Undergraduate Student Investment Management Fund

Semi-Annual Presentation
Friday, December 2, 2011
INTRODUCTION

Fund Members

Fund Managers

Michael Cohn

Steven Kutos

Rima Reddy

Jenna Hoppe

Fund Analysts

Michael Ham

Aaron Baker

Ajay GnanaSambanthan

Jonathan Lozano

Kenneth Qian
Process

• Determine allocation process
  – Two levels of Mean-Variance Optimization, Black-Litterman
  – Adjustments, improvements, and views

• Select asset classes
  – Sectors/regions and commodities/REITs

• Gather data
  – What, where, how

• Build/modify allocation models

• Run models with data
  – Testing, quality control, evaluate output
Optimization Inputs

- Static MVOs are highly sensitive to the input data
- Historical data is not the best indicator for the future
- Correlations across asset classes have increased over the last decade
- Different methods to estimate volatility
**Resampling**

- Reduces the sensitivity of the model
- Iterations of rolling sets of historical returns
- MVO performed on each iteration to construct a unique efficient frontier – maximizes the Sharpe ratio on each frontier
- Averaged the optimized portfolio over all frontiers
- Results in a more diversified portfolio
MVO Weights Over Time
Weighted Covariance

- Used an exponentially weighted moving average to account for increasing correlations across asset classes
- In an exponential weighting scheme, each observation is assigned a multiple of the weight assigned to its predecessor to better reflect current conditions
- Half-life: 3 years
GARCH Volatility Forecast

- Squared monthly return data tested positive for auto-correlations
- Garch volatility provides accurate forecasts of variances and covariances through its ability to model time-varying conditional variances
- Problem: only useful to forecast up to 3 periods
Charter Allocation

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>US Equity</th>
<th>Ex-US Equity</th>
<th>US Fixed Income</th>
<th>Commodities</th>
<th>REITs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Bound</td>
<td>100%</td>
<td>25%</td>
<td>20%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Lower Bound</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Ex-US Equity MVO

EX-US MVO

MVO

EM
EU
Canada
Japan
New Zealand

Singapore
Israel
Australia
Hong Kong
Ex-US Equity MVO

- All assets constrained +/- 5% of market weights
Black-Litterman

• Benefits
  – Ability to incorporate investor views
  – Lessen the historical returns bias

• Procedure
  – Use a reverse optimization process to obtain excess equilibrium returns for each US Sector from market caps and covariances
  – Express under/outperform views
  – Run Black-Litterman optimizer to combine the two distributions
Example Fundamental View

- Increasing geopolitical risk - Middle east uncertainties
- Highest oil refining capacity since Jan 2008 - Large proven oil and natural gas reserves
- Oil prices have remained relatively high even with an increased risk of downturn
- $265 billion in announced industry takeovers through 2011 Q3

- Increasing geopolitical risk - Middle east uncertainties
- Highest oil refining capacity since Jan 2008 - Large proven oil and natural gas reserves
- Oil prices have remained relatively high even with an increased risk of downturn
- $265 billion in announced industry takeovers through 2011 Q3
Our Views: +/- 50bps

<table>
<thead>
<tr>
<th>Excess Return Views</th>
<th>View (relative to market)</th>
<th>Equilibrium Excess Return</th>
<th>Absolute +/- 50 bp</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer Discretionary</strong></td>
<td>Underperform</td>
<td>6.51%</td>
<td>6.01%</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>Outperform</td>
<td>4.95%</td>
<td>5.45%</td>
</tr>
<tr>
<td><strong>Financials</strong></td>
<td>Underperform</td>
<td>7.21%</td>
<td>6.71%</td>
</tr>
<tr>
<td><strong>Industrials</strong></td>
<td>Outperform</td>
<td>6.44%</td>
<td>6.94%</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Outperform</td>
<td>9.00%</td>
<td>9.50%</td>
</tr>
</tbody>
</table>
Black-Litterman Results

- Cons Discretionary
- Cons Staples
- Energy
- Financials
- Health Care
- Industrials
- Materials
- Technology
- Telecom
- Utilities

- Market Weights
- BL Weights
Sensitivity of Views

- Change from Market Weights

- Cons. Disc.
- Energy
- Financials
- Industrials
- Technology

- Absolute +/- 50 bp
- Absolute +/- 100 bp
Commodities

• Reason for investment
  – High correlation, diversification

• Restricted by charter constraints from direct investment
  – Solution: basket of stocks with high commodity exposure
Commodities Basket

• Company selection
  – Regressed companies against commodity and US Equity indices

• Selection criteria
  – High correlation to commodities, low correlation to US Equity
    Ex. \( R = \alpha + \beta (S&P \ 500) + \beta (Oil) + \epsilon \)

• Incorporation into portfolio
  – Built a custom index using the selected firms
## Commodities Holdings

<table>
<thead>
<tr>
<th>Company</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrick Gold</td>
<td>Gold</td>
</tr>
<tr>
<td>Goldcorp</td>
<td>Gold</td>
</tr>
<tr>
<td>Agrium International</td>
<td>Agribusiness</td>
</tr>
<tr>
<td>Syngenta</td>
<td>Agribusiness</td>
</tr>
<tr>
<td>CF Industries</td>
<td>Agribusiness</td>
</tr>
<tr>
<td>Brasil Foods</td>
<td>Agribusiness</td>
</tr>
<tr>
<td>Monsanto</td>
<td>Agribusiness</td>
</tr>
<tr>
<td>Canadian Natural Resources</td>
<td>Oil</td>
</tr>
<tr>
<td>Cameron International</td>
<td>Oil</td>
</tr>
<tr>
<td>International Paper</td>
<td>Forestry</td>
</tr>
<tr>
<td>Helca Mining Company</td>
<td>Mining</td>
</tr>
<tr>
<td>Silver Wheaton Corp</td>
<td>Mining</td>
</tr>
</tbody>
</table>
REITs – ETF Selection

- Vanguard VNQ REIT
- Number of holdings: 106
- Total net assets: $17.5B
- Expense ratio: 0.12%
- Turnover ratio: 12.1%
- Equity REITs
Fixed Income

• Forego TIPS
  – Inflation expectations low
  – 5 year breakeven rate = 1.76% as of 10/24/11

• Intermediate over short term
  – Interest rates to stay low

• Corporate vs. Treasury

• Chose iShares GVI (Intermediate Bond Fund)
## ETF Selection

### Country ETFs
- iShares MSCI Japan Index
- Vanguard MSCI Europe
- Vanguard MSCI Emerging Markets
- iShares MSCI New Zealand
- iShares MSCI Canada Index
- iShares MSCI Australia Index
- iShares MSCI Hong Kong Index
- iShares MSCI Singapore Index
- iShares MSCI Israel

### Sector ETFs
- Vanguard Consumer Discretionary
- Vanguard Consumer Staples
- Vanguard Energy
- Vanguard Financials
- Vanguard Healthcare
- Vanguard Industrials
- Vanguard Materials
- Vanguard Technology
- Vanguard Telecom
- Vanguard Utilities

### General Considerations
- Holdings overlap
- Composition
- Tracking error
- Expense ratio
- Liquidity
- Prior holdings
Benchmarks

Standard Benchmarks
- MSCI World Equity Index
- Russell 3000

Composite Benchmark
Applied charter constraints to market portfolio
- 55% MSCI US Equity
- 25% MSCI Ex-US Equity
- 20% Barclays Capital Aggregate Bond Index
### Fund Performance

<table>
<thead>
<tr>
<th></th>
<th>Holding Period Return</th>
<th>Annualized Return</th>
<th>Holding Period Std. Dev.</th>
<th>Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIM Fund</td>
<td>-1.57%</td>
<td>-16.18%</td>
<td>7.42%</td>
<td>27.03%</td>
</tr>
<tr>
<td>Custom BM</td>
<td>-1.07%</td>
<td>-11.25%</td>
<td>6.11%</td>
<td>22.27%</td>
</tr>
<tr>
<td>Russell 3000</td>
<td>-1.00%</td>
<td>-8.38%</td>
<td>7.57%</td>
<td>30.60%</td>
</tr>
<tr>
<td>World Equity</td>
<td>-1.55%</td>
<td>-15.95%</td>
<td>8.40%</td>
<td>27.56%</td>
</tr>
</tbody>
</table>
Undergraduate SIM Fund

INTRODUCTION

HIGH LEVEL MVO

EX-US MVO

US SECTORS – BLACK LITTERMAN

COMMODITIES

REITS

FIXED INCOME

INVESTMENTS

FUND PERFORMANCE

CONCLUSION

Fund Performance

![Chart showing fund performance over time]
Going Forward

- Rebalancing
- Attribution analysis
- Monitoring
- Developing SIM Fund for next year
What We Learned

• Strengths and weaknesses of models
• There is no right answer
• Details, details, details
• There are always constraints
Questions?