Appendix 18-A

RATIOS USED IN CREDIT AND EQUITY RISK PREDICTION MODELS

Chapter 18 discusses research that examined the utility of accounting (and other financial) measures in risk evaluation and prediction. The exhibits provided in this appendix list the explanatory independent variables (financial risk measures) used in the key research studies in this area. The topics covered by the exhibits are:

Exhibits 18A-1(a) and (b)	**Bankruptcy Prediction Models**
Exhibit 18A-2	**Bond Ratings Prediction Models**
Exhibit 18A-3	**Beta Prediction Models**

The exhibits, except for Exhibit 18A-1(b), are all similar in layout detailing the specific variables used in each of the studies. Exhibit 18A-1(b) [adapted from Reilly (1991) and work by Gentry, Newbold, and Whitford (1994)], on the other hand, summarizes the findings of fourteen studies that focused on bankruptcy prediction.

As noted in the chapter, for the most part, the ratios found to be useful in the research correspond to the categories (activity, liquidity, solvency, and profitability) that we have used throughout the book. Additional new indicators are primarily measures of earnings variability and size.

EXHIBIT 18A-1(a)
Independent Variables Used in Bankruptcy Prediction Models

	Ohlson (1980)	Altman et al. (1977)	Deakin (1972)	Altman (1968)
Activity			Four asset categories divided by sales: (1) Current assets (2) Quick assets (3) Working capital (4) Cash	Sales to total assets
Liquidity	Current ratio	Current ratio	Current ratio Quick ratio Cash ratio Four asset categories divided by total assets: (1) Current assets (2) Quick assets (3) Working capital (4) Cash	
	Working capital to total assets			Working capital to total assets
Leverage and Solvency	Liabilities to assets	Equity (market) to Capital Times Interest earned	Debt to assets	Equity (market) to debt (book)
	Funds from operations to total liabilities Dummy variable indicating if net worth is negative		Funds from operations to debt	
Profitability	Return on assets Dummy variable indicating if net income was negative in last two years	Return on assets Retained earnings to total assets	Return on assets	Return on assets Retained earnings to total assets
Earnings variability	Percentage change in net income	Standard error of return on assets		
Size	Total Assets	Total Assets		

EXHIBIT 18A-1(b)
Summary of Most Useful Ratios for Predicting Failure

Category/Ratios	Number of Studies in Which the Ratio Was Significant
Financial Leverage	
Cash Flow/Total Debt	7
Total Debt/Total Assets	6
Retained Earnings/Total Assets	5
Short-term Liquidity	
Net Working Capital/Total Assets	6
Current Assets/Current Liabilities	6
Cash/Sales	2
Cash/Current Liabilities	4
Profitability	
Net Income/Total Assets	5
EBIT/Total Assets	4
Activity	
Quick Assets/Sales	2

Adapted from Frank K. Reilly, "Using Cash Flows and Financial Ratios to Predict Bankruptcies," *Analyzing Investment Opportunities in Distressed and Bankrupt Companies*, Charlottesville, VA: The Institute of Chartered Financial Analysts, 1991, Table 1, P.25

EXHIBIT 18A-2
Independent Variables Used in Bond Ratings Prediction Models

	Belkaoui (1983)	Belkaoui (1980)	Kaplan and Urwitz (1979)	Pinches and Mingo (1973)	Pogue and Soldovsky (1969)	Horrigan (1966)	West (1966)
Activity and liquidity	Current ratio	Current ratio				Working capital to sales Sales to equity	
Leverage and solvency	Long-term debt to capital	Long-term debt to capital	Long-term debt to assets	Total debt to assets	Debt to capital	Equity to debt	Debt to equity (market values)
	Short-term debt to capital	Short-term debt to capital	Long-term debt to equity				
	Fixed charge coverage	Fixed charge coverage	Times interest earned	Times interest earned	Times interest earned		
	Cash flow to investment in fixed assets and inventory plus dividends		Cash flow to debt				
Profitability			Return on assets	Return on assets	Return on assets	Operating profit	
Earnings variability			Accounting beta	Years of consecutive dividends	Coefficient of variation—ROA		
			Coefficient of variation—net income				Coefficient of variation—net income
Size	Total assets	Total assets	Total assets	Issue size	Total assets	Total assets	Bonds outstanding
Subordination	0-1 dummy	0-1 dummy	0-1 dummy	0-1 dummy		0-1 dummy	
Market-based	Price to net book value	Price to net book value	Market beta				
Other			Coefficient of variation—total assets		Industry dummy variable		Period of solvency

EXHIBIT 18A-3
Independent Variables Used in Beta Prediction Models

		Predictive and Explanatory			Explanatory			
		Hochman (1983)	Rosenberg and McKibben (1973)	Beaver et al. (1970)	Mandelker and Rhee (1984)	Bildersee (1975)	Lev (1974)	Ball and Brown (1968)
Earnings Variability	Operating Risk	Accounting beta (operating income)	*		OLE		Variable cost % (v)	Accounting beta
	Financial Risk	Debt to capital			FLE	Debt to equity Preferred equity to common equity		
	Total Risk†			Standard deviation earnings/price		Standard deviation earnings/price		
Growth		Dividend yield		Asset growth				
Dividends				Dividend payout				
Liquidity						Current ratio		

*See Exhibit 18-8 in text.
†Earnings variability can be measured as the sum of operating risk and financial risk.