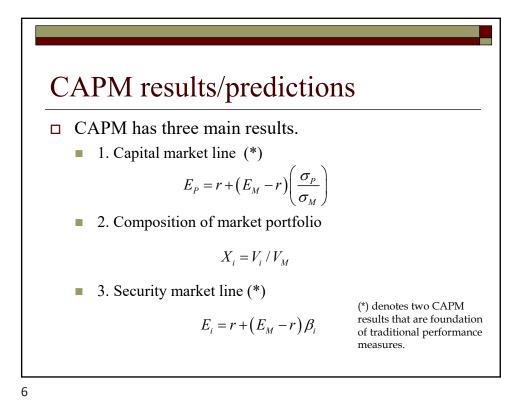
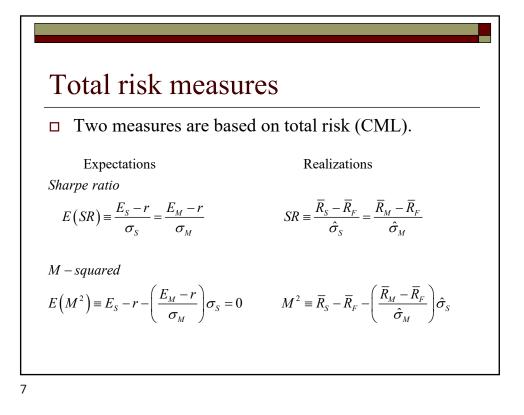
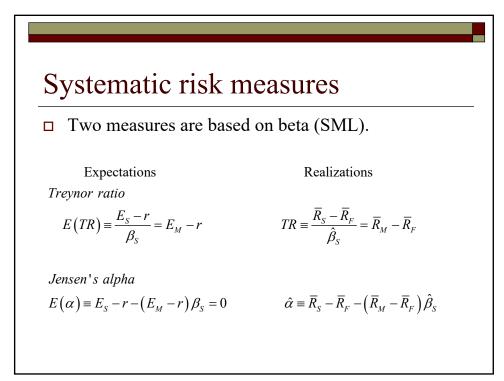




- □ Markowitz (*JF* 1952) assumed *n* risky assets.
- Tobin (*REST* 1958) showed link between diminishing positive marginal utility of wealth and risk averse indifference curves.
- Sharpe (JF 1964) and Lintner (REST 1965) added risk-free cash equivalents to set of securities in capital market.
 - Assumed individuals can borrow or lend at risk-free interest rate, *r*.





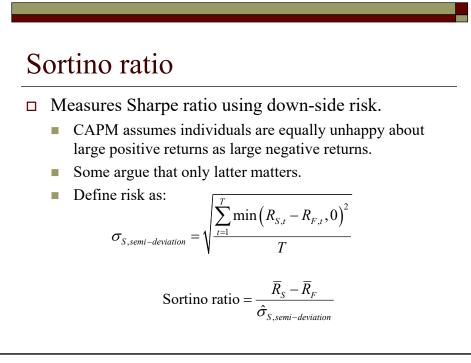


Appraisal ratio

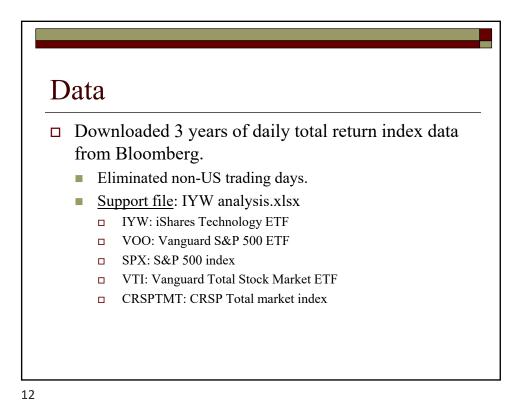
- Measures risk-adjusted reward from active management.
 - Jensen's alpha divided by residual risk (i.e., standard error of regression estimate).

$$4R = \frac{\hat{\alpha}}{\hat{\sigma}_{s}}$$

9

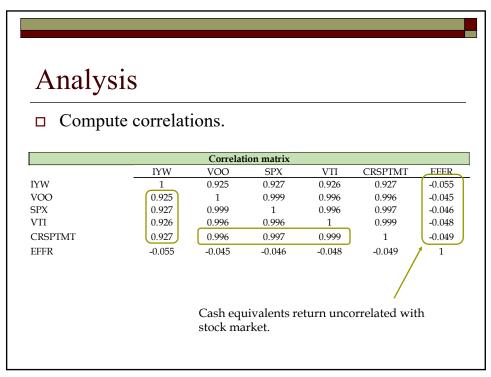


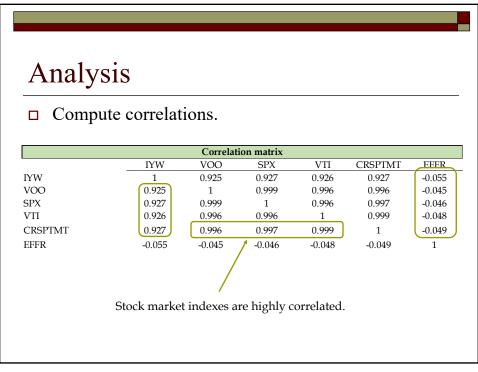


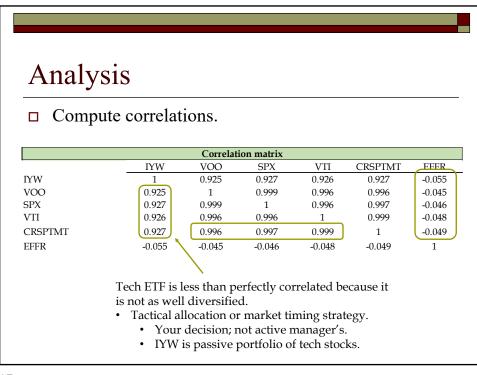


nalysis						
•	-					
Compute	summary	z statist	ics.			
	s ann nan j	Builde	1051			
		Return sum	2			
Description	IYW	VOO	SPX	VTI	CRSPTMT	EFFF
n	756	756	756	756	756	756
Mean (daily)	0.00035	0.00029	0.00029	0.00027	0.00027	0.0000
StDev (daily)	0.02080	0.01608	0.01611	0.01627	0.01645	0.0000
Skewness	-0.43874	-0.73061	-0.74355	-0.74483	-0.83969	3.4460
Autocorrelation	-0.18844	-0.20893	-0.21618	-0.18298	-0.19878	0.5798
Minimum	-0.14646	-0.12487	-0.12761	-0.12082	-0.13128	0.0000
Median	0.00138	0.00094	0.00094	0.00088	0.00085	0.0000
Maximum	0.10701	0.09109	0.08977	0.09066	0.09036	0.0004
Mean (annual)	8.79%	7.34%	7.36%	6.74%	6.76%	0.72%
StDev (annual)	33.02%	25.53%	25.57%	25.83%	26.12%	0.09%
CAGR	9.19%	7.62%	7.64%	6.97%	6.99%	0.72%
	30.17%	24.63%	24.72%	22.42%	22.46%	2.18%

Compute	summary	y statist	tics.			
		Return sum	mary statistic	25		
Description	IYW	VOO	SPX	VTI	CRSPTMT	EFFR
n	756	756	756	756	756	756
Mean (daily)	0.00035	0.00029	0.00029	0.00027	0.00027	0.0000
StDev (daily)	0.02080	0.01608	0.01611	0.01627	0.01645	0.0000
Skewness	-0.43874	-0.73061	-0.74355	-0.74483	-0.83969	3.4460
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CAGR	9.19%	7.62%	7.64%	6.97%	6.99%	0.72%
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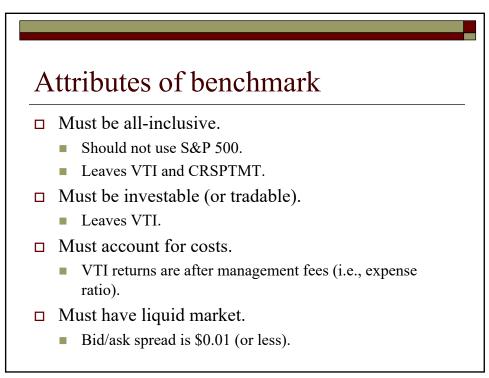


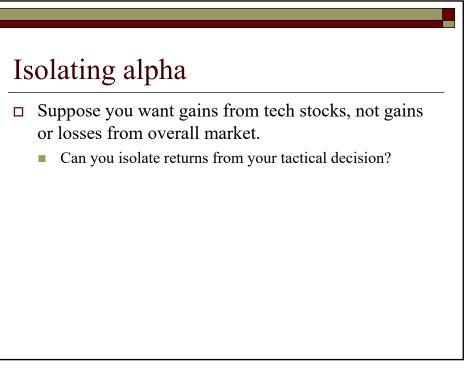
nalysis				
•				
Compute IYW per	forman	ce meas	ures	
			,ui 05.	
	isk-adjusted j			
Description	VOO	SPX	VTI	CRSPTMT
п	756	756	756	756
Sharpe ratio - portfolio	0.0154	0.0154	0.0154	0.0154
Sharpe ratio - market	0.0163	0.0164	0.0147	0.0146
M-squared	0.0000	• 0.0000	0.0000	0.0000
Treynor ratio - portfolio	0.0003	0.0003	0.0003	0.0003
Treynor ratio - market	0.0003	0.0003	0.0002	0.0002
Jensen's alpha	0.0000	0.0000	0.0000	0.0000
Appraisal ratio	0.0007	0.0006	0.0047	0.0051
Sortino ratio - portfolio	0.0211	0.0211	0.0211	0.0211
Sortino ratio - market	0.0221	0.0222	0.0198	0.0196
M-squared - CAGR	-0.49%	-0.51%	0.37%	0.44%
Jensen's alpha - CAGR	0.15%	0.12%	0.94%	1.00%
When bench	marked to t	radable S&I	9 500 (VOC) ETF) or

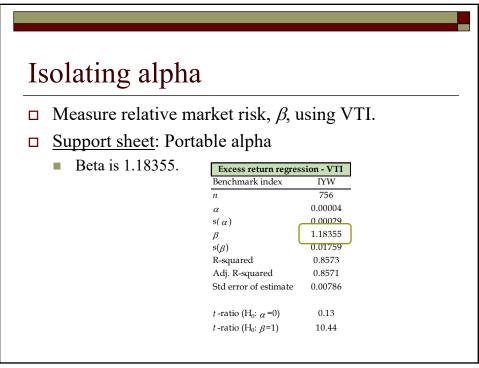
	ek-adjusted			
	sk-aujusieu	performance		
Description	VOÔ	SPX	VTI (CRSPTMT
n	756	756	756	756
Sharpe ratio - portfolio	0.0154	0.0154	0.0154	0.0154
Sharpe ratio - market	0.0163	0.0164	0.0147	0.0146
M-squared	0.0000	0.0000	0.0000	♦ 0.0000
Treynor ratio - portfolio	0.0003	0.0003	0.0003	0.0003
Treynor ratio - market	0.0003	0.0003	0.0002	0.0002
Jensen's alpha	0.0000	0.0000	0.0000	0.0000
Appraisal ratio	0.0007	0.0006	0.0047	0.0051
Sortino ratio - portfolio	0.0211	0.0211	0.0211	0.0211
				0.0211

alysis				
aryon				
compute IYW per	forman	e mea	lirec	
	IOIIIIaii		suics.	
R	isk-adjusted	performance		
Description	VOO	SPX	VTI	CRSPTMT
n	756	756	756	756
Sharpe ratio - portfolio	0.0154	0.0154	0.0154	0.0154
Sharpe ratio - market	0.0163	0.0164	0.0147	0.0146
M-squared	0.0000	0.0000	0.0000	0.0000
Treynor ratio - portfolio	0.0003	0.0003	0.0003	0.0003
Treynor ratio - market	0.0003	0.0003	0.0002	0.0002
Jensen's alpha	0.0000	0.0000	0.0000	0.0000
Appraisal ratio	0.0007	0.0006	0.0047	0.0051
Sortino ratio - portfolio	0.0211	0.0211	0.0211	0.0211
Sortino ratio - market	0.0221	0.0222	0.0198	0.0196
M-squared - CAGR	-0.49%	-0.51%	0.37%	0.44%
Jensen's alpha - CAGR	0.15%	0.12%	0.94%	1.00%

Analysis					
□ Compute I	YW per	forman	ce mea	asures.	
R	isk-adjusted	performance			Investors/managers
Description	VOO	SPX	VTI	CRSPTMT	want outperformance
n	756	756	756	756	expressed in
Sharpe ratio - portfolio	0.0154	0.0154	0.0154	0.0154	annualized return
Sharpe ratio - market	0.0163	0.0164	0.0147	0.0146	percentage.
M-squared	0.0000	0.0000	0.0000	0.0000	percentage.
Treynor ratio - portfolio	0.0003	0.0003	0.0003	0.0003	,
Treynor ratio - market	0.0003	0.0003	0.0002	0.0002	
Jensen's alpha	0.0000	0.0000	0.0000	0.0000	
Appraisal ratio	0.0007	0.0006	0.0047	0.0051	,
Sortino ratio - portfolio	0.0211	0.0211	0.0211	0.0211	
Sortino ratio - market	0.0221	0.0222	0.0198	0.0196	
M-squared - CAGR	-0.49%	-0.51%	0.37%	0.44%)
Jensen's alpha - CAGR	0.15%	0.12%	0.94%	1.00%	J



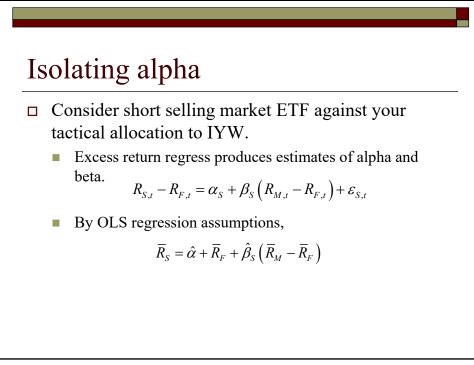


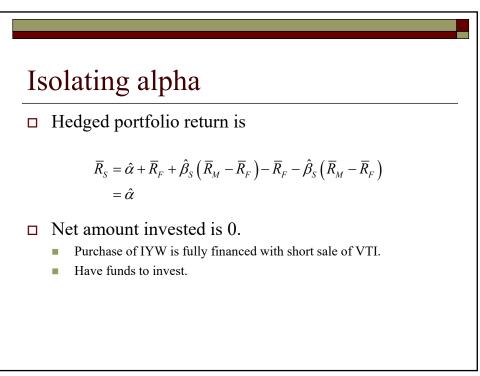


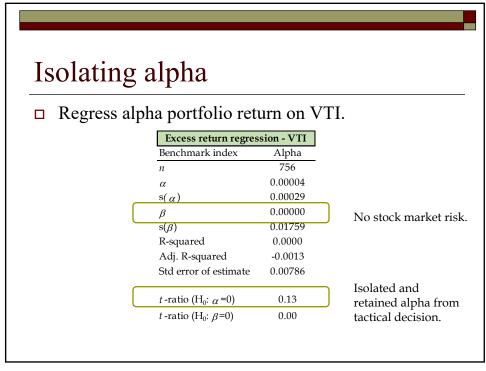
Isolating alpha

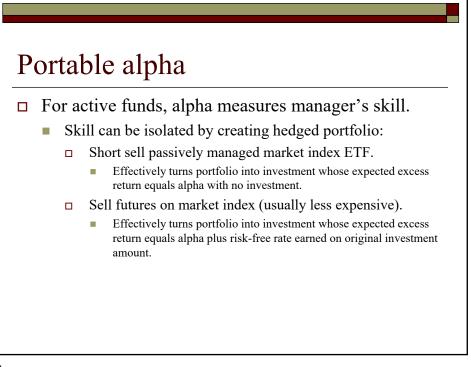
- □ Create hedged portfolio by short selling VTI.
 - Call it <u>alpha portfolio</u>.
 - Amount to short sell is 1.18355 VTI return.
 - Invest cash generated in cash equivalents.
 - Support sheet: Portable alpha

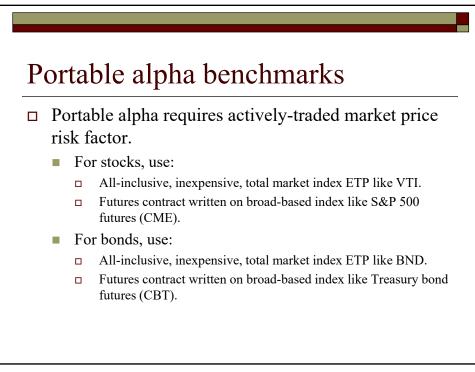
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- □ <u>Illustration</u>: Currently hold Pimco's BOND ETF.
 - Believe intermediate- and long-term interest rates are about to fall.
 - Want to immunize bond price risk exposure while maintaining Pimco's ability to generate positive alpha in BOND.
 - Support file: BOND.xlsx

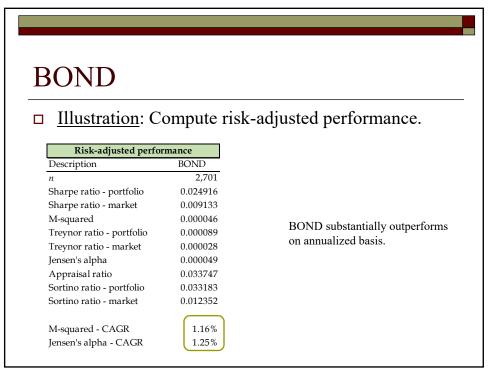
BOND					
□ <u>Illustrat</u>	ion: Cheo	k BO	ND's p	past re	turns.
	Summary s	atistics			
Description	BOND	BND	VTI	EFFR	
n	2,701	2,701	2,701	2,701	
Mean (daily)	0.000106	0.000062	0.000469	0.000034	
StDev (daily)	0.002887	0.003080	0.011199	0.000056	
Skewness	-1.8232	-1.5591	-0.8256	3.3457	
Autocorrelation	0.0474	0.0067	-0.1060	0.5120	
Minimum	-0.0428	-0.0559	-0.1208	0.0000	
Median	0.0003	0.0002	0.0007	0.0000	
Maximum	0.0198	0.0413	0.0907	0.0005	
Mean (annual)	2.68%	1.57%	11.81%	0.86%	BOND has substantially great
StDev (annual)	4.58%	4.89%	17.78%	0.09%	return and lower risk than BN
CAGR	2.71%	1.59%	12.53%	0.87%	
HPR	33.24%	18.36%	254.49%	9.70%	

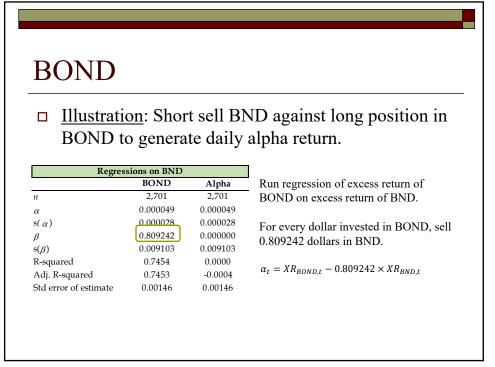
BOND

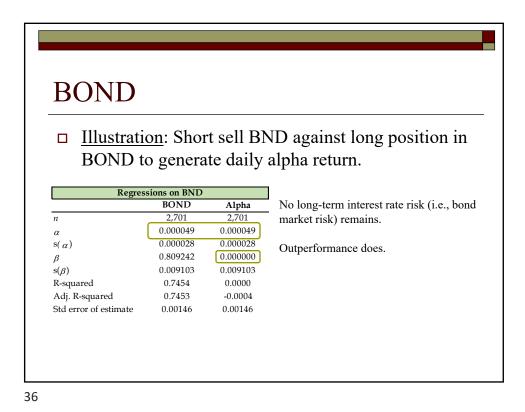
□ <u>Illustration</u>: Check BOND's correlations.

Correlation matrix								
	BOND	BND	VTI	EFFR				
BOND	1	0.863	0.104	-0.016				
BND	0.863	1	0.073	-0.024				
VTI	0.104	0.073	1	-0.036				
EFFR	-0.016	-0.024	-0.036	1				

Only way to earn abnormal return is to take on residual risk.







Portable alpha

- Alpha portfolio has no investment and no market risk but has abnormal return.
 - Alpha portfolio is called <u>alpha engine</u> in practice.
 - Term <u>portable</u> arises from fact that alpha engine can now be attached to another asset category.
 - Buy VTI with funds and will have abnormal stock market performance.
 - Why? Abnormal performance in high market cap stocks is unusual, and investment manager is rewarded on outperformance.

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