The Role of Default Risk and Growth Options in Explaining the Market Value of Equity

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ABSTRACT

We examine the role of default risk and growth options in explaining the market value of equity, besides that of earnings and book value of equity. Default risk is measured by the option-based probability of default at debt's maturity, while the growth options measure capturing the firm's upside growth potential is estimated from a regression model of option-based variables. Our main sample consists of 965 U.S. firms that filed for bankruptcy during 1992-2002. We also use three additional sub-samples of "healthy" firms as controls, with varying degrees of financial distress and growth prospects, to examine the conditionality of the impact of these factors. Our results confirm that growth options dominate the role of book equity (and net income) in proxying for unrecognized net assets. The default risk seems to have a mixed effect: a traditional distress risk penalty with a negative impact on equity value for distressed firms or value firms on main exchanges; and a (equityholders') default option, reflected positively in current equity market values in the case of more volatile firms traded on Nasdaq. Our results confirm that use of earnings and book equity indeed proxy for (omitted) distress and growth option effects.

JEL codes: G33, G3, G0, M4

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I. INTRODUCTION

Earnings and equity book value, the two main summary measures of the primary financial statements, occupy a central place in accounting-based valuation models. These two measures provide essential inputs for various valuation techniques using ratios (such as market-to-book or price-to-earnings) and other approaches (such as residual income). The question that naturally arises is what is their economic role in market equity valuation. Equity valuation using financial statement information has long attracted the interest of the investment and the academic communities alike. The seminal work of Ohlson (1995) and Feltham and Ohlson (1995) concerning accounting-based valuation models provided stimulus for a growing body of literature that examines the conditions under which the balance sheet or the income statement is more value-relevant (e.g., Barth et al., 1998) and whether book value of equity proxies for liquidation value versus expected future earnings (e.g, Collins et al., 1999). These studies showed that book value of equity is more value-relevant than earnings for financially distressed or underperforming firms, while earnings are more value-relevant for healthy firms.[1]

Follow-on studies have often employed linear models incorporating both earnings and equity book value to explain the market value of equity (Lev and Zarowin, 1999; Core et al., 2003). The theoretical basis for these empirical models, however, is not well established. Some researchers consider the linear valuation models of Ohlson (1995) and Feltham and Ohlson

[1] Joos and Plesko (2005) investigate firms that report negative earnings and conclude that investors look behind losses, considering the causes and nature of the loss to assess its long-term implications for firm value. They suggest investors recognize the impact of R&D expenditure (a growth proxy) in the valuation of (persistent) losses.

(1995) as a justification for using linear regressions, although this may not be appropriate when applied to broad cross-sectional samples due to their use of firm-specific parameters.

Barth et al. (1998), using a distressed sample of firms, find that the coefficient and incremental explanatory power of book equity value increase and those of net income decrease as bankruptcy approaches. Using a larger, healthy sample of firms (having book equity, net income and total assets in excess of 1$ million), they find that the coefficient and incremental explanatory power of book equity value (net income) is higher (lower) for financially distressed firms. However, they did not distinguish whether book equity proxies for liquidation value or for unrecognized net assets (growth prospects). Collins et al. (1999) examine a sample of distressed firms to assess the conditions under which book value of equity may proxy for expected future earnings (Ohlson, 1995) and/or for liquidation value (Berger et al., 1996). They find that book equity proxies for expected future earnings for loss firms that survive. However, they did not confirm whether book equity proxies for liquidation values for loss firms that file for bankruptcy.

Although these prior studies established a positive association between net income and book equity with the market value of equity at the aggregate level, these associations may be partly proxying for omitted default risk and growth option effects and may be conditioned on firms' financial health and growth characteristics.[2] Investors use book equity and net income information differently in equity valuation, depending on firm-specific characteristics. Book equity may be proxying for default risk on the downside more generally (not just for liquidation value), as well as for a firm's growth prospects on the upside. Thus, book equity's significance may be

[2] Recently, Demers and Joos (2007) explore the factors associated with historical IPO failures by developing an IPO failure prediction model that includes accounting information as well as proxies for the role of information intermediaries and other IPO deal–related characteristics. They show significant differences in failure models applicable to nontech versus high tech IPOs, and these structural differences are largely driven by accounting-based

reduced when default risk and growth options variables are explicitly accounted for in the valuation model. Inclusion of a direct proxy for growth options may also reduce net income's explanatory power.

This study examines the role of default risk (DR) and growth options (GO), derived from option theory, besides that of net income (NI) and book value of equity (BE), in explaining the market value of equity (ME). Default risk (DR) is measured by the option-based probability of default at debt's maturity, while the growth options (GO) measure captures the firm's upside growth potential estimated from a set of option-related variables based on industry data.

To examine the conditionality of the impact of the various factors on financial health and growth option characteristics we investigate four different sub-samples of firms. The main sample (sub-sample 1) consists of highly-distressed firms that filed for bankruptcy to examine the role of default risk (DR) and growth options (GO) in explaining the market value of equity, beyond those of the net income (NI) and book value of equity (BE) variables already established in the literature. We subsequently utilize three additional sub-samples of "healthy" firms (that did not file for bankruptcy) as controls, with varying degrees of financial health and growth prospects to examine the conditionality of the roles of these factors on financial distress and growth. The first control sample (sub-sample 2), "less distressed", consists of non-bankruptcy filing firms matched by industry and total assets as the bankruptcy-filing firms.[3] Sub-sample 3, "less healthy", consists of "healthy firms" with a relatively high degree of financial distress as measured by the option-based probability of default, DR = $-d_2$, being above the median. Finally, sub-sample 4 consists of "more healthy" firms (with DR being below the median). The use of different control sub-samples helps

proxies for firms' investments in intangible assets, operating performance and financial leverage.

[3] Although these firms have not filed for bankruptcy, they may be somewhat distressed if financial distress is due to

shed light on whether NI and BE continue to play the same significant role for firms in a better financial condition or with better growth prospects than the bankruptcy-filing firms used by Barth et al. (1998) and Collins et al (1999), or whether inclusion of more direct proxies for default risk and growth options may dominate the role of BE and NI in explaining the market value of equity in broader contexts. If our direct measures for default risk and growth option effects should prove to have a significant incremental role, the results may be interpreted as corroborating prior studies when using these two key accounting variables to partly proxy for (missing) distress and intangible assets. Our study seeks to explain under what circumstances (depending on varying financial distress and/or growth prospects) each of these variables may play a significant incremental role.

Our results confirm that book equity and net income are not sufficient factors to capture the growth prospects and distress effects relevant in explaining the market value of equity. Their explanatory role depends on the degree of financial distress and growth prospects of the firm. In the main sample of highly distressed (bankruptcy-filing) firms we verify, consistent with Barth et al. (1998), that the significance of net income decreases and that of book equity increases as bankruptcy approaches. Such smooth trend patterns do not exist for the "less distressed" control sample of firms (that did not file for bankruptcy). In more comprehensive samples, inclusion of the growth options (GO) measure dominates the role of book equity (and of net income) in proxying for the value of unrecognized net assets (growth prospects). Default risk (DR) seems to have a mixed effect: a traditional distress risk penalty with a negative impact on market equity value for highly-distressed firms or value firms on main exchanges; and a (equityholders') default option, which like insurance is reflected positively in current market equity values in the case of more volatile firms traded on

industry-wide factors (though less distressed than firms in the main sample).

Nasdaq.[4] The new proxies for default risk and growth options proposed herein seem to dominate and condition the role of book equity and earnings in explaining the market value of equity. Interestingly, certain variables may change signs and role, depending on the prevalence of financial distress and growth prospects in a particular sub-sample.

This study contributes to the valuation-content literature by considering a more comprehensive option-driven valuation model in explaining the market value of equity. The extended model incorporates explicitly default risk and growth option variables that have not been taken into consideration in prior related accounting literature. This study also sheds light on the conditional role of NI, DR and GO variables based on firm-specific characteristics (degree of financial health and growth prospects).

The rest of the paper is organized as follows. The rationale for our option-driven proxies for default risk and growth options is discussed in section II. Section III describes our data and methodology. The empirical findings are presented in section IV. The last section concludes.

II. OPTION-BASED DEFAULT RISK AND GROWTH OPTIONS

In this section we provide an option-based rationale for the default risk and growth option variables used in our extended model to explain the market value of equity as direct proxies for financial distress and growth.

[4] The basic intuition behind the standard option approach (e.g., Merton, 1973, 1974) is that the equity of a levered firm can be viewed as a call option held by equityholders to acquire the value of the firm's assets by paying off (i.e., having as exercise price) the face value of the debt at the debt's maturity. Hence, equityholders' limited liability provides a valuable option to default on principal debt payment at maturity and simply walk away by handing over the firm's (less valuable) assets instead. This equityholders' default option is reflected positively in current market prices.

A. Default Risk (DR)

Following the seminal work of Black and Scholes (1973) and Merton (1973, 1974, 1977), option valuation has been applied to the valuation of various corporate securities seen as packages of claims or options on the total value of the firm's assets, V; the various corporate liabilities, such as stockholders' equity, risky debt, warrants or convertible bonds, could now be valued as claims contingent on V as the underlying asset.

The total market value of the firm's assets at time t, V_t, is assumed to follow a standard diffusion process of the form:

$$dV_t/V_t = (\alpha - \delta)\, dt + \sigma\, dz \qquad (1)$$

where α denotes the (instantaneous) total expected rate of return on firm value, δ is the total payout by the firm (including dividends and coupon payments to debtholders) expressed as a % of V, σ is the (instantaneous) standard deviation of the firm's returns (% firm asset value changes), and dz is an increment of a standard Wiener process.

The market value of equity (ME) of such a levered firm, being analogous to a call option to acquire the value of the firm's assets, V, by paying the debt principal B due at maturity (T), is given by the extended Black-Scholes formula for a European call option (adjusted for a payout δ on firm value):

$$ME(V, \tau) = V e^{-\delta\tau} N(d_1) - B e^{-r\tau} N(d_2) \qquad (2)$$

where $d_2 = \{\ln(V/B) + [(r - \delta) - 1/2\sigma^2]\, \tau\} / \sigma\sqrt{\tau}$; $d_1 = d_2 + \sigma\sqrt{\tau}$

N(d) = (univariate) cumulative standard normal distribution function (from $-\infty$ to d)

B = face value (principal) of the debt

V = value of firm's assets

σ = standard deviation of firm value changes (returns in V)

δ = (constant) payout on firm value

r = risk-free interest rate

τ ($\equiv$ T - t) = time to debt's maturity

The first term in eq. (2) above is the discounted expected value of the firm if it is solvent (assuming a constant dividend payout δ). $N(d_2)$ in the second term of eq. (2) is the (risk-neutral) probability the firm will be solvent at maturity, i.e., Prob($V_T > B$), in which case it will pay off the debt principal B (with a present value cost of $B\, e^{-r\tau}$). Analogously, 1 - $N(d_2)$ or $N(-d_2)$ in eq. (2) represents the risk-neutral probability of default at the debt's maturity.

It is worth noting that while the value of the option depends on the risk-neutral probability of default (where d_2 depends on the value of the risk-free rate, r), the actual probability of default at the debt's maturity depends on the future value of the firm's assets (V_T) and hence on the expected asset return, μ. This is obtained by substituting the expected return on assets, μ, for the risk-free rate, r, in the above equation for $-d_2$, i.e.,

Actual prob. default (on principal B at maturity T) = Prob($V_T < B$) = 1 - $N(d_2) = N(-d_2) \sim -d_2(\mu)$

where $-d_2(\mu) = -\{\ln(V/B) + [(\mu - \delta) - \tfrac{1}{2}\sigma^2]\tau\}/\, \sigma\sqrt{\tau}$. (3)

We measure default risk (DR) using the actual default measure $-d_2(\mu)$ above. This default measure depends on the six primary option variables influencing $-d_2(\mu)$ in eq. (3).

Interestingly, eq. (2) can be re-written as follows:

$$ME(V, \tau) = (V\, e^{-\delta\tau} - B\, e^{-r\tau}) - V\, e^{-\delta\tau}\, N(-d_2 - \sigma\sqrt{\tau}\,) + B\, e^{-r\tau}\, N(-d_2) \qquad (2')$$

The first term in eq. (2') comes from the (net) expected value of a solvent firm where equity commits to paying the debt due at maturity. There are two opposing effects of default risk (DR) on market equity value (ME): the traditional negative (systematic risk) effect on market equity captured by the second term in eq. (2'), and a positive default-option effect on equity captured by the third term. In general both effects may exist simultaneously and so the relation between DR and ME is not monotonic. Our subsequent empirical results support such a mixed default risk (DR) effect in general, and depending on the sub-sample examined one of the two effects may dominate. For volatile firms on Nasdaq (resembling out-of-the-money call options) the third term (default-option effect) may dominate, so the net average DR effect may be positive. Our findings confirm that this is more pronounced for more volatile, growth-oriented firms traded on Nasdaq, whereas for main-exchange traded firms or highly distressed firms the traditional negative (systematic risk) impact typically dominates.

The real-life picture may be a bit more involved. There is also a fourth (also positive) term, capturing the impact of growth options (GO). The impact of GO on market equity value is similar (+) to that of the third term (default option), and is stronger for volatile Nasdaq firms than for established, main-exchange traded value firms. Our use of different sub-samples with varying default risk and growth option characteristics is intended to help separate out the impact and role of these various effects on the market value of equity.

B. Growth Options (GO)

We hypothesize that growth options are reflected positively in current market equity prices and may lead to a growth option discount on expected stock returns for growth firms, equivalent to a negative (rather than positive) systematic risk premium. Prior studies, among others Lakonishok et al. (1994) and Berk et al. (1999), use book-to-market, Tobin's q and/or earnings-to-price variables to proxy for growth opportunities. However, these variables are only indirect proxies of growth options with little theoretical underpinning. In contrast, we employ an option-theory based measure to value the firm's growth prospects. This measure should help differentiate between firms with valuable growth options and firms with few such opportunities.

The basic intuition behind this approach is that the market value of the firm (V) is made up of two components, the value of assets in place (proxied by the present value of sustainable free cash flows under a no-growth policy) and the present value of future growth options. The present value of growth options can therefore be backed out from the current total market value of the firm (V) as follows: [5]

$$GO_{i,t} = V_{i,t} - PV(C_{i,t}) \tag{4}$$

where $V_{i,t}$ is the total market value of the firm ($V_{i,t} = E_{i,t} + D_{i,t}$, where $E_{i,t}$ is the market value of equity and $D_{i,t}$ is the value of debt at time *t*). $PV(C_{i,t})$ is the present value of the sustainable (perpetual) free cash flows under a no-growth policy (discounted at the WACC).

[5] Traditional corporate finance theory suggests inferring PVGO by substracting from the stock price the perpetuity of earnings per share under a no-growth policy. However, when using this excess-value approach, it is the total enterprise value that should be the departure point from which growth options are measured as a residual: Total Enterprise Value = GO + PV(A). Thus the value of debt must be taken into account as well. In this case, it is the capitalized value of the firm's sustainable total free cash flows that should be used to estimate PV(A), not simply earnings. Capitalizing the value of free cash flows requires estimating an appropriate discount rate such as the WACC for each firm or to estimate asset betas and an unlevered cost of capital and then adjust for tax shields (to use

A second variant in estimating GO is to use the market implied GO value described above as the dependent variable in a regression model based on independent variables motivated by real options thinking. Based on real option theory (e.g., see Trigeorgis, 1996; Smit and Trigeorgis, 2004, p. 78), growth option value is significantly impacted by the firm-specific business volatility facing the firm and by managerial flexibility to favorably (asymmetrically) influence the value creation process, the firm's risk characteristics and return distribution. It is also impacted by the firm's organizational and financial flexibility (leverage) and cash flow position that allow it to leverage its capabilities, meet obligations, adjust to change and exploit future growth opportunities. It is further enhanced by the firm's systematic efforts to create, cultivate or develop future growth options, as proxied by R&D intensity, and to exercise such options as evidenced by an increase in capital expenditures and by the firm's cumulative growth experience. Finally, since the firm operates in a competitive environment, GO is impacted by the firm's relative market power and ability to appropriate shared growth opportunities vis-à-vis competition. The above is summarized in the following regression model developed in Trigeorgis and Lambertides (2006):

GO = *f*(market risk, firm-specific volatility, managerial flexibility, organizational flexibility, financial flexibility, cash flow position, R&D intensity, change in capital expenditures, cumulative growth, market power; fixed effects, industry effects, interactions) (5)

The dependent variable (GO) is the % of a firm's value arising from future growth opportunities (PVGO/V) as inferred or estimated by subtracting from the current total market (enterprise) value of the firm the capitalized or discounted (at the WACC) perpetual stream of the

Adjusted Present Value).

firm's sustainable total free cash flows under a no-growth policy (net of the value of debt). We refer to this as the GO implied (estimated) from current market value. Market risk is measured by the firm's systematic risk or beta (using CAPM). Firm-specific (business) volatility represents the idiosyncratic risk of stock returns and is estimated from the residuals of the regression of the stock's returns on the market index. Managerial flexibility and active management enable the firm to take advantage of upside opportunities while limiting downside losses, resulting in an asymmetric value distribution. Firms with a more asymmetric return distribution (measured by positive skewness) tend to manifest higher managerial flexibility, are deemed to be more successful in communicating to the market realization of their growth opportunities and represent more realized growth option value. Organizational flexibility in the firm's decision-making and administrative procedures is measured by the ratio of its Selling, General and Administrative (SG&A) expenses to Sales over the recent 3-year period (see also Tong and Reuer, 2006). This proxies for the organization's flexible infrastructure to support innovation and provide the general resources needed for exercising growth options. Financial flexibility is partly proxied by the firm's leverage, measured by B/V, the book value of total liabilities (B) divided by the market value of the firm (V).[6] Beyond leverage, financial flexibility to undertake future growth options is also partly proxied by the amount of excess cash and equivalents maintained by the firm. A high amount of cash flow coverage partly captures this. A low amount of cash flow coverage also relates to the probability of default at an intermediary stage due to inability to cover due debt payments before debt maturity. R&D intensity captures a firm's systematic investment efforts to cultivate or develop multi-stage growth options. R&D intensity is measured as average R&D expenses over the recent 3-year period as a % of sales. Higher R&D

[6] Myers (1977) also suggests that equity is more conducive than debt (and hence a lower leverage is preferable) for

intensity represents a higher mix of exploration vs. commercialization activities in the firm's portfolio mix, and reflects a higher proportion of (multi-stage or compound) option value. The change in capital expenditures (deflated by sales or total assets) measures the firm's commitment in exercising growth options. The firm's recent cumulative growth experience or growth trend capturing a changing asset mix is measured as the % change (growth) in firm revenues over the recent three-year period. The firm's market power and ability to exploit shared growth options relative to competition for the given industrial structure is proxied by market concentration, measured as the square root of the firm's Herfindahl-Hirschman Index (HHI) if the firm has above-average Tobin's Q, and zero if the firm has below-average Q. Fixed effects are used to capture time variation, accounting for unobserved heterogeneity and variation (e.g., in volatility) at the firm level and capturing the effects of economy-wide variations (such as in interest rates) or other unobserved factors. Various interaction effects are included as appropriate.

The regression model of equation (5) is applied at the industry level over the recent three-year period to obtain average coefficients for (loadings to) the above option-driven variables for each firm *i* in each year *t*. Then using current data on these variables for each firm, we determine a predicted $GO_{i,t}$ *score* for each firm *i* at time *t,* reflecting its predicted future growth option potential. We refer to the GO measure estimated from the above regression model based on option variables as our model or predicted GO.[7] The above analysis is based on time-series cross-sectional

financing growth options as debt can introduce ex post distortions in a firm's investment decisions.

[7] The market implied GO estimate is an input (the y variable) in determining the regression coefficients and arriving at our model or predicted GO score. The market implied GO score for a particular firm may be off if its stock is temporarily mispriced. We use the model or predicted GO measure in our subsequent empirical analysis as a better predictor of the firm's future growth option potential. For robustness purposes, we performed the analysis using the market implied GO as well. The results are qualitatively similar.

regressions using industry-level data (2-digit SIC) over the 1992-2002 period. The next section discusses the dataset and empirical models used in the study.

III. DATA AND METHODOLOGY

A. Dataset

Our main sample (sub-sample 1) consists of 965 highly-distressed U.S. firms identified in the BankruptcyData.Com (a division of New Generation Research, Inc.) as having filed a Chapter 11 bankruptcy petition during the recent 11-year period 1992-2002, with data available in the Compustat annual industrial and research tapes.[8] The comprehensive "healthy" sample (from which we construct the three control sub-samples) consists of the universe of all "healthy" firms (6560 U.S. firms that did not file for bankruptcy) with data available in the Compustat Active tape during the same period. For a firm to be included in the final sub-samples it must have data available to calculate the various component variables needed for the determination of the default risk (DR) and growth option (GO) measures described in the previous section.

We subsequently investigate the impact of default risk (DR) and growth options (GO) on the market value of equity (ME), beyond those of net income (NI) and book equity value (BE), as well as interaction effects, based on the following models:

(1) Primary (standard) model

$$ME = b_0 + b_1 NI + b_2 BE \quad (6)$$

(2) Extended model

$$ME = b_0 + b_1 NI + b_2 BE + b_3 DR + b_4 GO + \text{interactions} \quad (7)$$

[8] The original sample consisted of 1088 distressed firms during the period 1992-2002. We excluded a small number

where ME: market value of equity, NI: net income (before extraordinary items and discontinued operations), BE: book value of equity, DR: (option-based) default risk, GO: growth options measure.

Standard model (1) is subsumed by the extended model (2) which includes the additional default risk (DR) and growth option (GO) variables.[9] Figure 1 summarizes the four sub-samples used to examine the conditional dependence on financial health and growth option characteristics. Panel A organizes the sub-samples based on the degree of financial distress (and growth). Panel B summarizes the expected impacts of each variable and how they may vary by sub-sample based on our extended model (2).

Net income (NI) is expected to be significantly positive in all sub-samples. There should be a declining significance for sub-sample 1 (bankruptcy-filing firms) as bankruptcy approaches, but not for comparable healthy firms (sub-sample 2). NI is expected to be more significant for established, main-exchange traded firms and less so for Nasdaq firms. Book equity (BE), as a proxy for liquidation value, should be positive and significant for highly-distressed firms, increasing in significance as bankruptcy approaches in subsample 1, but with no such pattern for matched non-bankruptcy filing firms. For healthy or less distressed ("less healthy") firms BE may be less significant or insignificant. Default risk (DR) is expected to exhibit a mixed effect as per eq. (2'): a traditional negative effect for highly-distressed firms or for established firms on main exchanges; and a positive, default-option (insurance type) effect for volatile firms on Nasdaq. The net DR effect

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of firms identified as utilities and financial institutions due to structural financial differences from other industrial firms.

[9] If normalized by current price, the standard accounting-based model (1) maps into finance-based Fama and French (1992, 1993, 1995) type model (with earnings-to-price and book-to-market replacing NI and BE as the main

may appear insignificant for the aggregation of healthy firms. The growth option (GO) variable is expected to have a positive impact on market equity value, with the impact being more significant for more volatile or distressed firms ("less healthy", compared to more healthy) or for firms traded on Nasdaq, rather than for stable value firms on main exchanges.

The expected differential effects of these main factors by sub-sample are as follows. For the highly-distressed firms (sub-sample 1), the explanatory power of net income (book equity value) should decrease (increase) as financial health declines. The default risk (DR) is expected to be significant (negative) in the years prior to bankruptcy filing. The impact of growth options (GO) should be significant and positive, and its explanatory power is expected to decrease as bankruptcy filing approaches and the firm's growth prospects deteriorate.

For sub-sample 2 (matched less-distressed firms), the coefficients of NI and BE should no longer exhibit the nice trends (seen in sub-sample 1) as there is no longer a bankruptcy-filing event. The DR and GO measures are expected to be significant in explaining market equity. We expect growth options to remain significantly positive since less-distressed firms probably incorporate significant growth prospects, whereas the default risk (DR) is expected to exhibit a net mixed effect (the sign is a priori unclear, but potentially positive if the third default-option term in eq. (2') dominates).

Sub-sample 3 consists of "less-healthy" firms, many of which are likely traded on Nasdaq and are characterized by high distress and growth. For these firms, both the default risk and growth options effects are expected to be highly significant. GO is expected to be more significant for these less healthy firms than for the more-healthy firms typically traded on the

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variables).

main exchanges. The net impact of DR is again unclear (with possibly the traditional distress risk penalty effect dominating if the default-option effect is smaller for these firms).

For the more-healthy firms (sub-sample 4), the net effect of the two terms in eq. (2') underlying the default risk is again unclear in the aggregate (with possibly the default-option effect dominating since the distress risk effect is smaller for these more-healthy firms). When the sample is separated into Nasdaq vs. main-exchange traded firms, the traditional negative impact should prevail for value firms on main exchanges whereas the positive default-option impact may dominate for volatile, Nasdaq firms. Net income (NI) is expected to have higher explanatory power for established, "value" firms traded on Main exchanges, whereas the growth option (GO) variable is expected to be more important for firms traded on Nasdaq.

In summary, book equity (BE) is expected to lose significance when default risk (DR) and growth option (GO) measures are explicitly included. DR is expected to be more significant in more volatile environments (often associated with higher financial distress and growth prospects), and is expected to capture a net mixed effect. The net effect may be positive or negative depending on the sub-sample characteristics. Inclusion of the GO variable is expected to dominate the role of book equity in proxying for intangible assets and may also reduce net income's explanatory power. The GO variable is expected to be more significant in more volatile situations or for growth stocks traded on Nasdaq with more upside potential (than for main value firms).

IV. EMPIRICAL RESULTS

This section presents and discusses our findings. First, we present descriptive statistics for

the samples tested and then discuss the regression results for our main sample (highly-distressed) and those concerning the three control sub-samples involving differential distress and growth characteristics.

Table Ia presents descriptive statistics and correlations on the primary variables for the 965 highly-distressed firms in our main sample (sub-sample 1) over the period 1992-2002.[10] Panel A confirms that the (median) market and book values of equity, net income, and growth options decline, whereas default risk increases, as bankruptcy approaches. The negative mean book value of equity (BE) in the last year (-1) is due to the presence of many negative net worth firms.[11]

Panel B of Table Ia presents 5-year average Pearson correlations among the primary variables. The market value of equity is positively correlated with both book value of equity and growth options in the years prior to bankruptcy filing. The distress (DR) measure is negatively correlated with market equity for these highly-distressed firms. Interestingly, for these highly-distressed firms net income appears negatively correlated on average with both growth options and market equity (in several years prior to bankruptcy filing). Book equity is positively correlated with the growth option variable and may be picking up its impact when the latter is omitted from the model. These results confirm that net income and growth option variables play complementary roles in equity valuation.

Table Ib presents descriptive statistics and correlations for the full sample of 6560 "healthy" (non-bankruptcy filing) firms and by financial health sub-category over the period. Firms with default risk (DR) measure lower than the corresponding sample median DR in the relative year are

[10] If a test firm has fewer than five years of available data prior to the filing year, we include it for the number of years for which it has available data, which results in varying sample sizes across the five years. This avoids a sample selection bias since firms that file for bankruptcy often exist as public entities for fewer than five years.

[11] In fact, 64 of the 167 sample firms have negative equity book value in year –1, questioning the accuracy of the

categorized in the less-healthy group (sub-sample 3), otherwise they are categorized in the more-healthy group (sub-sample 4). As expected, more-healthy firms have higher net income, market and book value of equity than less-healthy firms. For these healthy firms, correlations are as expected, with net income being highly positively correlated with market equity and with the growth option variable. Our regression results are presented for each sub-sample next.[12]

Highly-Distressed (Main Sample)

Table II presents multivariate regression results regarding the main sample of highly-distressed firms, up to five years prior to bankruptcy filing. Panel A of Table II replicates Barth et al.'s (1998) standard model results. Both NI and BE exhibit a positive impact on market value of equity (ME) with the expected trends. As predicted, the coefficient of NI declines (from 7.49 in year -5 to 2.75 in year -1), whereas for BE increases (from 0.91 in year -5 to 3.31 in year -1) as bankruptcy filing approaches. NI is not statistically significant in the last years prior to bankruptcy while BE is significant in all years.

Panel B of Table II presents the results based on the extended model of eq. (7) including the distress and growth option variables. As expected, the incremental role of DR and GO is significant in all years, beyond that of NI and BE. The valuation role and explanatory significance of NI and BE is reduced when the new variables DR and GO are included. The role of book equity as a liquidation proxy is now partly captured by the default risk (DR) variable. DR is negative and significant in all years prior to bankruptcy filing, confirming that the higher the default risk the lower the market value of equity for highly-distressed firms (traditional penalty role). GO tends to decrease (from

claim that equity book value proxies for liquidation value.

[12] Pooled regression models are estimated using industry fixed effects. Presented t-statistics are based on White

0.46 to 0.18) as bankruptcy filing approaches. As expected, the value and significance of the firms' growth opportunities declines due to the deterioration in the firm's financial performance. Interaction effects between book equity and the growth options measure and between net income and default risk are significant in some years. The last column in Panel B of Table II summarizes all firm-year-observation (last five years) results based on averaging the five-year regression coefficients. Comparing the last columns in Panels A and B of Table II, the average coefficients of net income and book value of equity are significantly lower and their role in equity valuation is reduced when the default risk and growth option measures are included. The latter result confirms the practical role of net income and book value of equity in proxying for default risk and growth option effects in equity valuation (when direct proxies for these effects are not included).

In summary, our results based on the main sample indicate that a) book equity and net income are not sufficient factors in explaining the market value of equity, b) the default risk and growth option effects seem to play an important role in explaining market equity beyond NI and BE (with DR being a distress risk rather than a mere proxy for liquidation value), c) the growth option variable is significant suggesting that even highly-distressed firms incorporate significant growth prospects, although these decline as bankruptcy filing approaches.

Less Distressed (Matched)

Table III presents multivariate regression results using the less-distressed control sample of non-bankruptcy filing firms (matched by industry and total assets). Panel A confirms the absence of previous trends for NI and BE, since there is no bankruptcy-filing event in this case. Panel B confirms that the DR and GO variables are significant (beyond book equity and net income) in

heteroskedasticity-consistent standard errors.

almost all years for these non-bankruptcy filing firms as well.

To investigate further the differential explanatory role of these factors for healthy vs. more distressed firms, we estimate a pooled regression over the five-year period using a dummy (DRDum) to differentiate more-distressed firms. The intercepts for NI, BE, DR and GO coefficients are allowed to vary depending on the degree of distress. Results are presented in Table IV for this less-distressed control sample (5-year averages). Each factor is multiplied by an indicator variable (DRDum) that equals one if a firm is categorized in the lower financial-health category (within sub-sample 2) based on the median DR of the relative year, and zero otherwise. The table presents results for more vs. less financially-healthy firms within the sub-sample of less-distressed firms to examine the differential role of these variables with regard to the degree of distress. Results confirm once again that the default risk (DR) and growth option (GO) variables are significant in explaining the market value of equity. GO is significantly positive as expected. Similar to Table III, the incremental impact of net income (NI*DRDum) and book equity (BE*DRDum) is insignificant (when DR and GO are explicitly accounted for), i.e., these variables are not significantly related to the degree of distress. Moreover, the incremental default risk (DR*DRDum) for less financially healthy firms is significantly positive, suggesting a higher impact of default risk on market equity for more distressed firms (a default option effect). This incremental default-option effect (+0.14) dominates the absolute traditional negative DR impact (-0.04), with the net DR effect being positive (-0.04 + 0.14 = +0.10). Again, the presence of a mixed DR effect as predicted by our eq. (2') is confirmed.

(Less vs. More) Healthy Firms

The findings reported thus far provide support for our predictions regarding the market

equity valuation implications of the different roles of default risk and growth option variables for distressed firms (both those filing for bankruptcy and a control sub-sample of matched less-distressed healthy firms). Although highly (or less) distressed firms provide a potentially powerful test of our predictions, these findings by themselves are not generalizable for all types of firms. Next, we provide evidence on distress and growth effects by extending our predictions and tests on the entire population of 6560 healthy (non-bankruptcy filing) firms, the majority of which do not face significant financial difficulties (to be included in the sample of "healthy" firms, these firms have net income, total assets, and book equity greater than $1 million).[13] These generally healthy firms are sub-divided into less vs. more healthy sub-samples (sub-sample 3 and 4, respectively).

Table V presents multivariate regression results separately for the less (Panel A) vs. the more (Panel B) healthy sub-samples. Net income is significantly positive (similarly important across the two sub-samples of healthy firms). The growth option (GO) variable is more significant in sub-sample 3 due to the higher volatility and growth prospects associated with "less-healthy" firms. GO also dominates BE in capturing the value of unrecognized net assets in less-healthy firms (having not much liquidation value). The default risk (DR) measure, acting as traditional distress risk, is significantly negative for less-healthy firms. Interestingly, the coefficient of DR is significantly positive in more-healthy firms, motivating further investigation as to a potentially mixed effect that may differ among established value firms (traded on main exchanges) vs. volatile growth firms (traded on Nasdaq). This issue is investigated further in subsequent Table VII below.

Table VI provides evidence using a pooled regression on the universe of healthy firms and

[13] These requirements eliminate the need to use separate intercepts or slope coefficients for negative net income or

interaction terms (similar to Table IV for distressed firms). Results confirm that default risk and growth options are significant in explaining the market value of equity. Results also show that the incremental impact of default risk is negative for the less-healthy group of firms (consistent with the traditional distress risk penalty impact prevailing). That is, the default risk coefficient for less-healthy firms is (0.82 – 2.3), compared to 0.82 for the more-healthy firms.

Table VII delves deeper to investigate further the mixed DR effect for the group of more-healthy firms (sub-sample 4). Regression results are presented separately for healthy firms traded on Nasdaq with higher growth opportunities (Panel A) vs. more established firms traded on the Main (Amex or NYSE) exchanges dominated by more value firms (Panel B). Consistent with expectations, net income is more significant in explaining market equity for established value firms than for growth firms. The growth option (GO) variable is more significant in explaining market equity for Nasdaq/growth firms. According to model (1) in Panel A of Table VII, the coefficient of GO is 0.62 for growth firms vs. 0.17 for value firms. Model (2) includes interaction terms. The default risk (DR) measure appears to exhibit a mixed effect: negative impact for established value firms (indicating dominance of the traditional distress risk penalty) and a positive impact for more volatile growth firms traded on Nasdaq, suggesting equityholders' default option is reflected positively in market equity prices. The positive DR coefficient for growth firms and the negative DR coefficient for value firms in Table VII Panels A and B verify our mixed effect expectations based on eq. (2').

book equity value observations and ensure our sub-samples 3 and 4 are broadly "healthy".

V. CONCLUSIONS

We have examined the role of default risk and growth options variables in explaining the market value of equity, beyond that of earnings and book value of equity. We have analyzed four different sub-samples of firms. The main sample consisted of highly-distressed firms that filed for bankruptcy to examine the incremental valuation role of our default risk and growth options beyond net income and book value of equity. We utilized three additional sub-samples of "healthy" firms as controls, with varying degrees of financial distress and growth prospects, to examine the conditionality of these factors on firm-specific characteristics.

Our results confirm that book equity and earnings are not sufficient factors in explaining the market value of equity, and their role varies by the degree of financial distress and firm growth prospects. We show that in more comprehensive samples, inclusion of a growth option variable dominates the role of book equity (and net income) in proxying for unrecognized net assets or growth prospects. We also suggest that the role of book equity in proxying for liquidation value is specific to highly-distressed firms. Our general default risk variable captures a mixed effect for the universe of firms: a traditional distress risk penalty is generally more evident in established/value firms on main exchanges or in highly-distressed situations; and a (equityholders') default-option impact reflected positively in market equity values for more volatile firms (on Nasdaq).

Our study contributes to the valuation-content literature by proposing and testing a more comprehensive, option theory-driven valuation model to explain the market value of equity. Our model incorporates explicitly default risk and growth option variables that have not been taken into consideration in prior related accounting literature, and sheds light on the conditionality of the factors affecting market equity based on firm-specific characteristics. Our results confirm that use of

earnings and book equity indeed proxies for (omitted) distress and growth option effects.

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Figure 1. Description of Four Sub-samples and Anticipated Impacts
This figure summarizes the four sub-samples used to examine the conditional dependence of market value of equity (ME) on financial health and growth characteristics. Panel A organizes the sub-samples relative to the degree of financial health (and growth prospects). Panel B summarizes the expected impact for each variable (and how they may vary by sub-sample) based on our extended model of eq. (7): ME = f(NI, BE, DR, GO, interactions), where ME: market value of equity of the firm, NI: net income, BE: book equity, DR: (option-based) default risk, GO growth options measure.

Panel A: Description of sub-samples

Sub-sample	Financial health		Description	
1	Highly	DISTRESSED	965 firms filed for bankruptcy	
2	Less		965 control "healthy" firms (matched by industry and total assets)	
3	Less	HEALTHY	6560 "healthy" firms (with NI, BE, ME > 1$m) not filed for bankruptcy	DR > median
4	More			DR < median

Panel B: Anticipated impact of each variable on market value of equity (ME)

Sub-sample	Financial health		NI	BE	DR	GO
1	Highly	DISTRESSED	+ ↘	+ ↗	↘ -	↘ +
2	Less		∩ +	∩ +	?	+
3	Less	HEALTHY	+	X	?	+ more
4	More		+	+	?	+ less
		A: Nasdaq	+ less	+	+	+ more
		B: Main	+ more	+ less	-	+ less

Table Ia. Descriptive Statistics and Correlations for Main Sample (Sub-sample 1)
(Highly-distressed firms that filed for bankruptcy)

This table presents descriptive statistics (mean and median) for each variable up to five years prior to bankruptcy filing (Year 0) for the sample of 965 highly distressed firms over the 11-year period 1992-2002. ME: market value of equity, BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options.

Panel A: Descriptive Statistics for Highly-distressed firms

	ME	NI	BE	DR	GO
			Year -5		
Mean	233.36	0.20	93.67	-262.34	261.16
Median	59.70	0.15	30.36	-39.20	115.16
Num Obs	137				
			Year -4		
Mean	252.96	-2.30	96.17	-288.37	308.13
Median	77.68	-0.55	32.32	-31.58	140.02
Num Obs	167				
			Year -3		
Mean	239.55	-11.34	100.40	-90.45	398.34
Median	58.99	-2.59	28.54	-6.67	124.56
Num Obs	218				
			Year -2		
Mean	156.88	-38.65	67.95	-11.33	339.20
Median	41.46	-8.91	20.78	0.85	99.66
Num Obs	242				
			Year -1		
Mean	134.78	-86.45	-7.53	217.20	471.45
Median	20.75	-28.37	3.88	9.61	97.09
Num Obs	167				

Panel B: Pearson Correlations for Highly-distressed firms (5-year Avg)

	ME	NI	BE	DR	GO
ME	1	-0.01	0.38	-0.11	0.59
NI		1	0.16	-0.12	-0.15
BE			1	-0.10	0.21
DR				1	0.05
GO					1

Table Ib. Descriptive Statistics and Correlations for Healthy Firms

This table presents descriptive statistics (mean and median) for each variable for the universe of all 6560 healthy firms (that did not file for bankruptcy) having net income, market and book equity values more than $1 million over the 11-year period 1992-2002. The overall sample is divided in two sub-samples based on the (option-based) probability of default DR = - d_2 = -{ln(V/B) + [(r – δ) - 1/2σ^2] τ }/ $\sigma\sqrt{\tau}$. "Less-healthy" firms (sub-sample 3) have DR more than the corresponding median, and "more healthy" firms (sub-sample 4) less than the median. ME: market value of equity, BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options.

Panel A. Descriptive Statistics for Healthy Firms

	Full sample (universe of all healthy firms)					**Sub-sample 3: "Less-healthy" firms (DR > median)**					**Sub-sample 4: "More-healthy" firms (DR < median)**				
	ME	NI	BE	DR	GO	ME	NI	BE	DR	GO	ME	NI	BE	DR	GO
Mean	4808.78	196.78	1198.67	-2.26	3658.68	3073.18	134.63	877.21	0.10	2500.39	6545.01	258.96	1520.26	-4.61	4817.40
Median	444.69	22.44	185.60	-1.94	316.22	328.78	16.94	162.41	-0.69	256.06	635.89	30.07	206.90	-3.57	385.32
Num Obs	5413					2707					2706				

Panel B. Pearson Correlations for Healthy Firms

	Full sample (universe of all healthy firms)					**Sub-sample 3: "Less-healthy" firms (DR > median)**					**Sub-sample 4: "More-healthy" firms (DR < median)**				
	ME	NI	BE	DR	GO	ME	NI	BE	DR	GO	ME	NI	BE	DR	GO
ME	1	0.87	0.76	-0.01	0.63	1	0.89	0.68	0.12	0.79	1	0.86	0.80	0.00	0.58
NI		1	0.83	0.02	0.56		1	0.75	0.22	0.73		1	0.88	-0.02	0.50
BE			1	0.01	0.48			1	0.16	0.59			1	-0.01	0.44
DR				1	-0.02				1	0.02				1	0.01
GO					1					1					1

Table II. Main Sample of 965 Highly-distressed Firms (Filed for Bankruptcy): Multivariate Regression Analysis

Multivariate regression analysis by year for up to 5 years prior to bankruptcy filing (Year 0). The last column shows regression results for all firm-year observations (the last five years prior to bankruptcy filing). BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options. _neg denotes NI (or BE) is multiplied by an indicator variable that equals one if a firm has negative NI (or BE), and zero otherwise. Dependent variable is the market value of equity (ME).

Panel A. Primary (standard) model: $ME = b_0 + b_1\ NI + b_2\ BE$ (eq. 6)

	Year -5		-4		-3		-2		-1		All firm-year obs	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
c	32.630	(1.09)	21.620	(0.48)	-37.615	(-0.77)	71.226	(3.85)***	-37.254	(-0.67)	30.813	(0.04)**
NI	7.495	(6.98)***	4.968	(2.93)***	2.759	(01.)	0.973	(0.89)	2.754	(1.15)	2.641	(0.03)**
BE	0.926	(4.27)***	1.268	(4.5)***	1.661	(7.32)***	0.768	(6.36)***	3.313	(6.81)***	1.610	(0.00)***
NI_neg	-8.941	(-6.88)***	-8.221	(-3.16)***	-6.509	(-2.06)**	-0.978	(-0.84)	-2.910	(-1.21)	-2.818	(0.01)**
BE_neg	-2.491	(-1.72)*	-3.702	(-2.73)***	-3.715	(-3.56)***	-2.019	(-7.26)***	-3.466	(-5.66)***	-1.966	(0.00)***
R^2	64.9%		35.4%		32.8%		35.4%		23.0%		34.0%	
N	137		167		218		242		167		1193	

Panel B. Extended model: $ME = b_0 + b_1\ NI + b_2\ BE + b_3\ DR + b_4\ GO$ + interactions (eq. 7)

	Year -5		-4		-3		-2		-1		All firm-year obs	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
c	-0.222	(-0.01)	14.420	(0.86)	-27.469	(-1.19)	22.593	(1.47)	18.721	(1.5)	16.360	(0.17)
NI	4.138	(6.03)***	1.331	(2.32)**	0.996	(0.8)	1.796	(1.47)	0.234	(0.34)	0.890	(0.23)
BE	0.226	(1.39)	0.438	(3.71)***	0.460	(3.33)***	0.413	(3.41)***	0.039	(0.26)	0.220	(0.26)
NI_neg	-3.991	(-5.28)***	-1.555	(-1.8)*	0.030	(0.02)	-2.148	(-1.71)*	0.193	(0.26)	-0.523	(0.52)
BE_neg	-1.713	(-2.39)**	-2.997	(-6.05)***	-2.060	(-3.96)***	-1.296	(-5.15)***	-0.804	(-5.13)***	-0.760	(0.01)**
DR	-0.237	(-10.33)***	-0.244	(-17.86)***	-0.207	(-3.42)***	-0.202	(-7.98)***	-0.238	(-6.01)***	-0.211	(0.00)***
GO	0.460	(7.45)***	0.293	(5.63)***	0.470	(13.8)***	0.184	(9.99)***	0.183	(10.95)***	0.346	(0.00)***
NI*DR	0.0002	(1.23)	-0.0004	(-3.58)***	0.0023	(4.09)***	-0.0003	(-2.12)**	-0.0006	(-3.59)***	0.000	(0.22)
BE*GO	-0.0003	(-1.66)*	0.0000	(0.27)	0.0000	(0.87)	0.0000	(0.02)	0.0006	(10.87)***	0.000	(0.01)**
R^2	92.9%		93.5%		86.8%		61.1%		96.8%		81.0%	
N	137		167		218		242		167		1193	

***, **, *: significant at the 1%, 5%, 10% level (respectively)

Table III. Less-distressed Control Sample (965 Healthy Matched Firms by Industry and Total Assets)

Multivariate regression analysis by year for up to 5 years prior to bankruptcy filing (Year 0). The last column shows regression results for all firm-year observations (the last five years prior to bankruptcy filing). BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options. _neg denotes NI (or BE) is multiplied by an indicator variable that equals one if a firm has negative NI (or BE), and zero otherwise. Dependent variable is the market value of equity (ME).

Panel A. Primary (standard) model: $ME = b_0 + b_1\ NI + b_2\ BE$ (eq. 6)

	Year -5		-4		-3		-2		-1		All firm-year obs	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
c	34.957	(1.42)	20.571	(0.75)	-2.222	(-0.06)	-75.840	(-1.91)*	22.333	(0.75)	7.909	(0.51)
NI	2.858	(1.78)*	12.368	(8.71)***	15.156	(17.75)***	9.947	(7.96)***	9.678	(9.22)***	7.559	(0.00)***
BE	1.960	(7.13)***	0.857	(4.24)***	0.859	(5.5)***	2.151	(11.85)***	0.887	(5.77)***	1.591	(0.00)***
NI_neg	-2.455	(-1.14)	-17.028	(-10.11)***	-22.088	(-10.95)***	-12.289	(-3.36)***	-8.730	(-4.64)***	-7.912	(0.00)***
BE_neg	-6.382	(-7.21)***	1.237	(0.41)	4.642	(2.03)**	-1.488	(-0.22)	-3.416	(-1.46)	-1.843	(0.00)***
R^2	79.4%		71.6%		78.5%		82.9%		75.9%		61.0%	
N	143		183		210		225		190		2505	

Panel B. Extended model: $ME = b_0 + b_1\ NI + b_2\ BE + b_3\ DR + b_4\ GO$ + interactions (eq. 7)

	Year -5		-4		-3		-2		-1		All firm-year obs	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
c	17.202	(0.86)	-54.649	(-1.83)*	24.469	(0.57)	92.871	(2.34)**	10.637	(0.26)	20.256	(0.08)*
NI	0.180	(0.14)	-5.389	(-3.21)***	5.801	(5.35)***	4.556	(3.54)***	7.216	(4.62)***	4.510	(0.00)***
BE	1.700	(7.74)***	3.017	(12.93)***	0.761	(3.34)***	0.017	(0.1)	0.704	(2.84)***	0.845	(0.00)***
NI_neg	0.350	(0.2)	19.910	(8.63)***	-9.542	(-3.92)***	-3.556	(-0.96)	-8.376	(-3.3)***	-4.312	(0.00)***
BE_neg	-12.308	(-6.05)***	-3.810	(-1.15)	-5.192	(-2.19)**	-0.211	(-0.03)	-0.346	(-0.11)	-1.006	(0.00)***
DR	-0.063	(-5.75)***	0.079	(5.47)***	0.001	(0.07)	-0.128	(-8.63)***	-0.192	(-17.83)***	-0.054	(0.03)**
GO	0.063	(3.06)***	0.959	(34.35)***	0.199	(12.36)***	0.204	(3.64)***	-0.086	(-1.42)	0.212	(0.00)***
NI*DR	0.0002	(2.06)**	-0.0033	(-22.61)***	-0.0001	(-3.91)***	0.0001	(4.17)***	0.0001	(14.77)***	0.000	(0.33)
BE*GO	0.0004	(8.36)***	-0.0031	(-21.95)***	0.0002	(7.85)***	0.0002	(9.13)***	0.0001	(2.93)***	0.000	(0.25)
R^2	98.9%		97.4%		93.6%		97.5%		97.8%		79.0%	
N	144		185		213		227		193		2505	

***, **, *: significant at the 1%, 5%, 10% level (respectively)

Table IV. Less-distressed Control Sample (Matched Healthy Firms by Industry and Total Assets): Pooled Regression Analysis (5-year Averages)

Pooled regression analysis for all firm-year observations (last five years prior to bankruptcy filing). BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options. *DRDum denotes that each variable is multiplied by an indicator variable that equals one if a firm is categorized in the lower financial health category (within sub-sample 2) based on the median DR of the relative year, and zero otherwise. Dependent variable is the market value of equity (ME).

	Coef	t-stat
NI	5.13	(1.4)
BE	0.89	(1.6)
DR	-0.04	(-1.4)
GO	0.20	(2.48)**
DRDum	39.37	(0.8)
BE*GO	0.00	(2.23)**
NI*DRDum	1.44	(0.3)
BE*DRDum	-0.98	(-1.41)
DR*DRDum	0.14	(2.77)***
GO*DRDum	0.01	(0.1)
R^2	93.6%	
N	666	

***, **, *: significant at the 1%, 5%, 10% level (respectively)

Table V. Universe of Healthy Firms (6560) Subdivided into More vs. Less Healthy Sub-samples

Firms with higher DR value than the sample median DR in the relative year are categorized in the less-healthy group (sub-sample 3), otherwise they are categorized as more-healthy (sub-sample 4). BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options. Dependent variable is the market value of equity (ME).

Panel A. Less-healthy firms (DR > median) (Sub-sample 3)

	Coef	t-stat
NI	17.053	(6.3)***
BE	0.056	(0.18)
DR	-1.790	(-2.34)**
GO	0.275	(3.59)***
R^2	83.4%	
N	2707	

Panel B. More-healthy firms (DR < median) (Sub-sample 4)

	Coef	t-stat
NI	14.857	(5.46)***
BE	1.536	(3.62)***
DR	0.701	(1.75)*
GO	0.181	(1.97)**
R^2	79.7%	
N	2707	

***, **, *: significant at 1%, 5%, 10% level (respectively)

Table VI. Healthy Firms Sample (6560 Firms not Filed for Bankruptcy):
Pooled Regression Analysis (5-year Averages)

Pooled regression analysis for all firm-year observations (last five years prior to bankruptcy filing). BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options. *DRDum denotes that each variable is multiplied by an indicator variable that equals one if a firm belongs in the less healthy group based on median DR of the relative year, and zero otherwise. Dependent variable is the market value of equity (ME).

	Coef	t-stat
NI	15.294	(5.7)***
BE	1.560	(3.7)***
DR	0.828	(1.97)**
GO	0.238	(3.01)***
DRDum	-1.600	(-0.52)
BE*GO	0.000	(-1.47)
NI*DRDum	-0.138	(-0.03)
BE*DRDum	-0.874	(-1.37)
DR*DRDum	-2.300	(-2.29)**
GO*DRDum	0.105	(0.90)
R^2	80.9%	
N	5470	

***, **, *: significant at the 1%, 5%, 10% level (respectively)

Table VII. More-healthy Sub-sample (2706 firms with DR<median) Broken Down by Main (NYSE-Amex) vs. Nasdaq Firms (Proxying for Value versus Growth)
Sub-sample 4 consisting of "more-healthy" firms (with lower than the median probability of default in the relative year) are further broken down into A. Nasdaq firms subsample (proxying for growth) vs. B. Main (NYSE/Amex) exchange firms (proxying for value). BE: book value of equity, NI: net income, DR: (option-based) default risk, GO: growth options. Dependent variable is the market value of equity (ME).

Panel A. Nasdaq firms subsample (Growth)

	1		2	
	Coef	t-stat	Coef	t-stat
NI	7.157	(0.87)	21.101	(2.3)**
BE	2.203	(1.19)	3.281	(1.7)*
DR	1.386	(1.76)*	0.170	(0.65)
GO	0.623	(2.92)***	0.424	(2.4)**
NI*DR			0.013	(2.6)***
BE*GO			0.000	(-1.1)
R^2	87.27%		87.27%	
N	1642		1642	

Panel B. Main (NYSE-Amex) firms (Value)

	1		2	
	Coef	t-stat	Coef	t-stat
NI	13.925	(4.8)***	19.598	(6.1)***
BE	1.650	(3.7)***	1.672	(3.7)***
DR	0.031	(0.07)	-2.937	(-2.4)**
GO	0.171	(1.9)**	0.187	(2.2)**
NI*DR			0.012	(2.3)**
BE*GO			0.000	(-0.2)
R^2	78.6%		78.6%	
N	1642		1642	

***, **, *: significant at the 1%, 5%, 10% level (respectively)