Managing Financial Performance Via Financial Stress Models

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“Balanced Scorecard”

- Strategic management approach from 1990’s by Kaplan and Norton
- Management system to enable organizations to clarify vision and strategy in order to put into action:
  - Develop metrics
  - Collect data
  - Analyze data
- Four perspectives utilized
"Take A Swim" vs. "Get My Toes Wet"

- "Balanced Scorecard" involves taking a swim with lots of:
  - TIME and RESOURCES!

- Is It Possible To Start In A Small, Manageable, Less Risky Way?
  - Yes, you can get your toes wet with **Financial Stress Model Analysis**
Information Competition

- Users have multiple information channels
  - Financial statements
  - Analyst forecasts
  - Financial news about economy, industry
  - Friends/Internet chat groups
  - Direct observations
- Value of Financial Statements?

Financial Stress Models & Information Theory

- **Information Theory** view of the financial statements:
  - Purpose of financial statements is to provide information signals which facilitate economic activity
Possible Financial Statement Signals

- Current Operating Risk
  - Short-term Liquidity

- Capital Growth Capacity
  - Asset Financing Structure

- Earnings Quality
  - Persistence [sustainability]
  - Variability

How Can We Determine Value of Financial Statements?

- One way to measure value is to examine various financial statement components’ linkage with stock price changes
  - Stock prices theoretically impound [reflect] information from all information channels

- If the stock prices change as financial components change, then we presume someone is reading the financial statements.
Net Income Changes and Stock Prices

- Studies have repeatedly linked accounting net income to stock prices:
  - Ball & Brown 1968
    - EPS sign change = 16.8% price changes over 1957-1965 period
  - Nichols & Wahlen, 2004
    - EPS sign change = 35.6% price changes over 1988-2001 period

Earnings Persistence & Stock Returns

- Uninterrupted positive net income returns are associated with higher stock prices
  - Nichols & Wahlen, 2004
    - When earnings increase “high persistence” firms experience abnormal returns of 25.3% as compared to 13.6% for “low persistence” firms
What Is A “Financial Stress” Model?

- Model which uses various metrics to assess the degree to which an organization is under financial pressures which may lead to:
  - Bankruptcy
  - Reorganization
  - Merger

External Auditor Role

- Auditors are required to issue a modified opinion if it appears a company has a significant probability of going into bankruptcy during the year following the financial statement date.
  - Modified opinion if NOT a “Going Concern”
Auditor Going-Concern Opinion Outcomes

- **Nogler, 1995** Tracked 157 firms which had received going-concern opinions from their external auditors between 1983 and 1991

- Results
  - 33% filed bankruptcy
  - 32% had dissolution, liquidation, or merger
  - 35% subsequently received an unqualified opinion

What Information Is Portrayed By Financial Distress Models?

- Financial stress models typically measure various financial dimensions
  - Non-financial dimensions are typically NOT DIRECTLY included in model variables
Hypothesized Going Concern Model

Selected Financial Stress Models

- **Multiple discriminant analysis**
  - 1968 Altman 95% accurate on 66 company sample

- **Logistic regression**
  - 1990 Bell, Ribar, Vericho 90% with .1 cutoff

- **Recursive partitioning**
  - 1996 McKee 92% on 202 company sample

- **Genetic programming**
  - 2002 McKee-Lensburg 80% accurate on 291 U.S. public company sample
1968 Altman Model

Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Financial Ratio</th>
<th>Economic Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1$</td>
<td>Working Capital/Total Assets</td>
<td>Liquidity</td>
</tr>
<tr>
<td>$X_2$</td>
<td>Retained Earnings/Total Assets</td>
<td>Age of Firm</td>
</tr>
<tr>
<td>$X_3$</td>
<td>Earnings Before Interest Taxes/Total Assets</td>
<td>Asset Productivity</td>
</tr>
<tr>
<td>$X_4$</td>
<td>Market Value of Equity/Book Value of Total Debt</td>
<td>Insolvency Risk</td>
</tr>
<tr>
<td>$X_5$</td>
<td>Sales/Total Assets</td>
<td>Management’s Capability In Dealing With Competition</td>
</tr>
</tbody>
</table>

$Z$ is the bankruptcy score and is a linear combination of the five variables

$Z = \cdot1.2X_1 + \cdot1.4X_2 + 3.3X_3 + 0.6X_4 + 0.99X_5$

Interpreting $Z$ score:

- $Z > 2.99$ = Non-bankrupt
- $Z < 1.81$ = Bankrupt
- $2.99 > Z < 1.81$= Zone of Ignorance

Note: Mnemonic is ZSCORE in Standard & Poor's Compustat
Z Score Linkage To Bond Ratings

Source: Altman, Quantitative Techniques For The Assessment of Credit Risk

Progressive Decline Symptoms

Source: Castrogiovanni et al. Curing Sick Businesses: Changing CEOs in Turnaround Efforts
GTI Turnaround Strategies

- Z-score was 0.38 in May 1975 when turnaround started
- Z-score identified basic problem as underutilized assets
- Turnaround activities:
  - Sale of excess inventory
  - Collection efforts accelerated
  - Staff reduced
  - Capital improvements frozen
  - Sale of product line to raise cash to reduce debt
- Z-score was 7 in 1979

GTI Financial Turnaround Using Altman Z Score

Source: Altman & La Fleur, Managing A Return To Financial Health
### 2002 McKee-Lensberg Model Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Financial Ratio</th>
<th>Economic Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_0$</td>
<td>Total Assets</td>
<td>Size</td>
</tr>
<tr>
<td>$V_1$</td>
<td>Net Income/ Total Assets</td>
<td>Asset Productivity</td>
</tr>
<tr>
<td>$V_2$</td>
<td>Cash/Current Liabilities</td>
<td>Liquidity</td>
</tr>
</tbody>
</table>

### M-L Bankruptcy Probability For Two Airlines

[Delta filed for bankruptcy 9/15/05]

![Bankruptcy Probability Chart](chart.png)
McKee-Lensburg Genetic Programming Model

$$(V_0, V_1, V_3) = \frac{X^2}{X^2 + Y^2},$$

where

$$X = (V_0 + .85) \times V_1 - .85$$

$$Y = (1 + V_3)$$

And

$$V_0 = \log_{10}(\text{Total Assets/1000})$$

$$V_1 = \frac{\text{Net Income}}{\text{Total Assets}}$$

$$V_3 = \frac{\text{Cash}}{\text{Current Liabilities}}$$

M-L Bankruptcy Probability As Function of $V_1$ and $V_2$ When $V_3$ Held Constant
M-L Bankruptcy Probability As Function of $V_2$ and $V_3$ When $V_1$ Held Constant

Altman Bankruptcy Model And IBM

<table>
<thead>
<tr>
<th>Company Name</th>
<th>IBM (amounts in $ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal Year</td>
<td>31-Dec-04</td>
</tr>
<tr>
<td>Inputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Account</td>
</tr>
<tr>
<td>Current Assets</td>
<td>46970</td>
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<tr>
<td>Current Liabilities</td>
<td>39798</td>
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<tr>
<td>Total Assets</td>
<td>109183</td>
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<tr>
<td>Retained Earnings</td>
<td>44525</td>
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<tr>
<td>Sales</td>
<td>96293</td>
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<tr>
<td>Earnings Before Interest, Taxes</td>
<td>12028</td>
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<tr>
<td>Total Liabilities</td>
<td>79436</td>
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<tr>
<td>Market Value of Equity</td>
<td>160149</td>
</tr>
<tr>
<td>Output</td>
<td>Computed Z Score</td>
</tr>
</tbody>
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(Note: $Z > 2.99 = \text{Nonbankrupt}, Z < 1.81 = \text{Bankrupt}$)
McKee-Lensburg Bankruptcy Model and IBM

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<tr>
<td>Fiscal Year</td>
<td>December 31, 2004</td>
</tr>
<tr>
<td>Inputs</td>
<td></td>
</tr>
<tr>
<td>Account</td>
<td>Amount</td>
</tr>
<tr>
<td>Cash</td>
<td>1240</td>
</tr>
<tr>
<td>Total Assets</td>
<td>81091</td>
</tr>
<tr>
<td>Current Liabilities</td>
<td>1771</td>
</tr>
<tr>
<td>Net Income</td>
<td>3021</td>
</tr>
<tr>
<td>Output</td>
<td>Computed Bankruptcy Probability</td>
</tr>
</tbody>
</table>

http://business.etsu.edu/mckee/audit_models.htm
User "business.etsu.edu", Password "estimate"

Two Distress Models and IBM Stock Price

<table>
<thead>
<tr>
<th>Year</th>
<th>Z Score</th>
<th>Stock Price / 10</th>
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</thead>
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<td></td>
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Summary

- Financial stress impacts stock prices
- Quantitative financial stress models are highly correlated with financial health and, therefore, stock prices
- A “Quick and Dirty” way to manage financial performance is by “reverse engineering” financial stress models
- Various companies have successfully implemented analysis of financial stress models as way of gaining insights into needed changes

Take-Away

- If you want to try this approach:
  1. Download this presentation from the VU website
  2. Find the slide containing the model you want
  3. Double click on the model to activate the Excel spreadsheet
  4. Enter your company’s data
  5. Play “What If” by changing selected data
  6. Brainstorm on operational decisions that will transform business in desired direction
Selected References