State Space Models of ETF Price Dynamics

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Executive Summary

- Exchange traded funds (ETFs) have grown in diversity and size, generating considerable interest in their pricing and trading.
- Our basic idea is that the time series of NAVs and prices for an ETF contains information on the underlying unobserved “true” value of the ETF, which can be estimated using state-space techniques.
- The result is a “true premium” time series, estimated on a daily or intraday basis for each ETF, that can be different from the observed price/NAV ratio.
- Ultimately “true premiums” mean revert via the actions of arbitragers, but this process can take some time depending on liquidity.

* Forthcoming in the Journal of Investment Management
US ETP AUM has risen from $70.6 billion in 2000 to $2 trillion in 2014. US ETPs had ~$124 billion of inflows in 2014.

iShares is the largest ETP provider in the US, with $763 billion of the $2 trillion in 2014, representing a 38% market share.

ETFs represented ~25% of U.S. daily equity trading volume in 2014.

10-year CAGR for US ETP assets is 24%
- 22% for Equity ETPs
- 43% for Fixed Income ETPs

Notable statistics

1. "ETP" (or exchange traded product) as referred to above means any portfolio exposure security that trades intraday on a US exchange. ETPs include exchange traded funds (ETFs) registered with the SEC under the Investment Company Act of 1940 (open-end funds and unit investment trusts or UITs) and certain trusts, commodity pools and exchange traded notes (ETNs) registered with the SEC under the Securities Act of 1933. Statistics as of 12/31/14 unless otherwise noted.

2. 10-year CAGR as of December 31, 2014. ETP flows and assets are sourced using shares outstanding and net asset values from Bloomberg. Inflows for years prior to 2010 are sourced from Strategic Insights Simfund. Asset classifications are assigned by the BlackRock based on product definitions from provider websites and product prospectuses. Other static product information is obtained from provider websites, product prospectuses, provider press. The 10-year CAGR for Equity and Fixed Income ETPs are calculated by BlackRock.

Visualization of recent ETF articles

Source: Wordle
Overview

Exchange traded funds (ETFs) have grown in diversity and size, generating considerable interest in their pricing and trading.

Common themes include premiums/discounts, mispricing, and volatility transmission:

- Dieterich and Cui (2014): “Large swings in U.S. government-bond prices are renewing investor scrutiny of whether exchange-traded funds, or ETFs, are boosting market volatility.”
- Wimbish (2013): ETFs “…may also cause additional market-wide systemic problems because of the arbitrage opportunities they produce.”
- Ben-David, Franzoni, and Moussawi (2014): “liquidity shocks in the ETF market are propagated via arbitrage trades to the prices of underlying securities, adding a new layer of non-fundamental volatility.”

We develop a model that emphasizes arbitrage as a driver of ETF liquidity and price dynamics to analyze questions concerning:

- Dynamics of premiums and discounts
- Price discovery & speed of arbitrage
- Volatility and propagation of liquidity shocks

We estimate the model for a universe of all US-domiciled ETFs from 2005-2014

Sources:
ETFs differ from open-end and closed-end mutual funds in key respects, most importantly the creation/redemption mechanism that relies on arbitrage to ensure efficient pricing:

- Unlike open-ended mutual funds, but similar to closed-end funds, ETFs are traded intraday on an exchange in the secondary market at prices that can deviate from Net Asset Value (NAV).
- Purchases/sales of ETFs do not necessarily require investors to interact directly with the fund.
- Unlike conventional pooled vehicles, ETF shares are created or redeemed at NAV at the end of each trading day and only with market making firms known as Authorized Participants (APs).

NAV based on last prices can be stale, especially for funds holding less liquid or international securities:

- Grégoire (2013) notes that there is still evidence that mutual funds do not fully adjust their valuations and returns remain predictable.
- Example: Markit iBoxx US dollar-denominated, investment grade corporate bonds index has 1,115 constituents. Less than third (28%) of bonds in the basket traded once or more a day during the months January and February 2014, based on FINRA TRACE data.

An AP is never forced to redeem or create; they only do so if it is profitable by selling the higher-priced asset while simultaneously buying the lower-priced asset:

- Profit is measured not by the ETF’s premium but by the deviation of price from expected value at trade time.
- The speed of arbitrage is limited by:
  - Market maker risk aversion and capital.
  - Transaction costs and price impact in both underlying and secondary market.
Dynamic model based on arbitrage

ETF price represents expected value plus a true premium (both unobserved)

\[ p_t = v_t + u_t \]

Expected value follows a random-walk (unobserved)

\[ r_t = v_t - v_{t-1} \]

The unobserved true premium is corrected over time by arbitrage

\[ u_t = \psi u_{t-1} + \varepsilon_t \]

NAV is a weighted average of current value and past NAV

\[ n_t = (1 - \phi)v_t + \phi n_{t-1} + w_t \]

Notes

1. Prices and values in log terms, so all differences are returns
2. Observed premium is defined as \( \pi_t = (p_t - n_t) \)
3. Lower values of \( \psi \) imply faster correction of errors or less correlation in flow; shocks are captured by \( \varepsilon_t \)
4. Possible staleness in NAV is captured by \( 0 \leq \phi \leq 1 \)
5. The error term \( w_t \sim (\mu_w, \sigma_w^2) \) reflects NAV pricing noise.
Plot of daily NAV return against NAV lagged return – iShares iBoxx $ High Yield Corporate Bond ETF (HYG)

Fit Plot for navret

Past performance does not guarantee future results. For standardized performance, please see the end of this document.

Plot of daily ETF return against ETF lagged return – iShares iBoxx $ High Yield Corporate Bond ETF (HYG)

Past performance does not guarantee future results. For standardized performance, please see the end of this document.

Implications of the model

**Premiums:**
- ETF’s premium consists of two terms: (a) *Price Discovery*, the product of the staleness factor and a weighted average of past fundamental returns; and (b) *Transitory Liquidity*, captured by a weighted average of past liquidity innovations:
  \[ \pi_t = \varphi(r_t + \varphi r_{t-1} + \cdots) + \epsilon_t + \psi \epsilon_{t-1} + \psi^2 \epsilon_{t-1} + \cdots \]
- As the return and liquidity shocks have zero mean, the average premium mean-reverts to zero over time
  - For fixed income funds the convention to using bid prices to compute NAV implies a positive mean
- Even if fundamental returns are serially uncorrelated, the premium still exhibits positive autocorrelation that increases with staleness

**Returns:**
- ETF return volatility will exceed that of NAV returns if there is staleness in NAV
- Over longer intervals, the return variance will scale with time, NAV and ETF return differences will narrow

**Arbitrage:**
- Parameter estimates yield insights on the degree of staleness in NAV (\( \varphi \)) and the speed with which pricing errors are corrected (inversely related \( \psi \))
- Given estimates of expected value, we can recover the unobserved true premium, and decompose it into liquidity and price discovery components
Data sources and procedures

Universe

- Daily data on a universe of all US-domiciled ETFs from January 1, 2005 to January 31, 2014
  - Only physically backed ETFs on equities and fixed income; exclude exchange-traded notes, leveraged and inverse products, and other synthetic funds
  - Daily closing prices and NAVs sourced from BlackRock and Bloomberg.
  - Require funds with 250 consecutive trading days of history
    - Note that we do not restrict the sample to funds that are listed at the end of the sample period, but simply require a year’s continuous trading.
- This yields a sample of 947 ETFs

Sample characteristics

- Total AUM in the sample represents almost $1.5 trillion, which is comprehensive in the sense that total AUM in US ETPs was $1.74 trillion as of March, 31 2014*
- The great majority of the funds and assets are in domestic equity ETFs, followed by international equity.
- Consistent with Petajisto (2013), international funds have the largest absolute premium of 74 basis points.

* Source: BlackRock ETP Landscape, April 2014, based on 1,568 ETPs. ETP assets are sourced using shares outstanding and net asset values from Bloomberg. Asset classifications are assigned by the BlackRock based on product definitions from provider websites and product prospectuses.
## Descriptive statistics – U.S. domiciled ETFs 2005-2014

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Equity</th>
<th>Fixed Income</th>
<th>All Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
<td>International</td>
<td>Domestic</td>
</tr>
<tr>
<td>Number of Funds</td>
<td>387</td>
<td>403</td>
<td>113</td>
</tr>
<tr>
<td>Total AUM ($MM)</td>
<td>892,804</td>
<td>382,021</td>
<td>191,240</td>
</tr>
<tr>
<td>Average AUM ($MM)</td>
<td>2,307</td>
<td>948</td>
<td>1,692</td>
</tr>
<tr>
<td>Average Number Sample Days</td>
<td>1,581</td>
<td>1,224</td>
<td>1,116</td>
</tr>
<tr>
<td>Average ADV ($MM)</td>
<td>106.0</td>
<td>26.7</td>
<td>28.6</td>
</tr>
<tr>
<td>Average Trades Per Day</td>
<td>2,854</td>
<td>1,635</td>
<td>1,029</td>
</tr>
<tr>
<td>Average Bid/Ask Spread (bps)</td>
<td>16.6</td>
<td>52.4</td>
<td>28.6</td>
</tr>
<tr>
<td>Average Premium (bps)</td>
<td>-1.8</td>
<td>18.3</td>
<td>18.3</td>
</tr>
<tr>
<td>Average Absolute Premium (bps)</td>
<td>23.8</td>
<td>73.4</td>
<td>37.6</td>
</tr>
</tbody>
</table>

**Source:** Bloomberg and BlackRock data, 1/1/2005-1/31/2014. The figures for assets under management are taken from the last trading day of the sample. For bid-ask spreads, average daily volumes and number of trades, we use the past year as the period for computation, and report the unweighted means by asset class and exposure.
Empirical estimates of the model are of economic interest

Use Kalman filter (state-space) approach to explicitly estimate model at the fund level

- The time-series of observed price and NAV helps us infer unobserved state vector, namely expected value and all the parameters of the model.
- Provides a step-ahead forecast given information to date that can be used to inform trading decisions and timing dynamically.
- The Kalman filter is the best possible (optimal) estimator for a very large class of problems where we want to make inference based on observations of noisy signals.
- Used in a variety of real-world applications where estimates are based on noisy mechanical, optical, acoustic, or magnetic sensor data (e.g., submarine detection).
- The model has 8 parameters: coefficients $\varphi$ and $\psi$ (staleness and efficiency) and the means and standard deviations of the shocks $\varepsilon_t$, $w_t$, and $r_t$.
- Total of 7,576 estimates

**Observation equation**

$$\begin{bmatrix} p_t \\ n_t \end{bmatrix} = \begin{bmatrix} \psi p_{t-1} \\ \varphi n_{t-1} \end{bmatrix} + \begin{bmatrix} 1 & -\psi \\ 1-\varphi & 0 \end{bmatrix} \begin{bmatrix} v_t \\ v_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_t \\ \omega_t \end{bmatrix}$$

**Transition equation**

$$\begin{bmatrix} v_t \\ v_{t-1} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} v_{t-1} \\ v_{t-2} \end{bmatrix} + \begin{bmatrix} r_t \\ 0 \end{bmatrix}$$
Estimation at fund level: iShares iBoxx $ High Yield Corporate Bond ETF (HYG) Prices, NAV and Estimated State Vector from June 2008-June 2009

Source: Bloomberg (price and NAV) and BlackRock (State Vector Estimate), 6/1/2008-6/30/2009.
**HYG: Observed vs. True Premiums (2005-2014)**

The scatter plot shows the observed versus true premiums for the HYG investment, with the line of best fit given by:

\[ y = 0.4741x - 0.4375 \]

The coefficient of determination, \( R^2 \), is 0.4613.

**Source:** Bloomberg and BlackRock data, 1/1/2005-1/31/2014.
State-space model estimates across asset classes and exposures
U.S. domiciled ETFs 2005-2014

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Equity</th>
<th>Fixed Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
<td>International</td>
</tr>
<tr>
<td>Exposure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAV Staleness Coefficient (φ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.08</td>
<td>0.15</td>
</tr>
<tr>
<td>Median</td>
<td>-0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.11</td>
<td>0.18</td>
</tr>
<tr>
<td>Wtd. Mean</td>
<td>-0.02</td>
<td>0.22</td>
</tr>
<tr>
<td>Fr. Significant &gt;0</td>
<td>0.03</td>
<td>0.74</td>
</tr>
<tr>
<td>Arbritrage Speed Parameter (ψ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.24</td>
<td>0.43</td>
</tr>
<tr>
<td>Median</td>
<td>0.20</td>
<td>0.44</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.23</td>
<td>0.50</td>
</tr>
<tr>
<td>Wtd. Mean</td>
<td>0.28</td>
<td>0.19</td>
</tr>
<tr>
<td>Fr. Significant &gt;0</td>
<td>0.80</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Source: Bloomberg and BlackRock data, 1/1/2005-1/31/2014. Weighted means are based on AUM weights. Significance is the fraction of the estimate that is greater than zero, based on a one-tail t-test at the 5% level.
Interpretation of the results

Staleness parameter
- Estimates *increase* as we move from the most liquid asset classes (domestic equity) to the less liquid asset classes (fixed income), consistent with our prior observations.
- For domestic equity, staleness is, in general, both economically and statistically insignificant, which is consistent with our intuition.

Speed of arbitrage
- *Speed of arbitrage* (which is measured *inversely* by $\psi$) increases with liquidity, ranging from a median of *0.20 in domestic equity* to *0.90 in international fixed income*.
- Corresponding implied *half-life* for reducing a given unobserved pricing error by 50% is *0.43 to 6.56 days*, respectively.
- Consistent with our intuition that domestic equity exhibits relatively low staleness compared to international fixed income.
Estimation of price discovery component

The observed premium at any point in time can be expressed as

\[ \pi_t = p_t - n_t = (p_t - v_t) + (v_t - n_t) = u_t + (v_t - n_t) \]

Define the price discovery component of the premium as the portion of total variance that is not attributable to transitory noise shocks

\[ D = 1 - \left( \frac{\sigma_u}{\sigma_{\pi}} \right)^2 \]

We estimated price discovery component \( D \) of the observed average premium within the broader asset classes and cut by quintiles of AUM rank, with 1 being the largest and 5 the smallest.

- Price discovery component declines as fund size drops in all four categories of asset class and exposure. In other words, transitory liquidity shocks constitute a larger fraction of the premium for smaller, less actively traded funds.
- The estimates make intuitive sense in that roughly 74 percent of the variation in premiums for large international funds is due to price discovery.
- We also compared the estimated Price Discovery Component (D) for full sample period (2005-2015) and financial crisis (2008-2009). The results are interesting: for the largest funds in each exposure bucket (AUM quintile rank 1), the price discovery component is smaller during financial crisis, compared to full sample, implying that “big” funds are efficient in both stressed and normal periods. Price discovery share has increased recently, as larger funds have become capital market vehicles for hedge funds and other investors.
## Results on price discovery by fund size

**U.S. domiciled ETFs 2005-2014**

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Exposure</th>
<th>AUM Quintile Rank</th>
<th>Number of Funds</th>
<th>Total AUM ($MM)</th>
<th>Price Discovery Component (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>1</td>
<td>78</td>
<td>801,146</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>78</td>
<td>64,815</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>77</td>
<td>19,804</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>77</td>
<td>5,940</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>77</td>
<td>1,099</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>International</td>
<td>1</td>
<td>81</td>
<td>347,338</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>81</td>
<td>26,107</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>81</td>
<td>6,541</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>80</td>
<td>1,674</td>
<td>0.43</td>
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</tr>
<tr>
<td></td>
<td>5</td>
<td>80</td>
<td>360</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td><strong>Fixed Income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>1</td>
<td>23</td>
<td>162,123</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>23</td>
<td>18,958</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>23</td>
<td>7,230</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>22</td>
<td>2,409</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>22</td>
<td>520</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>International</td>
<td>1</td>
<td>9</td>
<td>18,077</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>9</td>
<td>2,556</td>
<td>0.33</td>
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<td>3</td>
<td>9</td>
<td>987</td>
<td>0.50</td>
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</tr>
<tr>
<td></td>
<td>4</td>
<td>9</td>
<td>306</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>8</td>
<td>73</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td><strong>All Funds</strong></td>
<td>947</td>
<td></td>
<td>1,488,063</td>
<td>0.46</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Bloomberg and BlackRock data, 1/1/2005-1/31/2014.*
Price discovery component for Domestic and International equity funds

**Source:** Bloomberg and BlackRock data, 1/1/2005-1/31/2014. Each point on the chart represents the mean estimate of D, based on quintiles of AUM for domestic and international equity.
# Cross-sectional regression analysis

## Summary
- Cross-sectional regressions confirm intuition that staleness is greater for fixed income and international funds.
- Standard deviation of price innovations decreases with fund size, and is larger for equity and international funds.
- Fixed income and international funds have higher values of the (inverse) speed parameter.

<table>
<thead>
<tr>
<th></th>
<th>Price Discovery Component (D)</th>
<th>Std. Dev. Price Innovations (ε) (x100)</th>
<th>NAV Staleness Coefficient (φ)</th>
<th>Arbitrage Speed Parameter (ψ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.22</td>
<td>0.79</td>
<td>-0.22</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>(4.30)</td>
<td>(13.68)</td>
<td>(-5.42)</td>
<td>(2.23)</td>
</tr>
<tr>
<td>Log AUM</td>
<td>0.03</td>
<td>-0.09</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(3.32)</td>
<td>(-8.12)</td>
<td>(3.75)</td>
<td>(0.90)</td>
</tr>
<tr>
<td>Log Dollar ADV</td>
<td>0.02</td>
<td>0.03</td>
<td>-0.01</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td>(1.75)</td>
<td>(2.92)</td>
<td>(-1.50)</td>
<td>(-1.44)</td>
</tr>
<tr>
<td>Fixed Income indicator</td>
<td>-0.46</td>
<td>-0.14</td>
<td>0.40</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>(-21.48)</td>
<td>(-5.67)</td>
<td>(23.37)</td>
<td>(10.52)</td>
</tr>
<tr>
<td>International indicator</td>
<td>0.14</td>
<td>0.07</td>
<td>0.23</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>(8.34)</td>
<td>(3.90)</td>
<td>(16.85)</td>
<td>(6.83)</td>
</tr>
<tr>
<td><strong>Adjusted R-square</strong></td>
<td><strong>0.44</strong></td>
<td><strong>0.28</strong></td>
<td><strong>0.44</strong></td>
<td><strong>0.13</strong></td>
</tr>
</tbody>
</table>

**Source:** Bloomberg and BlackRock data, 1/1/2005-1/31/2014 based on 919 observations. Figures in parentheses are t-statistics.
This paper develops a model to analyze ETF price dynamics

- Estimate the model individually for 947 US-domiciled ETFs from 2005 to 2014 using a multivariate state-space representation.
- We recover for each fund an estimate of the speed with which unobserved pricing errors are corrected through the arbitrage mechanism.
- We also attribute the observed fund premium or discounts into price discovery and transitory liquidity components and examine how this varies across asset class, exposure, and fund size.
- The results show that arbitrage acts quickly to correct pricing errors for domestic equity funds, with a half-life of is 0.43 days versus 6.56 days for international fixed income funds.
- Observed premiums/discounts largely reflect price discovery, particularly for ETFs with constituents trading outside of US market trading hours.
- Similar results hold for fixed income funds in times of market stress.

ETF pricing dynamics are driven by arbitrage; understanding of this key mechanism can help practitioners better utilize these powerful tools for gaining a wide range of diversified exposures at low cost.
References


## Standardized Performance as of 3/31/2015

The performance quoted represents past performance of specific funds and does not guarantee future results for such funds. Investment return and principal value of an investment will fluctuate so that an investor’s shares, when sold or redeemed, may be worth more or less than the original cost. Current performance may be lower or higher than the performance quoted. Performance data current to the most recent month end may be obtained by visiting www.iShares.com or www.blackrock.com. Shares of iShares Funds are bought and sold at market price (not NAV) and are not individually redeemed from the Fund. Brokerage commissions will reduce returns. Market returns are based upon the midpoint of the bid/ask spread at 4:00 p.m. eastern time (when NAV is normally determined for most iShares Funds), and do not represent the returns you would receive if you traded shares at other times.

### Performance Table

<table>
<thead>
<tr>
<th>Fund Name</th>
<th>Fund Inception Date</th>
<th>Expense Ratio (as of 9/30/14)</th>
<th>30-Day SEC Yield (as of 9/30/14)</th>
<th>1-Year</th>
<th>5-Year</th>
<th>10-Year</th>
<th>Since Inception</th>
</tr>
</thead>
<tbody>
<tr>
<td>iShares iBoxx $ High Yield Corporate Bond ETF (HYG)</td>
<td>4/4/2007</td>
<td>0.50%</td>
<td>5.24%</td>
<td>1.41%</td>
<td>7.69%</td>
<td>--</td>
<td>6.12%</td>
</tr>
<tr>
<td>Fund NAV Total Return</td>
<td></td>
<td></td>
<td></td>
<td>1.17%</td>
<td>7.49%</td>
<td>--</td>
<td>6.05%</td>
</tr>
<tr>
<td>Fund Market Price Total Return</td>
<td></td>
<td></td>
<td></td>
<td>1.72%</td>
<td>7.90%</td>
<td>--</td>
<td>6.51%</td>
</tr>
<tr>
<td>Index Total Return</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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