higher default risks than their positive BE counterparts for every single year across the study period. There are peaks in default risk for negative BE stocks in 1990 (global recession), 1997 (East Asian financial crisis) and 2000 (tech-wreck). And on two occasions (1997 and 2003), negative BE stocks are around nine times more likely to default. On average, negative BE stocks are three times more likely to default and the median for the period is 3.2.

Figure 6. Default Risk for Positive Book Equity and Negative Book Equity Stocks

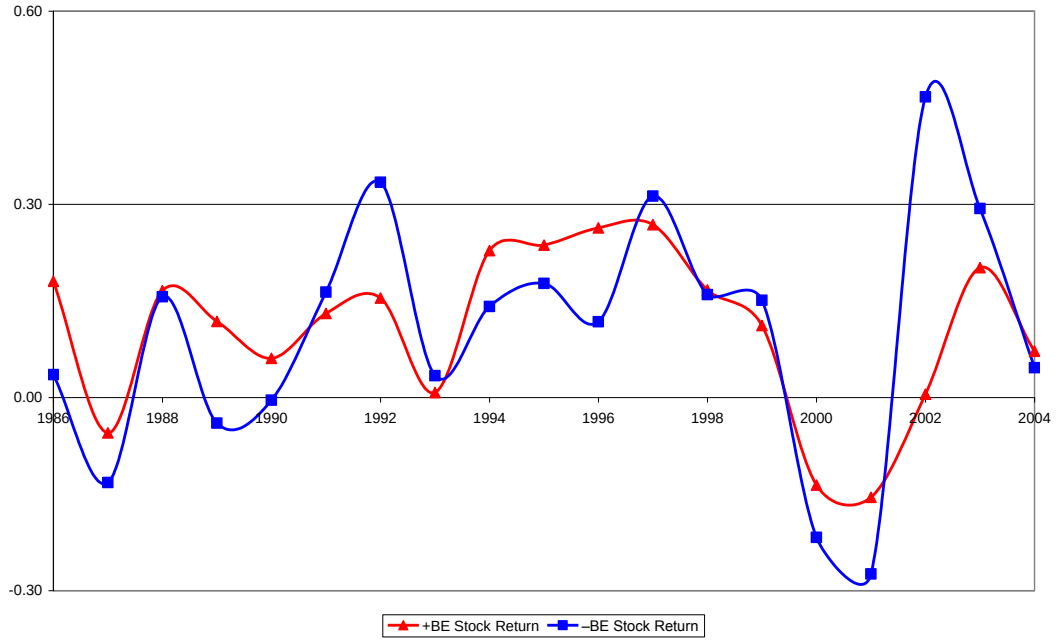


Given that default risks of negative BE stocks are monotonically higher than positive BE stocks, are the returns for negative BE stocks also higher than positive BE stocks as the risk premium explanation for stock return suggests? Annual average stock returns for both positive BE and negative BE stocks are illustrated in Figure 7.

As shown above in Figure 7, although negative BE stocks on average are three times more likely to default than their positive BE stock counterparts, these stocks do not have high returns. In fact, on average, across the study period, negative BE stocks generate a slightly lower return than positive BE stocks (10.2% and 10.6% respectively).

This result confirms our early finding that there is no simple linear relationship between BE/ME and return for negative BE stocks and it also provides further evidence that on average stocks with relatively high default risk underperform stocks with relatively low default risk in terms of return. Across the study period, on one occasion, return from negative BE stocks are 90 times higher than that of positive BE stocks (2002). However, on twelve occasions, positive BE stocks generate higher returns than their negative BE counterparts.

Figure 7. Return for Positive BE and Negative Book Equity Stocks



These results contribute to the ongoing debate in the literature about how to interpret the Fama and French value premium. If Fama and French's conjecture that the value premium exists to compensate a stock holder for the risk of financial distress then negative BE stocks

which have a greater probability of distress should have higher returns. However, our results show the contrary - they deliver anomalously low average returns ("distress anomaly"). This finding is consistent with empirical findings reported by Dichev (1998), Dichev and Piotroski (2001), Griffin and Lemmon (2002), Campbell, Hilscher, and Szilagyi (2008) and Garlappi, Shu, and Yan (2007).[14]

Given the distress anomaly exists on the aggregate level between negative and positive BE stocks, will similar pattern be observed at the portfolio level? 2 x 3 (size x BE/ME) portfolios are constructed as per Fama and French (2003) for positive BE stocks. Negative BE stocks are clarified into the value-growth categories as per Brown, Lajbcygier, and Li (2008). Stock size is calculated based on market capitalization in June of each year *t*, then the median NYSE size is used to split NYSE, NASDAQ, and AMEX stocks into two groups - Small and Big. These size rankings are used to construct size portfolios from July of year *t* to June of year *t* + 1. Similarly, three BE/ME groups are formed based on the NYSE breakpoints for the bottom 30% (Low), middle 40% (Medium), and top 30% (High) for the NYSE, NASDAQ, and AMEX. Thus six value-weighted portfolios (SmallLow, SmallMedium, SmallHigh, BigLow, BigMedium and BigHigh) are created as the intersection of size and BE/ME groups. Within each of these 6 portfolios, default risks of positive and negative BE stocks are calculated and results are presented in the Panel A of Table 4.

Apart from the *t*-values all being significant at least at the 5% level, Panel A of Table 4 illustrates that across the study period, negative BE stocks, on average, show monotonically higher default risks (second column from right) than their positive BE counterparts within each portfolio. Corresponding to higher risks for negative BE stocks in each portfolio, Panel

[14] Dichev (1998) uses Altman's Z-score and Ohlson's O-score, Griffin and Lemmon (2002) use O-score and Garlappi et al (2006) use Moody's KMV to measure financial distress. They all record that stocks with relatively high default risk underperform stocks with relatively low default risk.

B of the table reveals that negative BE stocks have higher value-weighted returns than their positive BE counterparts in every portfolio but the SmallLow. Among these six portfolios, the SmallHigh portfolio has the highest default risks for both positive BE and negative BE stocks (0.042 and 0.184, respectively), and this portfolio also has the highest value-weighted returns (16.4% and 48.5%, respectively). This observation is not surprising, for two main reasons. First, relative to large stocks, small stocks typically have a smaller capital base, less and more expensive access to capital, and greater volatility of earnings (Fama and French, 1993). Second, relative to growth stocks, value stocks are typically more highly leveraged and have much greater uncertainty surrounding their earnings streams (Fama and French, 1996). Therefore, stocks that are both small and value are more susceptible to distress. Hence the SmallHigh portfolio contains the riskiest stocks; consequently, investors ought to expect high returns as compensation for bearing this risk.

Our results also show that negative BE stocks in the two high BE/ME portfolios (SmallHigh, BigHigh) have higher default risks than their low BE/ME counterparts (SmallLow and BigLow), and that such high default risk does translate into higher returns, 48.5% and 44.1% for SmallHigh and BigHigh, respectively. Also noticeably, negative BE stocks in SmallLow generate a negative return, whilst the other low BE/ME portfolios, BigLow has a relatively small positive return compared to the two high BE/ME portfolios, SmallHigh and BigHigh. These results suggest that an increase in returns in the two high BE/ME portfolios plus a positive return for shorting SmallLow via incorporating negative BE stocks into the value premium, outweighs an increase in returns in the low BE/ME portfolio. Consequently, this explains the source of the enhanced value premium by including negative BE/ME stock in the value portfolio (i.e., HML), as reported by Brown, Lajbcygier, and Li (2008).

Table 4. Comparison of probability of default for positive BE and negative BE stocks

Panel A. Probability of Default, by Year and Portfolio																						
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	t value
SmallLow	Positive BE Stocks	0.009	0.005	0.006	0.009	0.010	0.009	0.001	0.001	0.005	0.002	0.001	0.002	0.003	0.002	0.004	0.009	0.002	0.000	0.001	0.004	
	Negative BE Stocks	0.098	0.000	0.124	0.176	0.439	0.457	0.073	0.045	0.027	0.002	0.054	0.036	0.125	0.051	0.068	0.138	0.054	0.012	0.018	0.105	3.4***
SmallMedium	Positive BE Stocks	0.005	0.012	0.013	0.013	0.032	0.007	0.003	0.001	0.006	0.004	0.003	0.003	0.003	0.003	0.014	0.004	0.002	0.001	0.001	0.007	
	Negative BE Stocks	0.098	0.000	0.113	0.038	N/A	0.000	0.000	0.000	0.063	0.000	0.012	0.000	0.000	0.018	0.044	0.007	0.000	0.000	0.000	0.022	1.8**
SmallHigh	Positive BE Stocks	0.043	0.046	0.067	0.091	0.142	0.086	0.037	0.017	0.045	0.039	0.021	0.014	0.016	0.020	0.074	0.027	0.013	0.002	0.005	0.042	
	Negative BE Stocks	0.073	0.161	0.057	0.185	0.120	0.003	0.191	0.051	0.902	0.104	0.150	1.000	0.103	0.020	0.064	0.097	0.039	N/A	0.000	0.184	2.1**
BigLow	Positive BE Stocks	0.003	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	
	Negative BE Stocks	0.047	0.000	0.348	0.050	0.188	0.031	0.067	0.046	0.300	0.000	0.000	0.092	0.035	0.045	0.066	0.057	0.037	0.002	0.002	0.074	3.3***
BigMedium	Positive BE Stocks	0.010	0.026	0.024	0.035	0.050	0.002	0.001	0.000	0.006	0.009	0.011	0.007	0.010	0.008	0.007	0.003	0.003	0.000	0.000	0.011	
	Negative BE Stocks	0.014	0.029	0.250	0.197	0.193	0.124	0.171	0.034	0.000	0.029	0.010	N/A	0.010	0.048	0.083	0.033	0.053	0.007	0.000	0.071	3.2***
BigHigh	Positive BE Stocks	0.081	0.088	0.116	0.118	0.149	0.073	0.018	0.006	0.026	0.025	0.016	0.006	0.000	0.009	0.028	0.008	0.001	0.001	0.005	0.041	
	Negative BE Stocks	0.076	0.090	0.144	0.196	0.154	0.133	0.051	0.007	0.045	0.070	0.000	0.178	0.023	0.024	0.092	0.093	0.066	0.097	0.000	0.081	2.3**

Probabilities of default are computed at the end of each month from 1986 to 2004. Positive (negative) BE stocks at year *t* are stocks whose book values are positive (negative) if book equities in the fiscal year ending in calendar year *t*-1 are positive (negative). Panel A represents the simple average of probabilities of default for six portfolios. Within each portfolio, stocks are further divided into positive BE and negative BE stocks. For the six portfolios, SmallLow refers to stocks with both small size and low BE/ME ratio and BigMedium refers to stocks with both big size and medium BE/ME ratio.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 1. *(continued)*

Panel B. Value Weighted Return, by Year and Portfolio																						
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	t value
SmallLow	Positive BE Stocks	-0.010	-0.196	0.034	0.061	0.008	0.086	0.140	-0.062	0.270	0.276	-0.069	0.085	0.039	0.394	-0.219	-0.303	0.087	0.265	0.018	0.048	
	Negative BE Stocks	-0.673	-0.825	-0.491	-0.396	-0.911	-0.283	0.170	-0.245	0.167	1.416	-0.710	0.304	-0.510	1.076	-0.953	-0.885	-0.310	1.283	-0.474	-0.171	1.3*
SmallMedium	Positive BE Stocks	0.088	-0.061	0.118	0.098	0.019	0.056	0.243	0.061	0.182	0.241	0.223	0.191	-0.023	0.162	0.261	-0.053	0.008	0.362	0.101	0.120	
	Negative BE Stocks	-0.306	-0.828	0.085	0.091	N/A	0.807	3.119	1.565	0.109	0.247	-0.002	1.909	-0.877	1.719	-0.085	0.052	-0.704	0.900	0.688	0.472	1.4*
SmallHigh	Positive BE Stocks	0.105	-0.024	0.179	-0.020	0.026	0.233	0.340	0.090	0.190	0.278	0.281	0.290	-0.026	0.113	0.335	0.139	-0.016	0.424	0.177	0.164	
	Negative BE Stocks	-0.005	-0.689	0.390	-0.408	-0.656	-0.497	1.909	2.000	1.933	0.909	1.028	0.391	-0.602	0.881	1.101	0.237	0.239	N/A	0.563	0.485	1.5*
BigLow	Positive BE Stocks	0.178	-0.134	0.216	0.306	0.148	0.153	0.021	-0.016	0.286	0.253	0.285	0.299	0.288	0.182	-0.246	-0.208	0.028	0.153	0.008	0.116	
	Negative BE Stocks	-0.204	-0.694	0.182	0.248	-0.020	1.619	0.928	0.388	1.341	1.438	0.124	1.535	0.241	1.121	-0.900	-0.802	0.631	0.897	0.058	0.428	1.7*
BigMedium	Positive BE Stocks	0.197	-0.080	0.160	0.155	0.051	0.102	0.224	0.024	0.242	0.272	0.353	0.305	0.065	-0.032	0.149	-0.079	-0.017	0.209	0.119	0.127	
	Negative BE Stocks	0.285	-0.199	0.537	0.828	0.156	0.204	1.615	0.120	0.504	0.190	1.855	N/A	-0.088	-0.521	0.385	-0.127	-0.039	0.269	0.041	0.334	1.4*
BigHigh	Positive BE Stocks	0.239	-0.013	0.207	0.075	0.046	0.174	0.196	-0.019	0.228	0.229	0.214	0.364	0.063	-0.076	0.346	-0.071	-0.043	0.224	0.200	0.136	
	Negative BE Stocks	0.610	-0.127	1.688	0.371	-0.198	0.018	0.992	-0.009	0.449	0.337	1.137	0.067	0.414	0.153	0.442	0.326	-0.846	-0.003	2.561	0.441	1.8**

Portfolio returns are calculated as value-weighted returns for all stocks within the portfolio. A stock return in year *t* is an annualized return from July of year *t* to June of year *t+1*. N/A means there is no negative BE stock in the portfolio.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

As expected, both SmallHigh and SmallLow have higher default risks than their big size counterparts, BigHigh and BigLow. However, only the SmallHigh portfolio's higher default risks are compensated by higher returns. The SmallLow portfolio generates lower returns than the BigLow portfolio. This finding suggests that if firm BE/MEs are controlled, in general small size stocks show higher default risks than big size stocks. However, whether higher returns are generated to compensate for the additional risk of being small size firms is conditional on firms' BE/ME ratio. This seems to suggest that there is no positive relationship between default risk and return in size-sorted portfolios, which in turn suggests that size is not a proxy for default risk.

On the other hand, our results show that the two high BE/ME portfolios (SmallHigh, BigHigh) have higher default risks than their low BE/ME partners (SmallLow and BigLow). These higher default risks also translate into higher returns, as SmallHigh, BigHigh portfolios have higher returns than SmallLow and BigLow. This finding suggests that if firm sizes are controlled, value stocks (high BE/ME) have higher default risks than growth stocks (low BE/ME) and value stocks are compensated by higher returns for bearing higher default risks. In other words, the existence of a positive relationship between default risk and return in BE/ME-sorted portfolios suggests that BE/ME is a proxy for default risk.

Based on the above analysis, it seems that the Fama-French's risk premium conjecture for stock returns can be upheld on BE/ME-sorted portfolios and this suggests that the value premium, HML, acts as a proxy for default risks (Griffin and

Lemmon (2002), Vassalou and Xing (2004)). We next answer if this is due to the relatively coarse division of stocks three-BE/ME portfolios. We further create five portfolios according to stocks' BE/ME rankings， and modelling results are reported in Table 5.

The distinction of the Table 5 is that there is a clear positive relationship between default risks and value-weighted returns for both positive and negative BE stocks across all BE/ME portfolios. This observation confirms our early finding reported in Table 4 suggesting that BE/ME acts as a proxy for default risk.

Panel A of Table 5 shows that the average default risks over the study period for positive BE stocks (negative BE stocks) are monotonically increasing (decreasing) with the increase (decrease) of BE/MEs. For positive BE stocks, high BE/ME stocks represent value stocks and low BE/ME stocks represent growth stocks. And value stocks have greater financial distress than growth stocks (Fama and French (1992, 1993, 1996)). Therefore, the monotonic pattern of default risks from low BE/MEs to high BE/MEs is consistent with Fama and French's risk premium explanation. For negative BE stocks, the inverse pattern between negative BE/MEs and default risks occurs. The lowest negative BE/ME quintile is, in absolute terms, equivalent to the highest BE/ME ratio quintile. Furthermore, the differences of default risks between the highest and the lowest BE/ME quintiles are statistically significant at the 1% level.

Table 5. BE/ME Ratio, Default Risk and Return

Five BE/ME portfolios are created as follows. In June of year *t* from 1986 to 2004, all stocks are sorted into five portfolios according to their BE/ME ratios. A stock's BE is its book common equity for the fiscal year ending in calendar year *t*-1, and is defined as the COMPUSTAT book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Market equity, ME, is obtained by multiplying a stock price in December of year *t*-1 with its shares outstanding. Within each portfolio, stock default risks and returns are computed from July of year *t* to June of year *t*+1. Default risks in each portfolio are simple average of all stocks' and returns in each portfolio are value-weighted within the portfolio. * Significant at the 5% level; ** Significant at the 1% level.

Panel A. BE/ME Ratio and Probability of Default, by Year

	BE/ME Ratio	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	t value
Positive BE Stocks	1 - Lowest	0.009	0.004	0.010	0.009	0.008	0.006	0.001	0.001	0.004	0.002	0.001	0.002	0.002	0.001	0.003	0.007	0.001	0.000	0.000	0.004	
	2	0.003	0.010	0.012	0.012	0.023	0.006	0.001	0.002	0.006	0.003	0.000	0.001	0.003	0.004	0.004	0.004	0.001	0.000	0.001	0.005	
	3	0.011	0.024	0.035	0.049	0.072	0.016	0.004	0.000	0.004	0.006	0.005	0.004	0.004	0.002	0.015	0.004	0.004	0.001	0.000	0.014	
	4	0.030	0.036	0.052	0.057	0.113	0.053	0.011	0.002	0.013	0.013	0.006	0.007	0.006	0.011	0.043	0.008	0.004	0.001	0.000	0.025	
	5 - Highest	0.076	0.076	0.126	0.151	0.190	0.187	0.068	0.026	0.063	0.056	0.027	0.005	0.010	0.020	0.082	0.048	0.020	0.003	0.006	0.065	
	Highest - Lowest	0.067	0.072	0.115	0.142	0.182	0.182	0.067	0.025	0.059	0.054	0.026	0.003	0.008	0.018	0.079	0.041	0.019	0.003	0.006		4.5**
Negative BE Stocks	1 - Lowest	0.237	0.180	0.393	0.425	0.536	0.551	0.229	0.114	0.169	0.114	0.062	0.167	0.115	0.082	0.179	0.128	0.150	0.021	0.026	0.204	
	2	0.050	0.088	0.195	0.144	0.152	0.132	0.072	0.035	0.006	0.005	0.028	0.048	0.017	0.008	0.070	0.081	0.025	0.023	0.006	0.062	
	3	0.004	0.044	0.071	0.122	0.061	0.086	0.036	0.006	0.006	0.025	0.001	0.037	0.027	0.035	0.003	0.062	0.029	0.000	0.002	0.035	
	4	0.036	0.032	0.068	0.017	0.068	0.047	0.022	0.000	0.015	0.003	0.012	0.001	0.007	0.018	0.008	0.015	0.000	0.000	0.000	0.019	
	5 - Highest	0.002	0.000	0.019	0.024	0.095	0.008	0.020	0.000	0.014	0.000	0.008	0.011	0.007	0.009	0.012	0.005	0.002	0.004	0.000	0.013	
	Lowest - Highest	0.236	0.180	0.374	0.402	0.441	0.543	0.209	0.114	0.155	0.114	0.054	0.156	0.108	0.073	0.167	0.123	0.148	0.017	0.026		5.2**

Panel B. BE/ME Ratio and Value Weighted Return, by Year

	BE/ME Ratio	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	t value
Positive BE Stocks	1 - Lowest	0.157	-0.132	0.174	0.244	0.124	0.134	0.022	-0.027	0.290	0.249	0.218	0.306	0.311	0.230	-0.335	-0.224	0.031	0.175	-0.005	0.102	
	2	0.178	-0.096	0.165	0.163	0.045	0.095	0.217	0.012	0.254	0.295	0.315	0.281	0.136	0.024	0.033	-0.094	-0.025	0.218	0.074	0.121	
	3	0.178	-0.025	0.158	0.084	0.043	0.159	0.187	0.044	0.221	0.231	0.357	0.274	0.046	0.002	0.224	-0.013	0.010	0.226	0.135	0.134	
	4	0.206	-0.019	0.220	0.077	0.079	0.211	0.281	-0.006	0.211	0.262	0.263	0.311	0.033	0.002	0.326	-0.018	-0.054	0.215	0.116	0.143	
	5 - Highest	0.274	-0.018	0.278	0.037	-0.031	0.409	0.331	0.056	0.237	0.184	0.218	0.225	0.078	-0.039	0.354	-0.057	0.003	0.445	0.195	0.167	
	Highest - Lowest	0.117	0.113	0.104	-0.207	-0.154	0.275	0.309	0.083	-0.052	-0.065	0.000	-0.080	-0.233	-0.268	0.689	0.167	-0.028	0.269	0.200		1.2
Negative BE Stocks	1 - Lowest	0.959	-0.249	0.076	-0.226	-0.033	0.083	0.491	0.034	0.179	0.541	-0.076	0.351	-0.054	0.563	0.080	0.012	0.426	0.336	-0.005	0.184	
	2	0.164	-0.246	0.048	0.018	-0.064	0.085	0.359	0.039	0.037	0.531	-0.143	-0.142	-0.010	0.822	-0.237	-0.242	0.241	0.625	-0.153	0.091	
	3	-0.021	-0.357	-0.024	-0.049	0.338	0.148	0.164	-0.033	-0.152	0.003	0.027	-0.052	0.187	0.529	-0.165	-0.035	0.465	0.691	-0.014	0.087	
	4	-0.286	-0.296	0.148	-0.156	-0.014	0.345	0.035	0.082	0.027	0.245	-0.120	0.152	-0.063	0.202	-0.127	-0.231	0.282	0.392	-0.083	0.028	
	5 - Highest	-0.122	-0.362	-0.189	0.153	-0.156	0.130	0.114	-0.114	-0.040	0.467	-0.289	0.040	-0.124	0.611	-0.252	-0.266	0.066	0.165	0.174	0.000	
	Lowest - Highest	1.081	0.113	0.265	-0.379	0.123	-0.047	0.377	0.148	0.219	0.074	0.213	0.311	0.071	-0.048	0.331	0.278	0.361	0.171	-0.179		2.0*

Similar patterns can also be observed for value-weighted returns in Panel B of the table. Positive BE (negative BE) stocks demonstrate a monotonic increase (decrease) in returns from the quintile with the lowest BE/ME ratio to the quintile with the highest BE/ME ratio. This seems to suggest that BE/ME does act as a proxy for default risk. As Fama and French (1992) point out that a high BE/ME "*says that the market judges the prospects of a firm to be poor relative to firms with low BE/ME. Thus BE/ME may capture the relative-distress effect*." (p. 444). Though Fama and French make this statement based on positive BE stocks, it appears from our work that the inverse is true for negative BE stocks as well.

Contrary to the distress anomaly documented from both Figure 7 and Table 4 where higher default risks do not necessarily translate into higher returns, Table 5 reports the non-existence of such anomaly. How can we reconcile these seemingly conflicting results? We believe this is due to the ambiguity of firm's size effect. To prove the point, we further examine the relationship between firm's default risk and return on 10 size-sorted portfolios and find that, unlike BE/ME-sorted portfolios, only the smallest size portfolio has distinct higher default risk than any other portfolios and such high risk is compensated by high return. This risk/return trade-off does not extend to other 9 size-sorted portfolios.[15] This finding confirms the observation of Vassalou and Xing (2004) in which the small size-high default risk portfolio are typically the smallest of small caps and they earn higher return than big size stocks

[15] The modeling results are not reported here and they are available upon request.

only if they have high default risk. The lack of evidence to support the size effect seems to suggest that BE/ME, but not the firm size, acts as the proxy for default risk.[16]

5 Conclusion

The research presented in this article is the first to incorporate negative BE stocks into the body of literature. Previously, they are typically discarded from any subsequent studies by both practitioners and academics. Their increasing presence, the paradox created by omitting negative BE stocks in searching for the explanation of the vale premium make the literature void on them no longer bearable. This research includes them and finds that the increasing number of negative BE stocks reflects the relaxed listing requirements that began in the 1980s, especially on NASDAQ, when some weaker and financially unstable firms were allowed to enter the market. This leads to 77% of negative BE stocks NASDAQ-listed.

From now on, both practitioners and academics can confidently rely on this research outcomes, rather than the conventional wisdom, by claiming that indeed many of negative BE stocks do bear some characteristics of new economy, where they cluster around certain specific industries, such as the IT, pharmaceutical and telecommunication industries. Other traditional industries, such as oil and gas extraction, also contain many negative BE stocks. Much to our surprise from the perspective of value premium being a distress factor, there is no simple linear relationship between BE/ME and return for negative BE stocks. Though returns exhibit a downward trend from the most negative BE/ME to the least negative BE/ME

[16] To check the robustness of our findings, we conduct an additional test by adopting an accounting-based default model in calculation of firm's default risks. We report larger positive differences in default risk (O-Scores) between positive and negative BE stocks irrespective of portfolio formation. These results are not reported here but are available upon request.

portfolios, they do not decrease monotonically. Only the most negative BE/ME enjoys the absolute high return.

This research also compliments the existing literature in examination of the relationship between default risks and returns for both positive and negative BE stocks. We find that on average the default risks from negative BE stocks are three times high than their positive BE counterparts. Consistent with distress anomaly documented by other studies, such higher distress risks are not compensated by higher returns. Similarly, at each portfolio level, negative BE stocks also have higher default risks than positive BE stocks, but only those with the smallest in size and highest in BE/ME enjoy the absolute high returns. Further, our findings reveal a positive relationship between default risks and returns along the BE/ME-sorted portfolios. This shows that BE/ME does act as a proxy for default risk and it is consistent with a risk premium based explanations for the value premium. The same is not true for size-sorted portfolios. The interaction for returns between size and value represents an anomaly and this warrants further detailed study.

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