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Journal of Financial Economics 87 (2008) 706–739
JOURNAL OF Financial ECONOMICS
www.elsevier.com/locate/jfec

Financial distress and corporate risk management: Theory and evidence ☆

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Received 28 February 2006; received in revised form 2 April 2007; accepted 10 April 2007
Available online 14 December 2007

Abstract

This paper extends the current theoretical models of corporate risk-management in the presence of financial distress costs and tests the model's predictions using a comprehensive data set. I show that the shareholders optimally engage in *ex-post* (i.e., after the debt issuance) risk-management activities even without a pre-commitment to do so. The model predicts a positive (negative) relation between leverage and hedging for moderately (highly) leveraged firms. Consistent with the theory, empirically I find a non-monotonic relation between leverage and hedging. Further, the effect of leverage on hedging is higher for firms in highly concentrated industries.

JEL classification: G30; G32

Keywords: Hedging; Risk-shifting; Asset substitution; Derivatives

1. Introduction

This paper develops and tests a theory of corporate risk management in the presence of financial distress costs. The existing literature shows that hedging can lead to firm value maximization by limiting deadweight losses of bankruptcy (see Smith and Stulz, 1985).[1] These models justify only *ex-ante* risk-management

☆ This paper is based on a chapter of my Ph.D. dissertation at Cornell University. I would like to especially thank an anonymous referee for several useful suggestions during the reviewing process. I am grateful to George Allayannis, Warren Bailey, Sugato Bhattacharya, Sreedhar Bharath, Sudheer Chava, Thomas Chemmanur, Wayne Ferson, Ken French, John Graham, Robert Goldstein, Yaniv Grinstein, Jerry Haas, Pankaj Jain, Kose John, Haitao Li, Roni Michaely, M.P.Narayanan, Maureen O'Hara, Paolo Pasquariello, Mitch Petersen, Uday Rajan, William Schwert (the editor), David Weinbaum, Rohan Williamson, and seminar participants at Boston College, Cornell, Darden, Emory, London Business School, University of Michigan, Notre Dame, University of Rochester, The Lehman Brothers Finance Fellowship Competition 2003, and the Western Finance Association's 2005 meetings for valuable comments and suggestions. I am particularly grateful to Bob Jarrow and Bhaskaran Swaminathan for their advice. All remaining errors are mine.

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[1] Other motivations for corporate hedging include convexity of taxes, managerial risk-aversion (Stulz, 1984; Smith and Stulz, 1985) underinvestment costs (Froot, Scharfstein, and Stein, 1993), and information asymmetry (DeMarzo and Duffie, 1991, 1995). See also Breeden and Viswanathan (1996) and Stulz (1996).

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doi:10.1016/j.jfineco.2007.04.003

behavior on the part of the firm; *ex-post*, shareholders of a levered firm may not find it optimal to engage in hedging activities due to their risk-shifting incentives (Jensen and Meckling, 1976).[2] I extend the current literature by explaining the ex-post risk-management motivation of the firm.[3] I provide a simple model that generates new cross-sectional predictions by relating firm characteristics such as leverage, financial distress costs, and project maturity to risk-management incentives. I test the key predictions of the model with hedging data of COMPUSTAT-CRSP firms meeting some reasonable sample selection criteria for fiscal years 1996–1997. The empirical study presents the first large-sample evidence on the determinants of the extent of firms' hedging activities and provides new findings.

The key assumption underlying my theory is the distinction between *financial distress* and *insolvency*. I assume that apart from the *solvent* and the *insolvent* states, a firm faces an intermediate state called *financial distress*. Financial Distress is defined as a low cash-flow state in which the firm incurs losses without being insolvent. The notion that financial distress is a different state from insolvency has some precedence in the literature. Titman (1984) uses a similar assumption to study the effect of capital structure on a firm's liquidation decisions.

There are three important sources of financial distress costs. First, a financially distressed firm may lose customers, valuable suppliers, and key employees.[4] Opler and Titman (1994) provide empirical evidence that financially distressed firms lose significant market share to their healthy counterparts in industry downturns. Using data from the supermarket industry, (Chevalier 1995a, b) finds evidence that debt weakens the competitive position of a firm. Second, a financially distressed firm is more likely to violate its debt covenants[5] or miss coupon/principal payments without being insolvent.[6] These violations impose deadweight losses in the form of financial penalties, accelerated debt repayment, operational inflexibility, and managerial time and resources spent on negotiations with the lenders.[7] Finally, a financially distressed firm may have to forgo positive NPV projects due to costly external financing, as in Froot, Scharfstein, and Stein (1993). In this paper I focus on the first of these costs, i.e., the product market-related costs of financial distress.

I develop a dynamic model of a firm that issues equity capital and zero-coupon bonds to invest in a risky asset. The firm makes an initial investment with the consent of its bondholders. At a later date, shareholders can modify the firm's investment risk by replacing the existing asset with a new one. The firm's asset value evolves according to a stochastic process. The firm is in financial distress if the asset value falls below some lower threshold during its life. In this state, the firm loses market share to its competitors and therefore is unable to realize its full upside potential, even when the industry condition improves at a later date. Insolvency occurs on the maturity date if terminal firm value is below the face value of debt, in which case debtholders gain control of the firm. Shareholders' final payoffs depend on the terminal asset value as well as on the path taken by the firm's asset over its life.[8]

[2]Throughout the paper, I use the terms *ex ante* and *ex post* with respect to the time of borrowing.

[3]Other papers analyzing shareholders' ex-post risk-management decisions include Leland (1998) and Morellec and Smith (2003). Leland (1998) provides a justification for the firm's ex-post hedging behavior in the presence of tax-benefits of debt. In Morellec and Smith (2003), the manager-shareholder conflict reduces shareholders' ex-post asset-substitution incentives. My model, in contrast, is based on the cost of financial distress and provides new empirical predictions.

[4]For example, in the mid-1990s Apple Computers had financial difficulties leading to speculation about its long-term survival (see *Business Week*, January 29 and February 5, 1996). Software developers were reluctant to develop new application software for Mac-users, which led in part to a decline of 27% in the unit sales of Mac computers from 1996 to 1997 (see Apple's 1998 10-K filings with the SEC). Similarly, when Chrysler faced financial difficulties in the early 1980s, Lee Iacocca (former CEO of the company) observed that "its share of new car sales dropped nearly two percentage points because potential buyers feared the company would go bankrupt" (quoted from Titman, 1984).

[5]Lenders often impose debt covenants such as maintenance of minimum networth or maximum debt-to-equity ratio by the borrowing firms. See Smith and Warner (1979), Kalay (1982), and Dichev and Skinner (2001).

[6]Moody's Investor Service Report (1998) shows that during 1982–1997 about 50% of the long-term publicly traded bond defaults (including missed or delayed payment of coupon and principal) didn't result in bankruptcy filings.

[7]For example, when Delta airlines violated a debt-to-equity ratio covenant in 2002, it was required by its lenders to maintain a minimum of $1 billion in cash and cash equivalents at the end of every month from October 2002 until June 2003. See Delta's 2002 10-K filings with the SEC.

[8]This approach is similar (but not the same) to valuation of equity as a path-dependent (down-and-out call) option. The equity value in my model differs from the corresponding barrier option by the amount of losses incurred in financial distress. Brockman and Turtle (2003) provide some empirical evidence in support of equity's valuation as a path-dependent option.