BOOK-TO-MARKET RATIO, DEFAULT RISK AND RETURN IMPLICATIONS:

From a negative perspective

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A paradox is created by the common practice in stock evaluation models of excluding stocks with a negative book equity (BE). If we interpret the book-to-market ratio as a proxy for distress risk, it makes no sense to exclude these negative BE stocks since they are, prima facie, most prone to distress risk. This paper reassesses the relationship between default risk, return and the book-to-market ratio by incorporating negative BE stocks into the study. We find that negative BE stocks carry higher default risks than their positive BE counterparts and that these risks are not totally offset by higher returns. This suggests that a default risk filter can be used in the investment universe selection process through which the portfolio return can be enhanced.

The relationship between default risk, the book-to-market ratio (BE/ME) and stock returns is of interest for both practitioners and academics. For the practitioner, the BE/ME is a supposed yardstick to differentiate value stocks from growth stocks in portfolio management, which in turn determines the share return difference. For the academic, it presents an asset pricing anomaly. In addition to the mixed results documented by prior studies regarding whether the BE/ME proxies the firm's default risk, the results obtained were from incomplete data samples from which conclusions were drawn in the absence of, or with little attention paid to, negative book equity (BE) shares. This creates a paradox. For example, if negative BE stocks represent potentially the most financially distressed firms (Fama and French 1993), how can these distressed negative BE stocks be excluded from the investigation of the relationship between default risk and BE/ME?

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 et al. 1999) since limited liability means that shares cannot have negative value. Further, negative BE stocks 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 the omission of negative BE stocks from stock evaluation is a mistake. First, while it is true that negative BE stocks were rare prior to 1980, their numbers have gradually increased since the mid-1980s and stabilised at approximately 5 per cent of all traded stocks (Brown et al. 2008). Also, negative BE stocks are generally expected to be either young start-ups or old failing firms. Consequently, these stocks may potentially exert significant influence on results from any value-based asset pricing models such as the Fama-French three-factor model.

For these reasons, it appears that there is no longer any basis for researchers to conduct studies and draw conclusions in the absence of, or with little attention paid to, negative BE stocks. This is not only due to the increasing weight of negative BE stocks but also because the current debate about the interpretation of the value premium anomaly is restricted to positive BE stocks only. Therefore, this points to the need for an investigation into the role of negative BE stocks in the value premium debate regarding default risk and return, and the manner in which negative BE stocks should be assessed in conjunction with their positive BE counterparts.

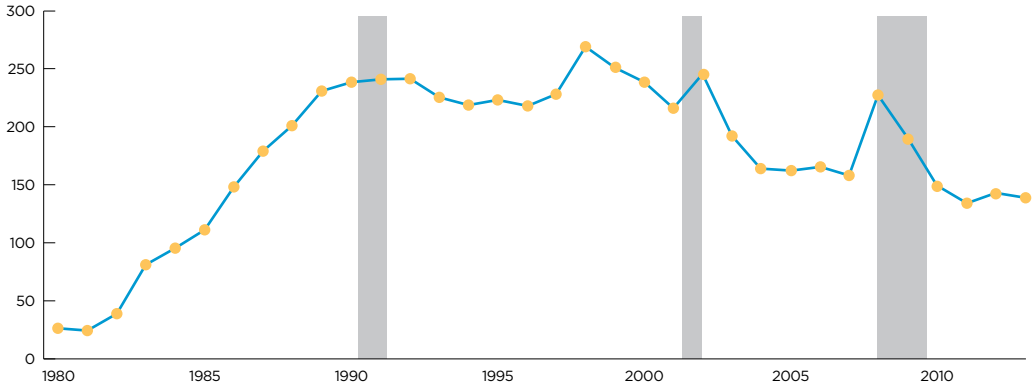
Data and some characteristics of negative BE stocks

Book equity can be simply defined as the accounting value of a firm's net assets (assets minus liabilities). In this study, book equity, as defined by Brown et al. (2008), is the COMPUSTAT-provided book value of stockholders' equity plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. 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 daily and monthly stock prices and returns and COMPUSTAT is the source for relevant accounting data.

To be included in our dataset, a stock must: (a) have COMPUSTAT book common equity for year *t-1*; (b) have appeared on COMPUSTAT for at least two years in order to avoid the survival bias inherent in the way COMPUSTAT adds firms to its database (Banz and Breen 1986); (c) have monthly CRSP prices for December of year *t-1* and June of year *t*; and (d) be an ordinary common equity.

The study period is from 1986 to 2014. As depicted in Figure 1, negative BE stocks are rare before 1980 (as Fama and French (1993) point out). The number of negative BE stocks does not exceed 100 until 1984, but dramatically increases after 1986. Hence, the years prior to that are relatively unimportant in the context of the study.

FIGURE 1: Number of negative book equity stocks



Note: The number of negative book equity stocks is calculated based on the definition across the COMPUSTAT-provided data set. The shaded areas denote recession periods as defined by The National Bureau of Economic Research (NBER).[1]

To proxy the default risk on the company's debt, we adopted an options-based Merton model (Merton 1974). Recent related work has tended to use either a traditional accounting-based Z-score (Altman 1968) or O-score (Ohlson 1980) to assess the default risk (Dichev 1998; Griffin and Lemmon 2002) or the option-based Merton model (Vassalou and Xing 2004; Campbell et al. 2008). An options-based default risk model is used in this study because many previous studies have found it outperforms accounting-based models in terms of default predictive power (Hillegeist et al. 2004). In addition, the Merton model (Moody's KMV model) has been widely used by both academics and practitioners (Kealhofer et al. 1998; Hillegeist et al. 2004). Default risk in this study is measured by the default risk indicator which takes the form of:

$$\rho_{PD} = N(-DD) = 1 - N\left(\frac{\ln(\frac{V_A}{B}) + (\mu - 0.5\sigma_A^2)T}{\sigma_A\sqrt{T}}\right) \qquad (1)$$

where ρ_{PD} is the default risk indicator,[2] V_A is the current total market value of the firm, μ is the expected continuously compounded return on V_A, σ_A is the volatility of firm value, and B is the current book value of the debt maturing at time T.

Since Figure 1 has shown that the number of negative BE stocks increased dramatically after the early 1980s, this seems to suggest that the growth of negative BE stocks is closely associated with the advent of the 'new economy'. Our investigation shows that indeed over three quarters of the negative BE stocks are listed on NASDAQ. This inevitably links these stocks with the new economy.

Why are the majority of negative BE stocks listed on the NASDAQ? The primary reason is the relaxed listing requirements for NASDAQ. For instance, the initial listing standard for net tangible assets is $40m on the NYSE, whereas there is no specific requirement for this item under NASDAQ. Fama and French (2001) find that the rate of new listings, largely on NASDAQ, explodes after 1979, from about 140 per annum to more than 500 per annum. Ritter and Welch (2002) show that the percentage of 'tech' stocks increases from about 25 per cent of the IPO market in the early 1990s to an amazing 72 per cent during the 'internet bubble' (1999 to 2000).

This illustrates that there is a change in the market for new listings after 1980, allowing firms to list earlier in their life cycles, when they are smaller and financially unstable, growing rapidly, but still relatively unprofitable (Fama and French 2004). Further, it is no surprise to find that negative BE stocks indeed cluster around certain specific industry sectors which are synonymous with the new economy, such as the IT, pharmaceutical and telecommunication industries. In addition, other traditional industries, such as oil and gas extraction, also contain many negative BE stocks. The above depicts the heterogeneity of the negative BE stocks. It also suggests that some negative BE stocks are start-up firms who have a tendency to 'eat' into their equity. After examining some of the characteristics of negative BE stocks, the next question which arises is whether these negative BE stocks are prone to financial distress?

Results discussion

As the majority of negative BE stocks are associated with the new economy, this suggests that they are relatively small in size compared to their positive BE counterparts. Panel A of Table 1 shows that, on average, negative BE stocks are indeed much smaller than the positive BE stocks. On average negative BE stocks have statistically significantly higher default risk than the positive BE stocks.

It is expected that firms with high default risk earn higher returns than firms with low default risk as investors charge a return premium for bearing these high default risk stocks. (Fama and French 1993; Vassalou and Xing 2004). However, contrary to this, the evidence provided in the table is that the higher default risk for negative BE stocks is not compensated by higher return. Instead, both the raw return and the risk-adjusted return (the Sharpe ratio) are lower for negative BE stocks, though the differences are not statistically significant. This seems to suggest the existence of the 'distress anomaly' (Dichev 1998; Campbell et al. 2008), in which the stocks with the greater default risk deliver anomalously low average returns.

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To assess further the implications for default risk and returns for both positive and negative BE stocks, we created 2 x 3 (size x BE/ME) portfolios following Brown et al. (2008). We split the stocks into two size groups, Small and Big. Three BE/ME groups are formed based on the NYSE breakpoints for positive BE stocks for the bottom 30 per cent (Low), middle 40 per cent (Medium), and top 30 per cent (High). Thus six value-weighted portfolios (SmallLow, SmallMedium, SmallHigh, BigLow, BigMedium and BigHigh) are created as the intersection of size and BE/ME groups. We applied a well-known procedure used in Brown et al. (2008), the generalised style classification, to then classify and add negative BE stocks into the value groups by considering how close past returns of negative BE stocks correspond to those of the preformed positive BE stocks value groups. For example, if a small negative BE stock whose monthly average return over the past year is closest to those stocks in the small size and high BE/ME portfolio, then it would be allocated to the SmallHigh portfolio.

The first noticeable observation from Panel B of Table 1 is that there is virtually no difference in average size between the positive and negative BE stocks in the three small-size portfolios. However, the size difference for the three big-size portfolios are highly significant. For each of the six portfolios, the negative BE stocks have significantly higher default risk than their positive BE counterparts. However, this higher default risk is not always rewarded by higher raw equity return. For instance, the negative BE stocks generate a lower return than the positive BE stocks in the SmallLow portfolio.

TABLE 1: Comparison of default risk and return profile for positive BE and negative BE stocks for US stocks from 1986 to 2014

		Size	Default risk	Return	Sharpe ratio
Panel A — at the aggregate level					
	Positive BE stocks	1432	0.030	0.130	0.051
	Negative BE stocks	356	0.080	0.115	-0.006
	t value	7.3***	3.3***	0.2	1.2
Panel B — at the portfolio level					
SmallLow	Positive BE stocks	197	0.005	0.022	-0.109
	Negative BE stocks	160	0.13	-0.033	-1.993
	t value	1.1	4.1***	-0.15	4.36***
SmallMedium	Positive BE stocks	200	0.008	0.123	0.074
	Negative BE stocks	203	0.033	0.656	-1.168
	t value	0.1	1.9**	1.5*	2.1**
SmallHigh	Positive BE stocks	114	0.053	0.188	0.159
	Negative BE stocks	93	0.198	0.666	-0.259
	t value	1.3	2.0**	1.7*	1.7*
BigLow	Positive BE stocks	9467	0.002	0.112	0.12
	Negative BE stocks	302	0.085	1.006	-0.431
	t value	6.5***	2.8***	1.9**	1.5*
BigMedium	Positive BE stocks	5811	0.019	0.125	0.229
	Negative BE stocks	280	0.083	0.489	0.028
	t value	9.2***	3.1***	1.5*	1.2
BigHigh	Positive BE stocks	4214	0.049	0.145	0.326
	Negative BE stocks	222	0.098	1.059	0.058
	t value	10.1***	2.2**	2.4**	1.1
Panel C — after filtering stocks with positive default risk indicator					
	Positive BE stocks				0.133
	t value				2.6**
	Negative BE stocks				0.076
	t value				1.9**

*Notes: Size of stocks in the table refers to total assets measured in USD millions. The default risks are computed at the end of each month based in Formula (1). 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). 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 a medium BE/ME ratio. The Return column reports the raw returns, which are calculated as value-weighted returns for all stocks within the portfolio. A stock return in year t is an annualised return from July of year t to June of year t+1. We used the Treasury bill rate to proxy the risk-free rate in the Sharpe ratio calculation. *Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.*

This distress anomaly is more pronounced in terms of Sharpe ratios. Across the six portfolios, negative BE stocks deliver the lower risk-adjusted return compared to the positive BE stocks in the same portfolio. This observation seems to suggest that negative BE stocks are more volatile than their positive BE counterparts, which contributes to the noticeable negative risk-adjusted returns for negative BE stocks.

After assessing the relationship between default risk and the return for both positive and negative BE stocks, what is the main implication for practitioners in terms of return enhancement? The distress anomaly in our findings seems to suggest that returns can be enhanced if we install a default risk 'filter' to exclude those stocks with positive default risk scores[3] in selecting the investment universe. Panel C of the table reports that after installing this filter, both positive BE and negative BE stocks deliver significant higher risk-adjusted returns. This finding suggests that a simple default risk filter can be used in practice to enhance the portfolio return.

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Conclusion

This research complements the extant literature in examining the relationship between default risk and return from both positive and negative BE stocks. Prior research draws inferences about the relationship between default risk and the return profile in the absence of negative BE stocks. An inconsistency arises when negative BE stocks are omitted because these stocks are the ones most prone to distress risk. For this reason we incorporated these stocks in this study.

We find that negative BE stocks have higher default risk than positive BE stocks but this high risk is not necessarily compensated by high return, particularly not by high risk-adjusted return. Using these most distressed stocks, we confirm the distress anomaly documented in the literature. The implication for portfolio management from this study is that default risk can be used as a filter in the investment universe selection process. After installing this filter, the risk-adjusted return for both positive and negative BE stocks are both economically and statistically significantly different from the portfolios without such a filter.

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Notes

1. There have been three recessions since 1990. The early 1990s recession is from July 1990 to March 1991. The early 2000s recession is from March 2001 to November 2001. The most recent one is from December 2007 to June 2009.
2. It is worth noting that the default risk indicator obtained from the equation is not a default probability per se, unlike the default probabilities obtained from Moody's KMV-Merton model. This is primarily due to the calibration of the KMV-Merton model itself. No attempt is made to claim that the default risk indicators obtained from this model would be equivalent to those of the KMV-Merton model.
3. A stock is considered to have a zero value of default risk if the default value is zero rounded to four decimal places.

Reference

Altman, EI 1968, 'Financial ratios, discriminant analysis and the prediction of corporate bankruptcy', *The Journal of Finance*, vol. 23, pp. 589–609.

Banz, RW and Breen, WJ 1986, 'Sample-dependent results using accounting and market data: Some evidence', *The Journal of Finance*, vol. 41, no. 4, pp. 779–93.

Brown, SJ, Lajbcygier, P and Li, B 2008, 'Going negative: What to do with negative book equity stocks?', *Journal of Portfolio Management*, vol. 35, pp. 98–102.

Campbell, JY, Hilscher, JD and Szilagyi, J 2008, 'In search of distress risk', *The Journal of Finance*, vol. 63, pp. 1467–84.

Collins, DW, Pincus, M and Xie, H 1999, 'Equity valuation and negative earnings: The role of book value of equity', *The Accounting Review*, vol. 74, pp. 29–61.

Dichev, ID 1998, 'Is the risk of bankruptcy a systematic risk?', *The Journal of Finance*, vol. 53, pp. 1131–47.

Fama, EF and French, KR 2004, 'New lists: Fundamentals and survival rates', *Journal of Financial Economics*, vol. 73, no. 2, pp. 229–69.

Fama, EF and French, KR 2001, 'Disappearing dividends: Changing firm characteristics or lower propensity to pay?', *Journal of Financial Economics*, vol. 60, no. 1, pp. 3–43.

Fama, EF and French, KR 1993, 'Common risk factors in the returns on stocks and bonds', *Journal of Financial Economics*, vol. 33, pp. 3–56.

Griffin, JM and Lemmon, ML 2002, 'Book to market equity, distress risk and stock returns', *The Journal of Finance*, vol. 57, pp. 2317–36.

Hillegeist, SA, Keating, EK, Cram, DP and Lundstedt, KG 2004, 'Assessing the probability of bankruptcy', *Review of Accounting Studies*, vol. 9, pp. 5–34.

Kealhofer, S, Kwok, S and Weng, W 1998, 'Uses and abuses of bond default rates', KMV Corporation, working paper, no. 999–0000–039, San Francisco.

Merton, RC 1974, 'On the pricing of corporate debt: The risk structure of interest rates', *The Journal of Finance*, vol. 29, pp. 449–70.

Ohlson, JA 1980, 'Financial ratios and the probabilistic prediction of bankruptcy', *Journal of Accounting Research*, vol. 18, pp. 109–31.

Ritter, JR and Welch, I 2002, 'A review of IPO activity, pricing, and allocations', *The Journal of Finance*, vol. 57, no. 4, pp. 1795–828.

Vassalou, M and Xing, Y 2004, 'Default risk in equity returns', *The Journal of Finance*, vol. 59, pp. 831–68.