ETFs & ETPs:
Toward a Better Ratings System…
… and ETF Underlying Liquidity

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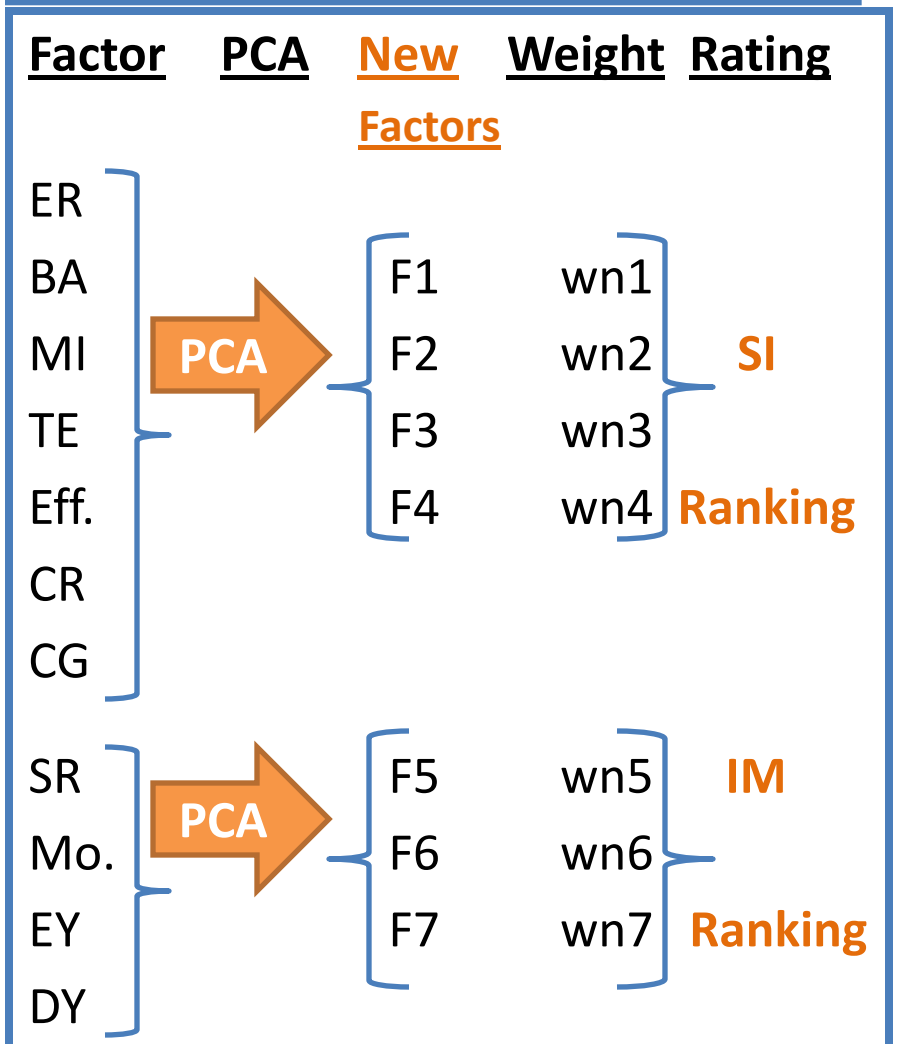
Ratings Methodology (Equity ETFs)

Current

Factor	Weight	Rating
Expense Ratio	w1	Structural Integrity Ranking
Bid Ask Ratio	w2	
Market Impact	w3	
Tracking Error	w4	
Efficiency	w5	
Concentration	w6	
Capital Gains	w7	
Sharpe Ratio	w8	Investment Metrics Ranking
Momentum	w9	
Earnings Yield	w10	
Dividend Yield	w11	

PCA Enhancement



What is (a) PCA?

Definition:

- Mathematical procedure that transforms a number of (possibly) correlated variables into a (smaller) number of independent variables called *principal components* that describe the data in the most informative manner and reduces noise.

Analogies:

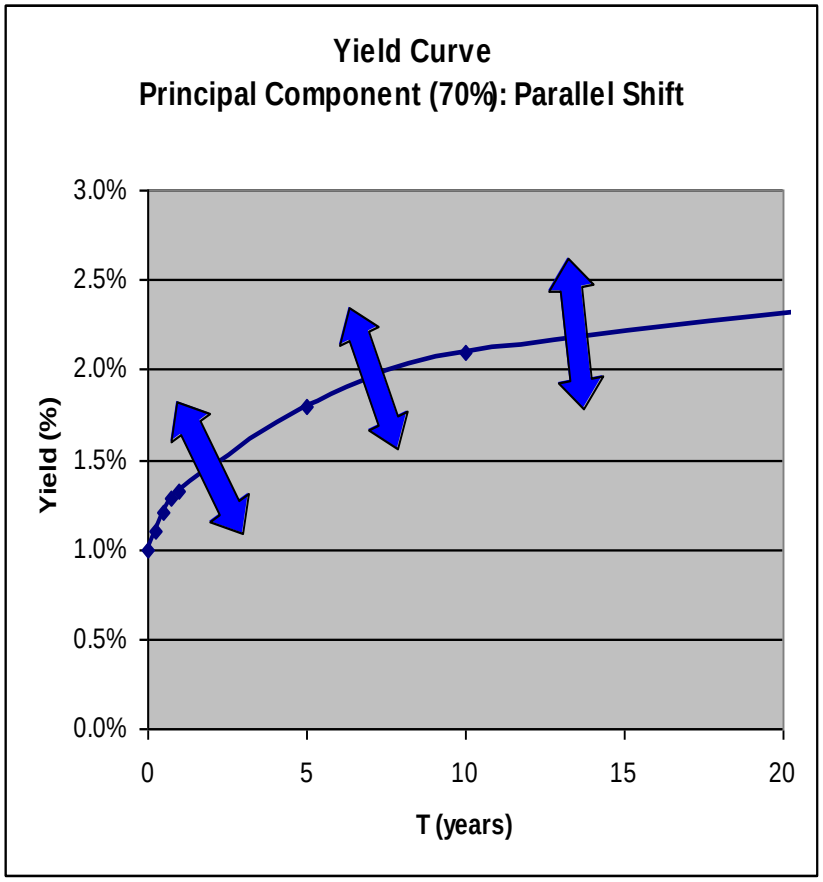
	Current Ratings	PCA-based Ratings	Comment
•	Regular TV	High Definition TV	**Clearer picture**
•	No Glasses	Glasses on	**Sharper focus**
•	Earth is center of solar system	Sun is center	**Persepective**

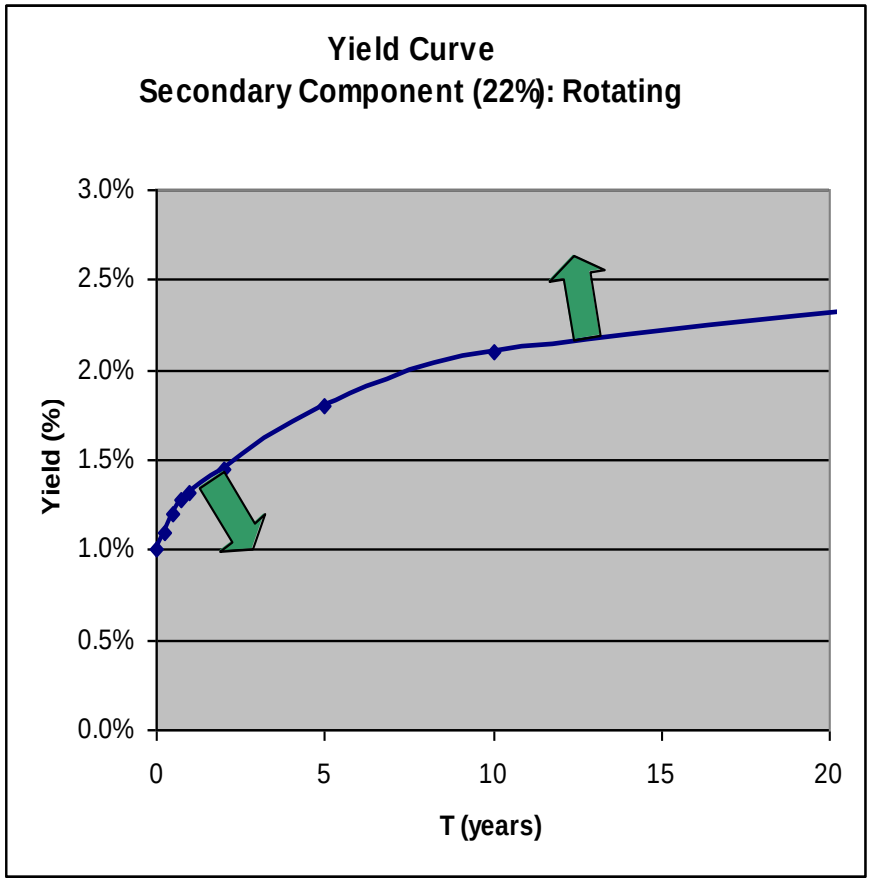
Where utilized:

- Many engineering and scientific applications
- Used extensively in Finance – especially in factor reduction of covariance matrices of security returns and yield curve modeling.

PCA in Finance

Yield Curve Modeling





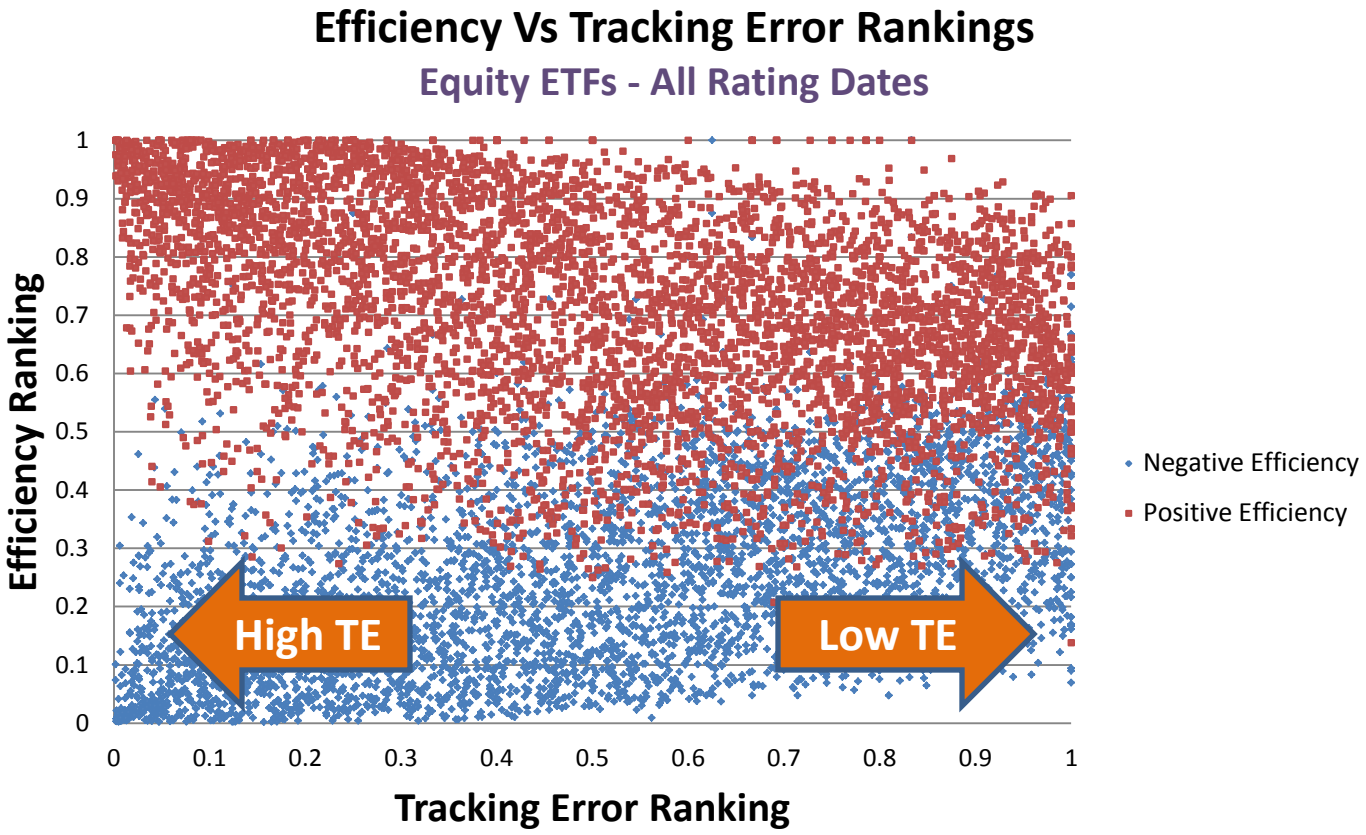
Objectives of PCA for XTF Ratings

Possible enhancement of current ratings methodology

- **Identify** the most **fundamental underlying variables**
- **Remove some bias** in our current ratings
- **Reduce noise** in our current ratings

→ **More accurate & robust ratings**

Behavior of Efficiency – Tracking Error Sector



Information Ratio

A possible modification:

- Use the **Information Ratio**

α = ETF Total Return – Index Total Return

$$XOR = \frac{Efficiency}{TrackingError} = \frac{avg(\alpha) + ER}{SDev(\alpha)}$$

- This would rate high efficiency and low tracking error in **tandem**
- **Analogous** to **Sharpe Ratio** (which we use in IM Rating):

$$SR = \frac{return}{volatility} = \frac{avg(return)}{SDev(return)}$$

Sample PCA analysis for

Investment Metrics Rating

Importance of components:

	Comp.1	Comp.2	Comp.3	Comp.4
Standard deviation	0.381	0.324	0.227	0.108
Proportion of Variance	**0.463**	**0.335**	**0.164**	**0.037**
Cumulative Proportion	0.463	0.798	0.963	1.000

← New weights for IM Rating

Transformation (Rotation) Matrix (i.e. Loadings)

	Comp.1	Comp.2	Comp.3	Comp.4
SR	-0.604	-0.408		0.678
Mom.	-0.603	-0.310		-0.733
EY	0.298	-0.654	-0.694	
DY	0.429	-0.556	0.710	

Transformation from Market Factors to Fundamental Factors

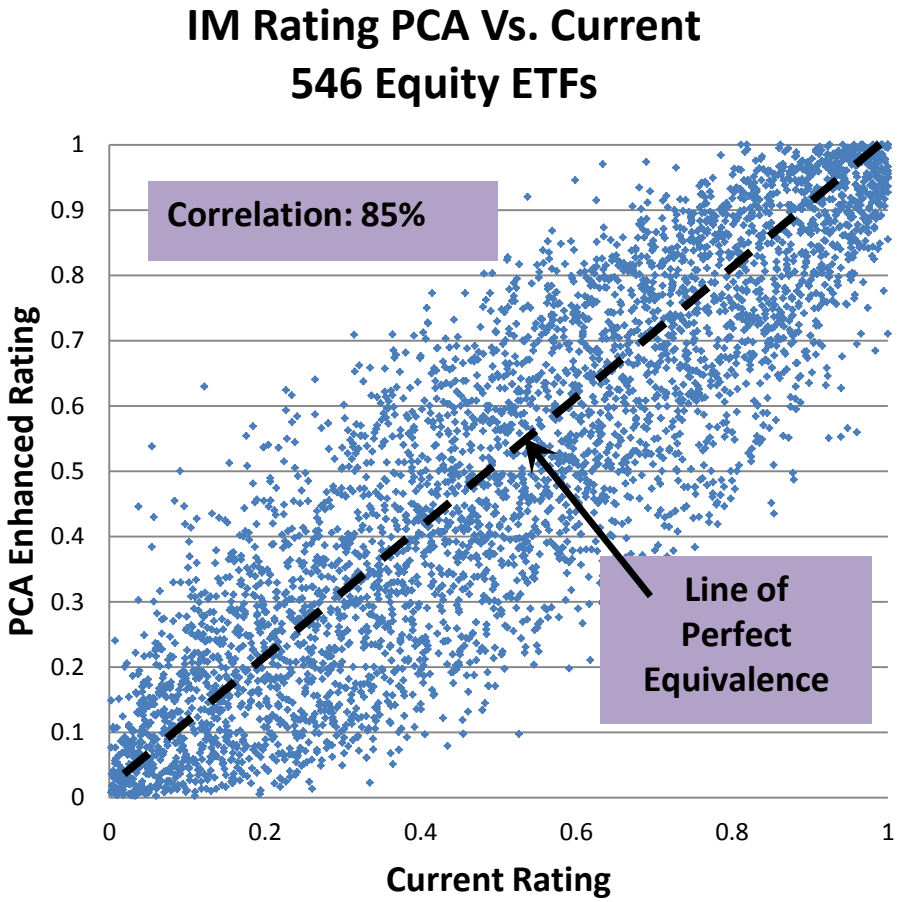
Covariance Matrix of New Components

← Shows the independence of new factors

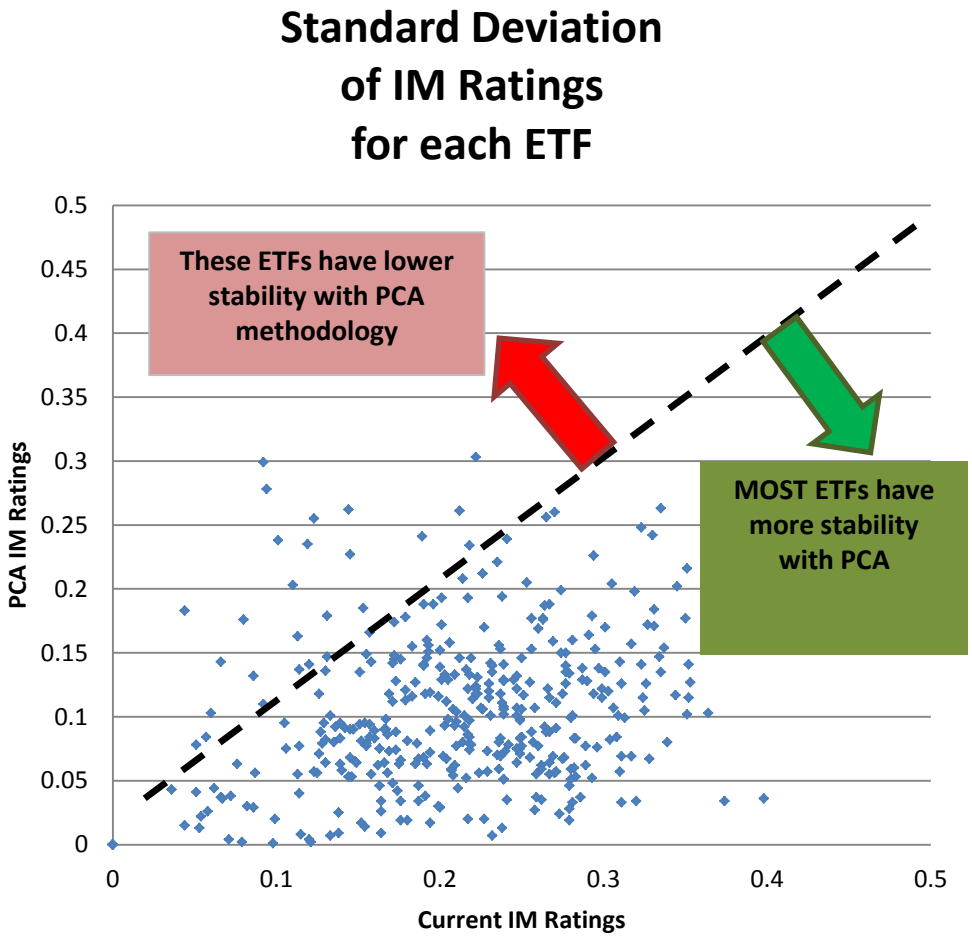
	Comp.1	Comp.2	Comp.3	Comp.4
Comp.1	**0.145**	0.000	0.000	0.000
Comp.2	0.000	**0.105**	0.000	0.000
Comp.3	0.000	0.000	**0.051**	0.000
Comp.4	0.000	0.000	0.000	**0.012**

PCA Vs. Current IM Ratings

Highly correlated but different



PCA can substantially reduce noise in the Ratings



Ratings Research Pipeline

- Rating methodology for the following:
  - Information Ratio
  - Leveraged & Short ETFs (separate peer group)
  - ETNs
  - Tracking error for international ETFs
  - Multi-asset ETFs
  - **Credit Risk factor for applicable ETFs & ETNs**
- Possibly eliminate ranking
- Follow through with PCA or …
- … Alternative Approach

ETF Underlying Liquidity

ETF Liquidity derived from the liquidity of the ETF's *equity* components

XTF Underlying Liquidity

- Two types:
  - Underlying Liquidity
    - Based on market impact: includes *volatility* not just volume
    - Determines the liquidity of the (single) least liquid component
    - Output is the maximum # ETF shares (or dollar value) that can be traded while minimizing slippage from the BAS
  - ETF/NAV Liquidity Ratio
    - Based on the liquidity of *all* components
    - Output is the ratio of the ETF market impact to that of the NAV

Underlying Liquidity

1. Calculate volatility, σ, average daily volume (ADV), V, for every component and use them to get the *Market Impact per ETF share, M*:

$$\mathbf{M = \sigma \sqrt{(X/V)}},$$

where X is the number of shares of the component in a *single share* of the ETF

2. Decide on some pre-determined threshold Market Impact that should not be crossed by any single component, Mt. For example: Mt < 3* Standard Deviations of the Bid Ask Spread (of component).

Underlying Liquidity

3. The component with the largest value of M/Mt is deemed the least liquid:

max[M/Mt]

4. The relationship between ETF shares and market impact is:

MI(N shares) = M (per share) √ N

5. Find the maximum number of ETF shares that can be traded such that M(least liquid) = Mt:

√ N(UL) = Mt/M

N(UL) = (Mt/M)^2

Caveats

- Like Implied Liquidity, UL has an arbitrary parameter, and I don’t like arbitrary parameters.
- Both methods assume a single component is far more important in terms of illiquidity than all the others, but that is often not true. You don’t always have liquidity outliers.
- Why not use all the components?

ETF/NAV Liquidity Ratio

- Calculate the dollar-valued market impact of each component:

$$\mathbf{M(component) = \sigma \sqrt{(X/V)} * P}$$

- The market impact of the ETF NAV is just the sum of these (dollar valued) market impacts.

$$\mathbf{M(NAV) = \Sigma M(component)}$$

- Can also calculate the market impact per share of the ETF:

$$\mathbf{M(ETF) = \sigma e \sqrt{(Xe/Ve)} * Pe,}$$

where all quantities are directly from the ETF.

ETF/NAV Liquidity Ratio

- ETF/NAV Liquidity Ratio is the ratio of the ETF and NAV market impacts:

  LR = M(NAV)/M(ETF),

  where a value greater than unity means the ETF is more liquid and a value less than unity means the basket is more liquid.

Examples (UL)

ETF	Description	Underlying Liquidity (shares)
SPY	SPDR S&P 500 ETF	34 M
IVV	iShares S&P 500	34M
PSCU	PowerShares S&P SmallCap Utilities Portfolio	0.3M
FGEM	EGShares Financials GEMS ETF	12.9 M

Examples (LR)

ETF	Description	ETF Market Impact	NAV Market Impact	ETF/NAV Liquidity Ratio
SPY	SPDR S&P 500 ETF	9.3E-05	1.2E-02	133.3
IVV	iShares S&P 500	5.6E-04	1.2E-02	22.2
PSCU	PowerShares S&P SmallCap Utilities Portfolio	3.7E-03	3.7E-03	1.0
FGEM	EGShares Financials GEMS ETF	1.6E-02	4.0E-04	0.03