Team Introduction

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Investment Thesis
Equity of a firm with debt in its capital structure is analogous to a call option on the written assets of a firm.

Exercise Price = Face Value of Debt

### Call Option Replicated

A call option can be rewritten using a portfolio of stocks (assets), put options on the underlying stocks (assets), and risk-free bonds to provide an identical payoff.

$$\begin{align*}
\text{Call Option} & \\
S_T < x & \quad 0 \\
S_T > x & \quad S_T - x \\
\text{Stock (Assets)} & \\
S_T < x & \quad S_T \\
S_T > x & \quad S_T \\
\text{Put Option} & \\
x - S_T & \quad 0 \\
-x & \quad -x \\
\text{Risk Free Borrowing} & \\
0 & \quad S_T - x \\
\end{align*}$$

**Equity = Assets + Put Option - Safe Debt**
Eisdorfer, Goyal, and Zhdanov hypothesize that if investors do not value the default option, misvaluation can occur.

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<th>High Default Option</th>
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Valuation of Equity in the Model

There are two components to valuing equity within the model, 1) value to the equity holders (if they were to operate into perpetuity), 2) value of default option.

Value of Equity = Value to Equity Holders + Value of Default Option

Value of Default Option

The default option can be deconstructed into two parts: 1) discounting the cash flows of a firm until an optimal stopping time, 2) discounting the cash flows of a firm into perpetuity.

\[
\text{Default option} = \sup_{T_{x_d(t)}} \mathbb{E}_x^Q \int_0^{T_{x_d(t)}} e^{-rt} CF_{it} dt - \mathbb{E}_x^Q \int_0^\infty e^{-rt} CF_{it} dt \geq 0
\]

Value of Default Option Continued

\[ CF_{it} = \left[ (1 - \tau)(x_{it} - I_{it} - F_i) + \tau \text{Dep}_{it} - \text{Capex}_{it} \right] \times \left[ 1 + \eta 1_{(1-\tau)(x_{it} - I_{it} - F_i) + \tau \text{Dep}_{it} - \text{Capex}_{it} < 0} \right] - D_{it} \]

- Tax Rate
- Fixed Costs
- Capital Expenditures
- Interest Payments to Debtholders
- Tax Shield Due to Depreciation Expense
- Distress Costs*
- Principal Repayment

*Incurred when a firm incurs negative cash flows.

Comparing Model Value to Market Value

Stocks are sorted into deciles according to the ratio of the equity value implied by the valuation model to the actual equity value.

\[
\frac{4 \text{ B}}{3.5 \text{ B}} = 1.14 \quad \text{Undervalued}
\]

\[
\frac{3.5 \text{ B}}{4 \text{ B}} = 0.88 \quad \text{Overvalued}
\]
Misvaluation in Returns

The model indicates that the misvaluation picked up by our model is related to the default option.

Most misvalued stocks (over- or undervalued) stocks are smaller, more volatile, less liquid, have lower analyst coverage with higher analyst forecasts dispersion, and have lower institutional ownership than more fairly-valued stocks.

Implementation
Portfolio Construction Process Overview

1. Source accounting and return data from Bloomberg and CRSP/Compustat, respectively.
2. Matlab Code: Returns Model Equity Value
3. Calculate: \( \frac{Model\ Equity\ Value}{Current\ Equity\ Value} \)
4. Trim the Bottom and Top 2% of the Ratios
5. Sort Ratios into Deciles and Invest in 10th Decile

*CRSP/Compustat till 2018, supplemented with Bloomberg for current info
Filtering for Investible Universe

- Charter Constraints
- Ease of Access

Russell 3000
>$1 billion market cap
Daily Volume >50k
>$10 Stock Price

Investable Universe

Final # of Stocks: 58
Portfolio Construction: Inputs & Assumptions

**Model Inputs**

- Current liabilities
- Long-term liabilities
- Revenue
- Fixed Costs
- Volatility
- Risk-free rate
- COGS
- WAAC
- CAPEX
- Depreciation
- Leverage
- SIC Code

**Model Equity Value**

- SG&A → Proxy for fixed costs
- SIC Codes → Used to calculate industry averages for Depreciation & CAPEX
- Return on Assets → Equals WACC
Decile Details and Construction

Paper data an average of 1983 – 2012, our data a snapshot of October 2019
Sector Weighting Comparison

Russel 2000
- CASH: 18%
- Healthcare: 13%
- Financial Services: 16%
- Industrials: 18%
- Technology: 20%
- Consumer Cyclical: 2%
- Real Estate: 3%
- Basic Materials: 3%
- Utilities: 3%
- Consumer Defensive: 11%
- Energy: 4%
- Communication Services: 4%

Our Portfolio
- CASH: 18%
- Healthcare: 18%
- Financial Services: 18%
- Industrials: 16%
- Technology: 13%
- Consumer Cyclical: 3%
- Real Estate: 3%
- Basic Materials: 3%
- Utilities: 5%
- Consumer Defensive: 16%
- Energy: 18%
- Communication Services: 0%
Rebalancing

Pull Latest Data
We will pull the most updated data on Bloomberg as companies’ report financial information.

Avoid Bankrupt Companies
We will have a dedicated team to monitor that the securities are not under bankruptcy.

Rebalance Accordingly
We shall rebalance our portfolio monthly using equal weights.
Each team member will rotate positions throughout the semester. This will ensure all team members are exposed to every aspect of the investment process.