Actively Managed Exchange Traded Funds

Presentation to Q Group

April 5, 2005
ETFs – Structure & Mechanics

Primary Creation and Redemption Activity
(@ 4 PM, @ NAV)

Investors

Mutual Fund

Creation

Redemption

Cash

New Shares

Old Shares

Cash
ETFs – Structure & Mechanics

Primary Creation and Redemption Activity
(@ 4 PM, @ NAV)

Secondary Market Trading Activity (during day)

Mutual Fund

Creation

New ETF Shares

Old ETF Shares

Redemption

Stock Basket

Stock Basket

Amex Specialist /APs

Cash

ETF Shares

Cash

Buyers

ETF Shares

Cash

Sellers
Actively Managed ETFs - Challenges

3 Basic Requirements

- Publish estimated value every 15 secs.
  - SEC & market requirement
- Market makers must be able to hedge inventory
  - Facilitates tight bid-ask spread
- Creation/Redemption process that works

Full disclosure not required

- Works, but not necessary
- Key insight: only enough information needed
Actively Managed ETFs – Solution
(Patents Pending)

- Fund Selection Universe
- Fund Holdings

Modeling Process

Fund Risk Characteristics

- Disclosed
- Estimated Value
- IIV Portfolio (Intra-day Indicative Value)

Filtering Mechanism

Hedge Portfolio

Non-Disclosed

Market-Making
Actively Managed ETFs – Modeling Process

Statistical risk factor methodology used

- Principal Component Analysis (PCA), classical technique originated in 1901.

Comparison of Risk Modeling Techniques

Generic Risk Models:

\[ \text{Risk} = \beta \square + \beta \square + \beta \square + \ldots \]

Features: Set of multiple factors
Factors intended to be common to all securities
Each security has exposure (\( \beta \)) to each factor
Actively Managed ETFs – Modeling Process

➡️ Commercial Risk Models
➡️ Most commonly used in finance

\[
\text{Risk} = \beta_{\text{Market}} + \beta_{\text{Value}} + \beta_{\text{S1}} + \ldots.
\]

Features: Factors are pre-specified
Data must fit into factors
Transient factors not captured
Must use to have economic meaning
Actively Managed ETFs – Modeling Process

PCA Models:

\[ \text{Risk} = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots \]

Features: Factors not pre-specified
Data determines factors
By definition, factors common to all securities
Transient factors captured
Much higher explanatory power
Can use since accuracy only objective

Problem requires high frequency data over short period
Actively Managed ETFs – Methodology*
(Conducted Evening of day T)

AMEX ACTIVE ETF PROCESS

Intra-Day Prices → Fund Selection Universe →
Principal Components Analysis Process → Risk Model Factors →
COMBINATION → IIV Portfolio (for day T+1)

FUND CUSTODIAN

Fund Holdings (end of day T) →
REGRESSION ANALYSIS → Fund Risk Characteristics

*Patent Pending
Risk Model Test – Simulated Active Portfolios

- Random portfolios generated
  - Large-Cap, Mid-Cap, Small-Cap
  - Growth, Value, Blend
  - 50 to 100 stocks
  - Max of 10% daily turnover of Fund holdings

- Difference between IIV and the value of actual Portfolio holdings compared at 10 minute intervals during 2001.

- Use S&P 500 example
Model Results – Simulated Portfolio

Differences Between Model and Simulated Portfolio
S&P 500 Simulated Active Portfolio
1/4/01 - 12/28/01

Average = 0.016%
Standard Deviation = 0.200%
Maximum = 1.045%  8/2/2001 10:20
Minimum = -0.748%  9/17/2001 11:30
Skewness = 0.2378
No. of Observations = 9,310

AMERICAN STOCK EXCHANGE
Equities Options ETFs
# Model Results – Simulated Portfolio

*10/3/2001*

## Top 10 Holdings in Portfolio

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>WPI</td>
<td>Watson Pharm.</td>
<td>3.92%</td>
</tr>
<tr>
<td>TXU</td>
<td>TXU Corp.</td>
<td>2.96%</td>
</tr>
<tr>
<td>TGT</td>
<td>Target Corp.</td>
<td>2.81%</td>
</tr>
<tr>
<td>IMNX</td>
<td>Immunex Corp.</td>
<td>2.67%</td>
</tr>
<tr>
<td>AHC</td>
<td>Amerada Hess</td>
<td>2.53%</td>
</tr>
<tr>
<td>CA</td>
<td>Computer Associates</td>
<td>2.37%</td>
</tr>
<tr>
<td>EDS</td>
<td>Elec. Data Systems</td>
<td>2.32%</td>
</tr>
<tr>
<td>ED</td>
<td>Consolidated Edison</td>
<td>2.21%</td>
</tr>
<tr>
<td>PLP</td>
<td>Phillips Petroleum</td>
<td>2.21%</td>
</tr>
<tr>
<td>CSX</td>
<td>CSX Corp.</td>
<td>2.17%</td>
</tr>
</tbody>
</table>

*Total: 26.16%

Total # of Holdings: **84**

## Top 10 Holdings in IIV

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNC</td>
<td>Conseco Inc.</td>
<td>1.05%</td>
</tr>
<tr>
<td>APC</td>
<td>Anadarko Petroleum</td>
<td>1.02%</td>
</tr>
<tr>
<td>APA</td>
<td>Apache Corp.</td>
<td>0.94%</td>
</tr>
<tr>
<td>SFA</td>
<td>Scientific-Atlanta</td>
<td>0.85%</td>
</tr>
<tr>
<td>EOG</td>
<td>EOG Resources</td>
<td>0.85%</td>
</tr>
<tr>
<td>BR</td>
<td>Burlington Resources</td>
<td>0.83%</td>
</tr>
<tr>
<td>RKY</td>
<td>Adolph Coors</td>
<td>0.81%</td>
</tr>
<tr>
<td>VZ</td>
<td>Verizon Comm.</td>
<td>0.80%</td>
</tr>
<tr>
<td>BUD</td>
<td>Anheuser-Busch</td>
<td>0.78%</td>
</tr>
<tr>
<td>KMG</td>
<td>Kerr-McGee</td>
<td>0.76%</td>
</tr>
</tbody>
</table>

*Total: 8.69%

Total # of Holdings: **474**
## Model Results—Simulated Portfolios

<table>
<thead>
<tr>
<th></th>
<th>LargeCap</th>
<th>MidCap</th>
<th>SmallCap</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth</strong></td>
<td><strong>Average = -0.019%</strong>&lt;br&gt;<strong>Standard Dev. = 0.256%</strong>&lt;br&gt;<strong>Maximum = 0.845%</strong>&lt;br&gt;<strong>6/8/2001 11:40</strong>&lt;br&gt;<strong>Minimum = -1.018%</strong>&lt;br&gt;<strong>3/15/2001 15:30</strong></td>
<td><strong>Average = -0.039%</strong>&lt;br&gt;<strong>Standard Dev. = 0.310%</strong>&lt;br&gt;<strong>Maximum = 1.171%</strong>&lt;br&gt;<strong>5/22/2001 13:20</strong>&lt;br&gt;<strong>Minimum = -1.423%</strong>&lt;br&gt;<strong>3/21/2001 15:40</strong></td>
<td><strong>Average = 0.032%</strong>&lt;br&gt;<strong>Standard Dev. = 0.389%</strong>&lt;br&gt;<strong>Maximum = 1.866%</strong>&lt;br&gt;<strong>1/18/2001 14:50</strong>&lt;br&gt;<strong>Minimum = -1.487%</strong>&lt;br&gt;<strong>1/8/2001 15:30</strong></td>
</tr>
<tr>
<td><strong>Value</strong></td>
<td><strong>Average = 0.006%</strong>&lt;br&gt;<strong>Standard Dev. = 0.201%</strong>&lt;br&gt;<strong>Maximum = 0.878%</strong>&lt;br&gt;<strong>9/28/2001 13:10</strong>&lt;br&gt;<strong>Minimum = -0.943%</strong>&lt;br&gt;<strong>9/21/2001 14:00</strong></td>
<td><strong>Average = 0.011%</strong>&lt;br&gt;<strong>Standard Dev. = 0.216%</strong>&lt;br&gt;<strong>Maximum = 0.915%</strong>&lt;br&gt;<strong>9/24/2001 15:50</strong>&lt;br&gt;<strong>Minimum = -0.727%</strong>&lt;br&gt;<strong>3/26/2001 12:30</strong></td>
<td><strong>Average = 0.010%</strong>&lt;br&gt;<strong>Standard Dev. = 0.307%</strong>&lt;br&gt;<strong>Maximum = 1.371%</strong>&lt;br&gt;<strong>9/21/2001 12:20</strong>&lt;br&gt;<strong>Minimum = -1.242%</strong>&lt;br&gt;<strong>5/7/2001 15:50</strong></td>
</tr>
<tr>
<td><strong>Blend</strong></td>
<td><strong>Average = 0.016%</strong>&lt;br&gt;<strong>Standard Dev. = 0.200%</strong>&lt;br&gt;<strong>Maximum = 1.045%</strong>&lt;br&gt;<strong>8/2/2001 10:20</strong>&lt;br&gt;<strong>Minimum = -0.748%</strong>&lt;br&gt;<strong>9/17/2001 11:30</strong></td>
<td><strong>Average = -0.006%</strong>&lt;br&gt;<strong>Standard Dev. = 0.229%</strong>&lt;br&gt;<strong>Maximum = 1.643%</strong>&lt;br&gt;<strong>1/4/2001 13:20</strong>&lt;br&gt;<strong>Minimum = -0.901%</strong>&lt;br&gt;<strong>10/25/2001 13:30</strong></td>
<td><strong>Average = 0.001%</strong>&lt;br&gt;<strong>Standard Dev. = 0.256%</strong>&lt;br&gt;<strong>Maximum = 1.069%</strong>&lt;br&gt;<strong>3/13/2001 12:30</strong>&lt;br&gt;<strong>Minimum = -1.328%</strong>&lt;br&gt;<strong>2/01/2001 15:50</strong></td>
</tr>
</tbody>
</table>
Actual Portfolio Test - 1

- Existing Mutual Fund
  - U.S. Equity
  - Diversified, Large-Cap

- Manager Chose Testing Period
  - Sent Daily Holdings, 1/4/01 – 7/1/01
  - Meant Testing 1/5/01 – 7/2/01

- Manager Chose Universes
  - Tested Using Several
    - Will Show Results Using Russell 1000
Model Results – Actual Portfolio 1

Differences Between Model and Actual Portfolio
IIV Portfolio Based on Russell 1000 Universe
1/5/01 - 7/2/01, 5 Min. Intervals

Average = -0.023%
Standard Deviation = 0.241%
Maximum = 0.730%
Minimum = -0.956%
No. of Observations = 9,471

Bin Frequency Chart
Model Results – Actual Portfolio
3/2/01, 5 Min. Intervals

Actual Portfolio vs. IIV Portfolio (Russell 1000 Universe)

Average = -0.040%
Standard Deviation = 0.075%
Maximum = 0.092%
Minimum = -0.233%

Portfolio Holdings = 108
IIV Holdings = 926
# Model Results – Actual Portfolio 1

## Various Universes vs. Index Only

1/5/01 - 7/2/01, 5 Min. Intervals

<table>
<thead>
<tr>
<th></th>
<th>Universes</th>
<th>Index Only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S&amp;P 500</td>
<td>S&amp;P 1500</td>
</tr>
<tr>
<td>Mean</td>
<td>-0.016%</td>
<td>-0.005%</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.204%</td>
<td>0.244%</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.634%</td>
<td>0.769%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.900%</td>
<td>-1.031%</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.22820</td>
<td>-0.22786</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.55891</td>
<td>0.65449</td>
</tr>
</tbody>
</table>
Actual Portfolio Test - 2

Existing Mutual Fund
- U.S. Equity
- Diversified, Large-Cap Value

Manager Chose Testing Periods
- 1st Test: 4/2/04 – 10/1/04
- 2nd Test: 1/3/00 – 6/30/00

Large-Cap Value Universe
Model Results – Actual Portfolio 2

Differences Between Model and Actual Portfolio
IIV Portfolio Based on Large-Cap Value Universe
4/2/04 – 10/1/04, 5 Min. Intervals

Average = -0.010%
Standard Deviation = 0.085%
Maximum = 0.352%
Minimum = -0.336%
No. of Observations = 9,702

Frequency

0 500 1000 1500 2000 2500 3000

-0.40% -0.35% -0.30% -0.25% -0.20% -0.15% -0.10% -0.05% 0.00% 0.05% 0.10% 0.15% 0.20% 0.25% 0.30% 0.35% 0.40% More

American Stock Exchange
Equities Options ETFs
Model Results – Actual Portfolio 2

Differences Between Model and Actual Portfolio
IIIV Portfolio Based on Large-Cap Value Universe
1/3/00 - 6/30/00, 5 Min. Intervals

Average = 0.008%
Standard Deviation = 0.208%
Maximum = 1.163%
Minimum = -0.764%
No. of Observations = 9,828
## Model Results – Actual Portfolio 2
### IIV vs. Index Only
#### 2004 & 2000, 5 Min. Intervals

<table>
<thead>
<tr>
<th></th>
<th>4/2/04 - 10/1/04</th>
<th>1/3/00 - 6/30/00</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large Value</td>
<td></td>
</tr>
<tr>
<td>IIV</td>
<td>-0.010%</td>
<td>0.008%</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.085%</td>
<td>0.208%</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.352%</td>
<td>1.163%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.336%</td>
<td>-0.764%</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.31658</td>
<td>0.47331</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.05679</td>
<td>2.73892</td>
</tr>
<tr>
<td>No. Observations</td>
<td>9,702</td>
<td>9,828</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td>S&amp;P 500</td>
</tr>
<tr>
<td>IIV</td>
<td>-0.033%</td>
<td>-0.030%</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.153%</td>
<td>0.639%</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.569%</td>
<td>3.226%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.620%</td>
<td>-2.476%</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.00620</td>
<td>-0.02476</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.40463</td>
<td>0.47522</td>
</tr>
<tr>
<td>No. Observations</td>
<td>9,702</td>
<td>9,828</td>
</tr>
</tbody>
</table>
Actively Managed ETFs – Hedging Process

IIV Portfolio → REGRESSION ANALYSIS → Risk Characteristics → RISK MINIMIZER → Hedge Portfolio

Hedge Instruments

Unique to each Market-Maker

Tracking will vary based on instruments
Actively Managed ETFs – Hedging Example

- Use 1/29/02 Sample Portfolio (based on S&P 500)
- Hedge Instruments Universe
  - 4 ETFs
    - SPDR, S&P MidCap, QQQ, Russell 2000 iShare
  - 80 Largest Holdings from IIV
- Can go long or short
- Use risk model from 1/29/02
# Hedging Example

**As of 1/29/02**

## Top 10 Holdings in Portfolio

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX</td>
<td>IMS Health Inc.</td>
<td>2.86%</td>
</tr>
<tr>
<td>MCD</td>
<td>McDonald's Corp</td>
<td>2.68%</td>
</tr>
<tr>
<td>NSC</td>
<td>Norfolk Southern</td>
<td>2.59%</td>
</tr>
<tr>
<td>EK</td>
<td>Eastman Kodak</td>
<td>2.57%</td>
</tr>
<tr>
<td>GE</td>
<td>General Electric</td>
<td>2.48%</td>
</tr>
<tr>
<td>CINF</td>
<td>Cincinnati Financial</td>
<td>2.41%</td>
</tr>
<tr>
<td>DVN</td>
<td>Devon Energy</td>
<td>2.27%</td>
</tr>
<tr>
<td>AGN</td>
<td>Allergan</td>
<td>2.10%</td>
</tr>
<tr>
<td>CHIR</td>
<td>Chiron</td>
<td>2.06%</td>
</tr>
<tr>
<td>BFB</td>
<td>Brown-Forman</td>
<td>2.03%</td>
</tr>
</tbody>
</table>

*Total: 24.04%

## Total # of Holdings: 75

## Top 10 Holdings in Hedge

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPY</td>
<td>S&amp;P 500 ETF</td>
<td>50.00%</td>
</tr>
<tr>
<td>MDY</td>
<td>S&amp;P 400 ETF</td>
<td>27.73%</td>
</tr>
<tr>
<td>BR</td>
<td>Burlington Resources</td>
<td>3.62%</td>
</tr>
<tr>
<td>AVP</td>
<td>Avon Products</td>
<td>2.73%</td>
</tr>
<tr>
<td>EK</td>
<td>Eastman Kodak</td>
<td>2.13%</td>
</tr>
<tr>
<td>PVN</td>
<td>Providian Financial</td>
<td>2.08%</td>
</tr>
<tr>
<td>SEE</td>
<td>Sealed Air</td>
<td>2.07%</td>
</tr>
<tr>
<td>RX</td>
<td>IMS Health Inc.</td>
<td>2.05%</td>
</tr>
<tr>
<td>SANM</td>
<td>Sanmina-Sci</td>
<td>1.97%</td>
</tr>
<tr>
<td>DCN</td>
<td>Dana Corp.</td>
<td>1.95%</td>
</tr>
</tbody>
</table>

*Total: 96.32%

## Total # of Holdings: 39
Hedging Example – Pricing Comparison
1/30/02, 1 Min. Intervals

Actual vs. IIV
Average = -0.011%
Standard Deviation = 0.046%
Maximum = 0.092% 11:56
Minimum = -0.138% 15:31
No. of Observations = 386

Actual vs. Hedge
Average = -0.054%
Standard Deviation = 0.070%
Maximum = 0.128% 15:49
Minimum = -0.189% 13:11
No. of Observations = 386
## Creation/Redemption Alternatives

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cash</strong></td>
<td><strong>Largest impact on risk</strong></td>
</tr>
<tr>
<td>Simple</td>
<td>Frictional costs</td>
</tr>
<tr>
<td>No change from current</td>
<td></td>
</tr>
<tr>
<td>No disclosure</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Frictional costs</strong></td>
</tr>
<tr>
<td><strong>Benchmark ETF</strong></td>
<td></td>
</tr>
<tr>
<td>Eliminates benchmark risk</td>
<td></td>
</tr>
<tr>
<td>No disclosure</td>
<td><strong>40 Act issues</strong></td>
</tr>
<tr>
<td>Minimizes hedging issues</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Complex</strong></td>
</tr>
<tr>
<td><strong>Defined Portfolio</strong></td>
<td><strong>Must define daily</strong></td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
</tr>
<tr>
<td>Minimize portfolio risk</td>
<td></td>
</tr>
<tr>
<td>Limited disclosure</td>
<td></td>
</tr>
<tr>
<td>Tax efficiency</td>
<td></td>
</tr>
</tbody>
</table>
Benchmark ETF Process w ETF Share Class

XYZ Active Fund

“Frictional” Cash

Cash (As Needed)

Benchmark ETF

APs

No Need to Equitize (Already Done)

Investors

Cash

Cash

Cash Equitized thru Futures, ETFs, Etc.

• Fund grows thru distribution
• Mgr. interaction unchanged
• In-kind means no new equitizing trades or taxable events

Buy

Sell
Actively Managed ETFs - Summary

- Non-transparency presents major challenges
- AMEX modeling solution addresses
  - Minimize industry changes
- Testing indicates real-world viability
- Creation/Redemption has multiple alternatives