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Credit risk, valuation and fundamental analysis

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ABSTRACT

This study explores how a firm's credit risk affects accounting based valuation of the firm, of its equity and of its debt. The valuation model integrates fundamental equity and credit analysis and, under appropriate conditions, abides by the value conservation principle even in the presence of credit risk. The term structures of credit spreads on corporate bonds and credit default swaps are linked to equity valuation and to pro-forma financial statements. Calibration of the valuation model to equity and credit market prices is feasible. The model explains how credit risk depresses price to earnings and price to book ratios.

1. Introduction

This study links the valuation of a firm's equity and debt to the firm's financial statements. More precisely, equity value and credit spreads on loans, bonds or credit default swaps are all linked to pro-forma financial statements. This integrates fundamental equity analysis with fundamental credit risk analysis.

This paper is related to the accounting literature on equity valuation, a textbook summary of which is Penman's (2010) book. However this literature values equity with little attention to the firm's credit risk, which seems an important omission for firms whose financial health is not robust. A rare exception is the model by Shaffer (2006), which assumes an exogenous probability of default and bankruptcy in a dividend growth model for equity valuation. Unlike in Shaffer, this paper shows how the probability of default can be made endogenous to the valuation model.

This paper is also related to bankruptcy prediction models, which have substantially developed through the duration models of Bharath and Shumway (2008), Chava and Jarrow (2004), Shumway (2001), Xu and Zhang (2008) and others. However these bankruptcy prediction models measure the credit risk of corporate debt without translating such risk into debt valuation. Corporate debt valuation has mainly been undertaken by the structural models of credit risk appeared in the finance literature since Merton (1974). Among these models we recall Anderson and Sundaresan (1996), Goldstein, Ju, and Leland (2001), Leland (1994), Leland and Toft (1996), and Mella-Barral and Perraudin (1997). More recent structural models attempt an ever more accurate analysis of how the bankruptcy process affects corporate debt valuation, as in Broadie, Chernov, and Sundaresan (2007), Fan and Sundaresan (2000), Pascal and Morellec (2004), and others. This paper too focuses on the valuation of the credit risk of corporate debt, but from an accounting perspective that is based on pro-forma financial statements. In fact it is to financial statements that corporate debt covenants are typically linked. Structural models are in a continuous time setting, whereas the models in this paper are in discrete time. Structural models are based on assuming a stochastic process for firm value, for free cash flows or for earnings. Instead the models in this paper assume no stochastic processes. In fact stochastic processes seem quite foreign to “fundamental” equity and credit analysts.

The main contributions of the paper can be summarised as follows. First, the analysis derives valuation formulae that accommodate the firm's credit risk and that seem relevant to practicing financial analysts. Credit risk complicates valuations because it entails forfeiting the default-free Modigliani–Miller world and its valuation results. Default entails that the firm's operating activities cannot be valued independently of the firm's financing activities. Both activities affect and are affected by possible default and recovery values after default. As a consequence capital structure and dividend policy are not irrelevant to firm valuation.

Second, financial leverage and the associated default risk depress price to earnings and price to book ratios. The extra returns to value investing may well be compensation for credit risk exposure.

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Third, credit spreads on corporate bonds and credit default swaps can be linked to pro-forma financial statements. Financial analysis provides debt valuations, not only equity valuations and firm valuations. Reverse engineering, i.e. model calibration to equity and credit market prices is feasible.

Fourth, because of credit risk, firm, equity and debt valuations are all affected by accounting policies. However mild conditions make all valuations independent of accounting policies, i.e. all valuations can abide by the value conservation principle even in the presence of credit risk. This is a very desirable feature.

Fifth the analysis shows how higher sales or higher operating assets may increase or decrease credit spreads and equity value.

The next sections present the general valuation model and specify survival probabilities. Then the model predictions are analysed. Bond and credit default swap valuations are also explained as well as examples of how the valuation models can be reverse-engineered. A discussion explains how credit risk complicates the valuation of groups. The conclusions follow.

2. Reformulated financial statements

As starting point, we define time t reformulated financial statements following Penman (2010). OA_t and OL_t are the time t book values of operating assets and operating liabilities. FA_t and FO_t are the time t book values of financial assets and financial obligations. B_t is the time t book value of common equity. The balance sheet identity is

$$OA_t + FA_t = OL_t + FO_t + B_t.$$

We can restate the balance sheet identity as

$$B_t = NOA_t - NFO_t, \quad NOA_t = OA_t - OL_t, \quad NFO_t = FO_t - FA_t.$$

NOA_t and NFO_t are respectively net operating assets and net financial obligations at time t. The reformulated statement of comprehensive income for the period $[t, t+1]$ is

$$OI_{t+1} - NFE_{t+1} = x_{t+1}, \quad NFE_{t+1} = FE_{t+1} - FR_{t+1}.$$

OI_{t+1} is comprehensive operating income during $[t, t+1]$, NFE_{t+1} is comprehensive net financial expense during $[t, t+1]$. x_{t+1} denotes comprehensive net earnings produced during $[t, t+1]$. FE_{t+1} and FR_{t+1} are respectively comprehensive financial expenses and comprehensive financial revenues during $[t, t+1]$. Here "comprehensive" means that the reformulated income statement comprehends all revenues and expenses, i.e. no revenue or expense bypasses the reformulated income statement to be recorded directly in the equity of the reformulated balance sheet. Penman (2010) explains how reformulation can achieve this "clean surplus" result, which can be stated as

$$B_{t+1} - B_t = x_{t+1} - d_{t+1}.$$

d_{t+1} are the net dividends paid during $[t, t+1]$, i.e. the dividends paid plus the share buy-backs minus the equity contributions during $[t, t+1]$. The cash flow statement identity is

$$C_{t+1} - I_{t+1} = -(NFO_{t+1} - NFO_t) + NFE_{t+1} + d_{t+1}.$$

C_{t+1} and I_{t+1} are respectively net cash flow from operations and net cash investment in operations during the period $[t, t+1]$, so that $C_{t+1} - I_{t+1}$ are the free cash flows.

In case of default during $[t, t+1]$ all the above accounting identities and relations still hold and the superscript "*" next to all variables denotes such case of default. For example d^*_{t+1} and NFO^*_{t+1} denote respectively net dividends and net financial obligations in case of default during $[t, t+1]$. Default during $[t, t+1]$ does not affect the opening balance sheet at t, which remains $B_t = NOA_t - NFO_t$. It follows that

$$NOA^*_{t+1} - NOA_t - (NFO^*_{t+1} - NFO_t) = OI^*_{t+1} - NFE^*_{t+1} - d^*_{t+1}$$
$$C^*_{t+1} - I^*_{t+1} = -(NFO^*_{t+1} - NFO_t) + NFE^*_{t+1} + d^*_{t+1}.$$

3. Recovery values after default

For simplicity we assume that, as the firm defaults on its debt obligations, it immediately enters bankruptcy. For simplicity we also assume that in case of default during $[t, t+1]$ financial assets can be sold for an amount close to their book value, so that

$$R^{FA}_{t+1} = FA^*_{t+1} \tag{1}$$

where R^{FA}_{t+1} denotes the recovery value of financial assets at time $t+1$. This assumption is in no way necessary for what follows and is made only to simplify the analysis. After default and bankruptcy, the firm may be reorganised and survive as a going concern or be liquidated, if the firm's recovery value available for creditors and equity holders is higher with liquidation. Therefore in case of default during $[t, t+1]$ the recovery value of the firm's operating assets at time $t+1$ is R^{OA}_{t+1} such that

$$R^{OA}_{t+1} = \max\left(\Theta V^{OA,nd}_{t+1}, \Theta_L \cdot OA^*_{t+1}\right). \tag{2}$$

$V^{OA,nd}_{t+1}$ is the fair value of operating assets at time $t+1$ in the absence of any risk of default. Θ is a parameter, with $0 \le \Theta \le 1$. Default and bankruptcy cause the fair value of operating assets at $t+1$ to drop from V^{OA}_{t+1} to $\Theta V^{OA,nd}_{t+1}$. Liquidation occurs only when $\Theta_L \cdot OA^*_{t+1} > \Theta V^{OA,nd}_{t+1}$. $\Theta_L \cdot OA^*_{t+1}$ is the time $t+1$ present value of the liquidation proceeds. OA^*_{t+1} is the book value of operating assets at time $t+1$ if default does occur during $[t, t+1]$. Θ_L is another parameter such that $0 \le \Theta_L$. Θ_L need not be less than 1, since the liquidation proceeds of the operating assets may exceed the book value of operating assets.

We assume that operating liabilities and financial obligations have the same priority in bankruptcy, that all creditors recover not more than the face value of their credit and that equity holders only receive any bankruptcy proceeds after all creditors have been fully paid. All this implies that after default the recovery values of financial obligations R^{FO}_{t+1}, of operating liabilities R^{OL}_{t+1}, of net financial obligations R^{NFO}_{t+1}, of net operating assets R^{NOA}_{t+1} and of equity R^{E}_{t+1} are respectively

$$R^{FO}_{t+1} = FO^*_{t+1} \cdot min\left(1, \frac{R^{FA}_{t+1} + R^{OA}_{t+1}}{OL^*_{t+1} + FO^*_{t+1}}\right) \tag{3}$$

$$R^{OL}_{t+1} = OL^*_{t+1} \cdot min\left(1, \frac{R^{FA}_{t+1} + R^{OA}_{t+1}}{OL^*_{t+1} + FO^*_{t+1}}\right) \tag{4}$$

$$R^{E}_{t+1} = R^{NOA}_{t+1} - R^{NFO}_{t+1}, \quad R^{NOA}_{t+1} = R^{OA}_{t+1} - R^{OL}_{t+1}, \quad R^{NFO}_{t+1} = R^{FO}_{t+1} - R^{FA}_{t+1}. \tag{5}$$

$R^{NFO}_{t+1} < 0$ when $R^{FO}_{t+1} < FA_{t+1}$. Next we turn the valuations.

4. Valuation and default risk

Given the above assumptions, this section presents valuation formulae for a firm, its equity and its net financial obligations in the presence of default risk. V_t is the fair value of equity at time t. r_t is the risk-free interest rate during the period $[t, t+1]$. We assume universal risk-neutrality, so that the required return from any financial asset during $[t, t+1]$ is the risk-free interest rate r_t. We also assume no taxation for the firm and no taxation for investors, for simplicity.