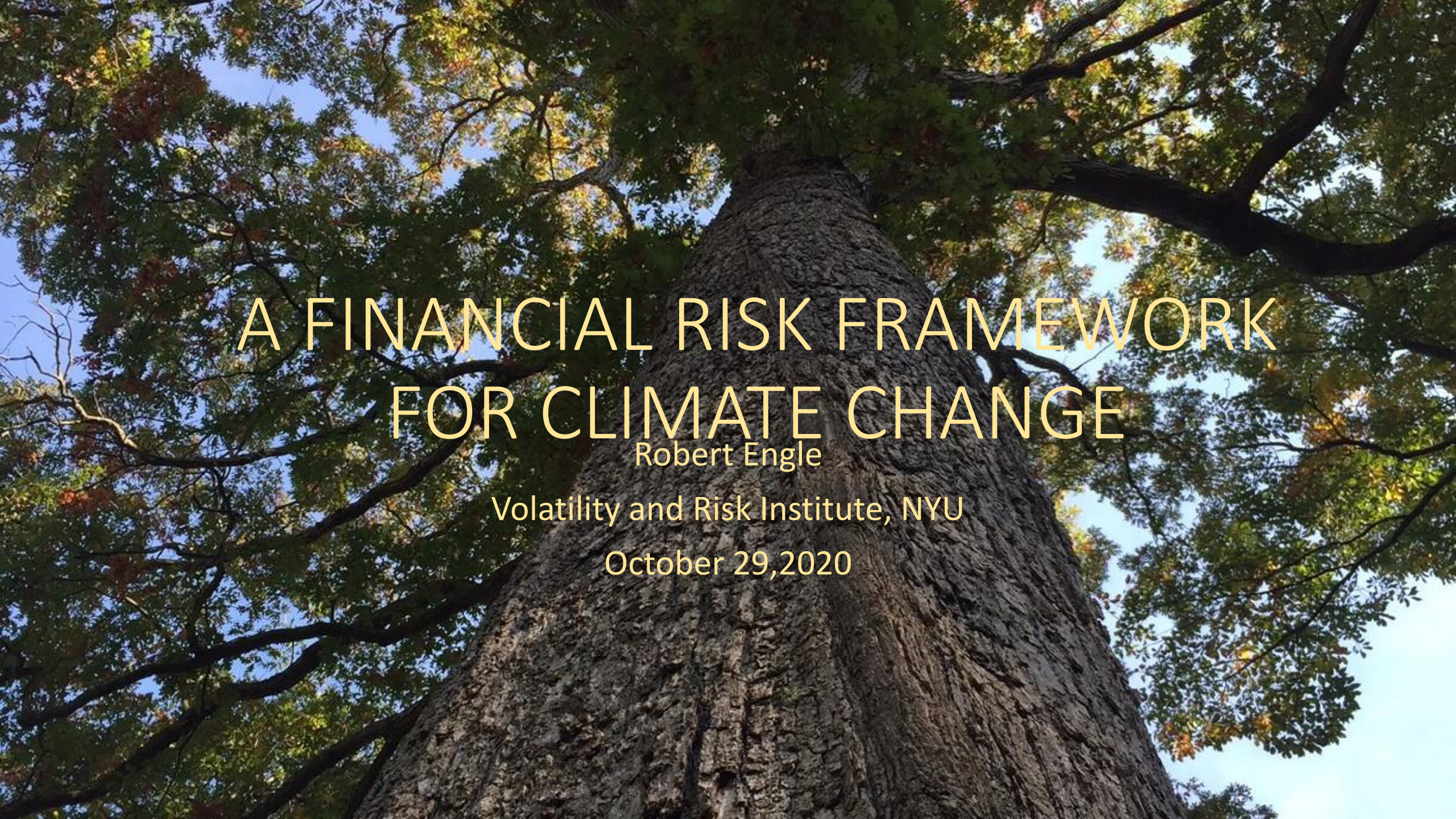

A FINANCIAL RISK FRAMEWORK FOR CLIMATE CHANGE

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October 29,2020

AFTER THE PANDEMIC IS OVER

- WE WILL STILL FACE CLIMATE CHANGE
- “THE PANDEMIC IS A DRESS REHERSAL FOR CLIMATE CHANGE”
- “IF YOU THINK THIS IS BAD, WAIT TILL YOU SEE GLOBAL WARMING!”

- WHAT CAN WE LEARN FROM THE PANDEMIC THAT WILL BE USEFUL IN CLIMATE CHANGE?
- BOTH ENTAIL MASSIVE SECTORAL SHIFTS. HOW SHOULD INVESTORS ORGANIZE THEIR PORTFOLIOS?
  - INVEST “SUSTAINABLY”
  - HEDGE CLIMATE RISKS


CLIMATE RISK

TWO CLIMATE RISKS

- Physical Risk
  - Damages due to warmer temperatures, rising sea level, droughts, floods and storms
- Transition Risk
  - Costs associated with the transition to a low carbon economy
  - Depend upon government policy including pricing, regulating and timing emissions.
- These risks sometimes reinforce each other and sometimes go in the opposite direction. For example, withdrawing from the Paris accord reduces transition risk but increases physical risk. And rejoining the Paris agreement increases transition risk and reduce physical risk. Scientific discoveries such as the fracturing of the Greenland ice sheet increase both risks.

CLIMATE RISK

- Individuals
  - Individuals face primarily physical risks. These are highly localized and it may explain why the electorate has not been united.
  - They are exposed to climate risk through investment risk and through the economy as a whole and job loss.
- Companies are exposed to both risks
  - Both risks affect the profitability of businesses
  - Consequently both risks affect the stock market valuation of companies
  - Understanding where these risks are greatest and how the market values them is complex.
- Climate Risk is Investment Risk

BROAD MARKET EFFECTS

- Risk is avoided by investors unless there is adequate compensation.
- Climate risk is a risk that investors should avoid unless it is adequately priced.
- Since climate risk affects the economy as a whole, it should reduce investment in the stock market.
- Policy that will reduce this risk should therefore result in a rise in the stock market.
- This theoretical prediction assumes that climate risk is already priced. However this is unclear.

STRATEGIES for INVESTORS

- INVEST "SUSTAINABLY"
  - ESG RATINGS ARE FOR
    - E IS ENVIRONMENT INCLUDING CLIMATE
    - S IS SOCIAL
    - G IS GOVERNANCE
  - DISCLOSURE IS CENTRAL – BUT WHAT DISCLOSURE?
- HEDGE CLIMATE RISK
  - Invest a portion of your portfolio in assets that will do especially well if the climate turns out to be especially bad
  - This means investing in companies prepared for climate change and/or shorting those that will suffer the most.
  - This will act as insurance and reduce the risk to consumption

Strategies-Hedging

- The theory of a hedge portfolio. A Markowitz investor will choose a portfolio with the highest expected return and a specific maximum volatility or equivalently, the lowest volatility for a specific minimum expected return.
- However, an investor may want to hold a portfolio that reduces her risk of a very bad outcome. Then she would overweight assets that do well in this bad state and underweight assets that do badly.
- For climate change this means holding companies that are well prepared for climate change and shorting ones that are not.

Strategies-Impact

- investors may seek to have an impact from their investments. This is often a company that is given sufficient capital to carry out some operation which has social or environmental benefits as well as financial.
- Impact investing is often done through direct investment.
- If it is done through purchase of equity then the net effect is to raise the price of the stock and thereby lower the cost of capital.
- Hedge investing and impact investing for climate change may be similar since in each case the investor would be long the companies that are preparing for climate change and short those who will lose from climate change.

ASSET PRICING AND CLIMATE PORTFOLIOS

- Climate risk is a pervasive factor that may be insufficiently priced and is not included in standard asset pricing models.
- Firms that are exposed to climate risk should be less desirable and therefore less expensive with higher expected returns.
- Investors willing to bear this risk can expect a risk premium
- Investors desiring to insure against this risk will short this portfolio and can expect a negative risk premium.
- The *alpha of a climate hedge portfolio would generally be negative*.

FINANCE OF CLIMATE RISK HEDGES

- If there is news that climate change will be more severe than the market expects,
- hedge portfolios will rise in value because both long and short positions appreciate.
- Ultimately, if the climate change is more severe than the market expects today, then the hedge portfolio will have an accumulation of positive returns leading to the hedge outperformance.
- Thus when there is little climate news, the negative risk premium should lead to negative alpha, but when there is news, the market will reprice assets and the portfolio should have positive alpha.

TESTING FOR CLIMATE PERFORMANCE: THE VOLATILITY LABORATORY

VLAB.STERN.NYU.EDU

EVALUATION OF PUBLIC CLIMATE PORTFOLIOS

- Return and Volatility
- Sharpe Ratio
- Alpha is the return realized in a portfolio above that achieved by a matched portfolio of standard risk factors.
- Risk adjusted returns are measured by Three factor Fama French Alpha, implemented with investible ETFs.
- Sample period: Trailing 1Y, 3Y, 5Y, Max, Exponential Weight

PORTFOLIOS

- SUSTAINABLE SECTOR
  - ALTERNATIVE ENERGY
    - WIND
    - SOLAR
    - NUCLEAR
  - WATER
  - WASTE
- MORNINGSTAR SELECTED FUNDS
  - FOSSIL FUEL FREE
  - LOW CARBON
  - LOW ENVIRONMENTAL RISK
  - SUSTAINABILITY MANDATE

BENCHMARK PORTFOLIOS

- EAFE
- S&P500
- SPY-XLE : A portfolios long SPY and short XLE an energy ETF
- Stranded Assets: Long SPY short 70% KOL, a coal ETF and short 30% XLE. This is an approximation to the stranded asset portfolio designed by Litterman for WWF.
  - This stranded asset portfolio we consider to be a transition risk factor because it appreciates as fossil fuel firms fall in value relative to the broad market.

5 YEAR BENCHMARK MEASURES

Benchmark	Return	Volatility	Sharpe Ratio
iShares MSCI ACWI ETF	9.04%	18.41%	0.47
SPDR S&P 500 ETF Trust	11.16%	19.00%	0.57
SPY:US - XLE:US	28.25%	21.41%	1.32
Stranded Assets	15.03%	16.51%	0.91

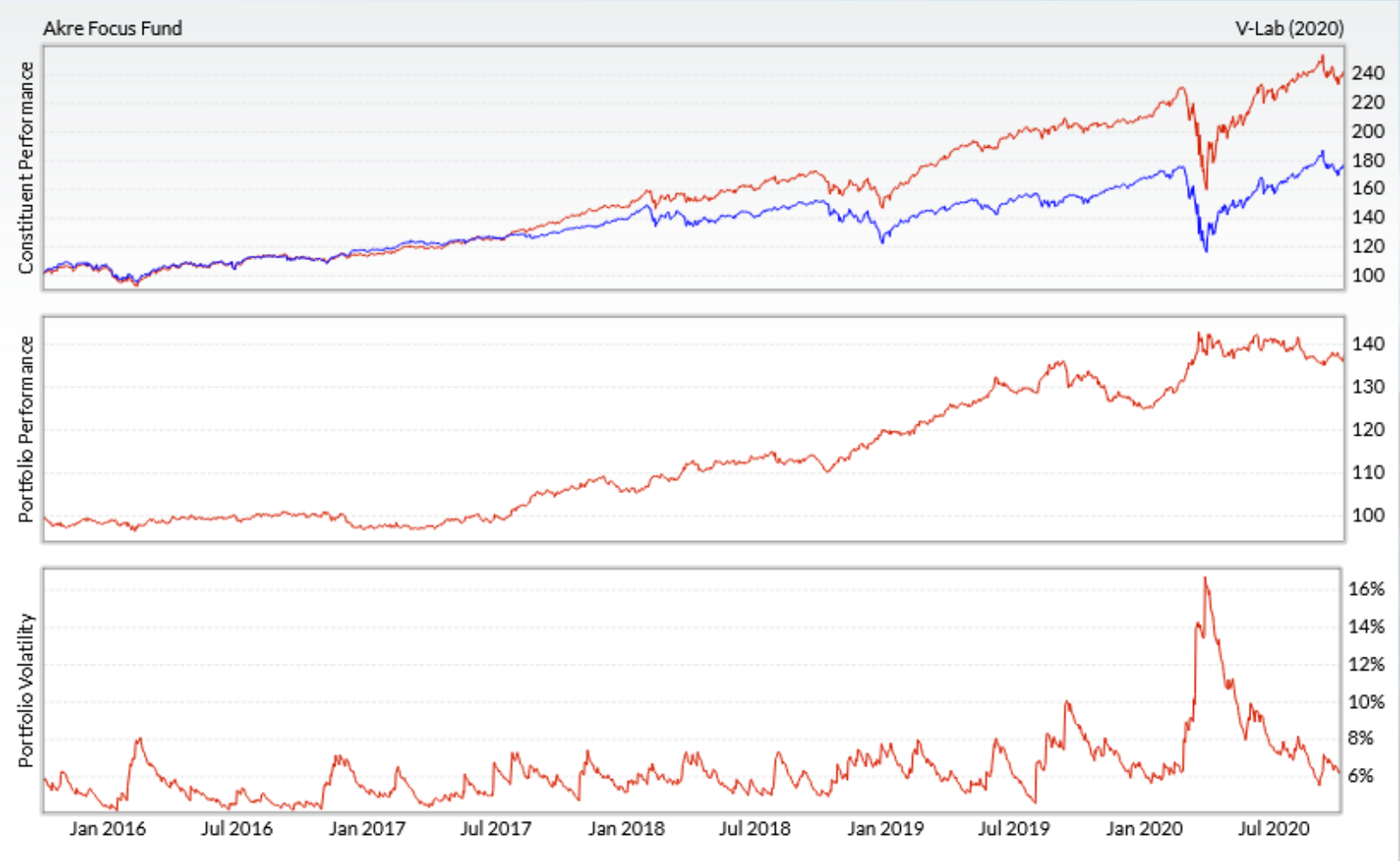
TOP 5 5 YEAR SHARPE RATIOS

Security	Return	Volatility	Sharpe Ratio
New Alternatives Fund Inc/Fund	18.18%	18.27%	0.98
First Trust NASDAQ Clean Edge Green Energy Index Fund	27.70%	28.44%	0.96
Brown Advisory Sustainable Growth Fund	19.58%	20.01%	0.96
Riverbridge Eco Leaders Fund	19.03%	20.00%	0.93
Akre Focus Fund	17.25%	18.51%	0.91

AKRE FOCUS FUND

Top Holdings	
American Tower Corp	11.57%
Mastercard Inc A	10.92%
Moody's Corporation	10.07%
Visa Inc Class A	7.38%
SBA Communications Corp	5.65%
O'Reilly Automotive Inc	4.71%
Constellation Software Inc	4.59%
CarMax Inc	4.56%
Roper Technologies Inc	4.31%
Adobe Inc	3.07%

PERFORMANCE OVER 5 YEARS



5y ALPHAS

Security	Return	Volatility	Sharpe Ratio	Correlation		↓ α	β
				Cos Sim	Tag Index		
Invesco WilderHill Clean Energy ETF	26.56%	30.42%	0.86	-0.003	0.078	11.35 (1.40)	1.17 (46.68)
First Trust NASDAQ Clean Edge Green Energy Index Fund	27.70%	28.44%	0.96	-0.011	0.077	10.95 (1.68)	1.13 (37.22)
New Alternatives Fund Inc/Fund	18.18%	18.27%	0.98	-0.033	0.027	10.40 (1.94)	0.73 (12.98)
First Trust Water ETF	17.63%	21.40%	0.81	-0.043	0.014	8.31 (2.79)	0.97 (54.15)
First Trust NASDAQ Clean Edge Smart Grid Infrastructure Index Fund	16.32%	25.47%	0.63	-0.018	0.074	6.97 (1.66)	0.98 (32.99)

ALPHA TABLE

- Notice how much better the recent performance is.
- Notice the one year benchmark Sharpe Ratios.

Benchmark	Return	Volatility	Sharpe Ratio
iShares MSCI ACWI ETF	8.37%	31.79%	0.26
SPDR S&P 500 ETF Trust	14.29%	33.03%	0.43
SPY:US - XLE:US	125.57%	36.98%	3.40
Stranded Assets	73.15%	21.52%	3.40

Alpha Table	1Y	3Y	5Y	EW	Max
All	5.02	1.65	0.51	2.54	-0.26
Fossil Fuel Free	9.50	3.62	1.87	4.42	0.28
Low Carbon	1.11	-0.06	-0.42	0.56	-0.09
Low Environmental Risk	-1.92	-0.03	0.02	-0.15	1.10
Sustainability Mandate	6.40	1.60	0.67	2.86	-0.52
Sustainable Sector	20.83	7.89	3.98	9.35	-1.70

PERFORMANCE OF V-LAB FUNDS
OCTOBER 31, 2019

Average FF Alpha by Window Length					
Category	1Y	3Y	5Y	EW	Max
Alternative Energy	14.65	-4.32	-10.89	-4.94	-20.00
Fossil Fuel Free	-7.63	-5.88	-6.59	-5.77	-4.77
High Environmental Score	-9.07	-7.58	-8.02	-7.27	-4.02
International Sustainable	-4.24	-4.72	-7.78	-5.55	-6.09
Low Carbon	-8.83	-6.66	-6.89	-6.27	-4.65

WHY ARE SUSTAINABLE FUNDS DOING WELL IN THE PANDEMIC?

- There is a close similarity between the effects of climate change and the effects of COVID-19.
- *Transition risk is occurring*. We saw an upward shift in the supply of fossil fuels from Russia and Saudi competition. At the same time we saw a downward shift in the demand for fossil fuels as the world sheltered at home. This impacted not only energy producers but upstream and downstream supply chains.
- Look at airlines, entertainment, retail, tourism. These all are impacted by transition risk even though most do not have high ESG risk scores.
- And look at the winners - technology.
- And in addition *physical risk* also appears to be rising.

CLIMATE NEWS

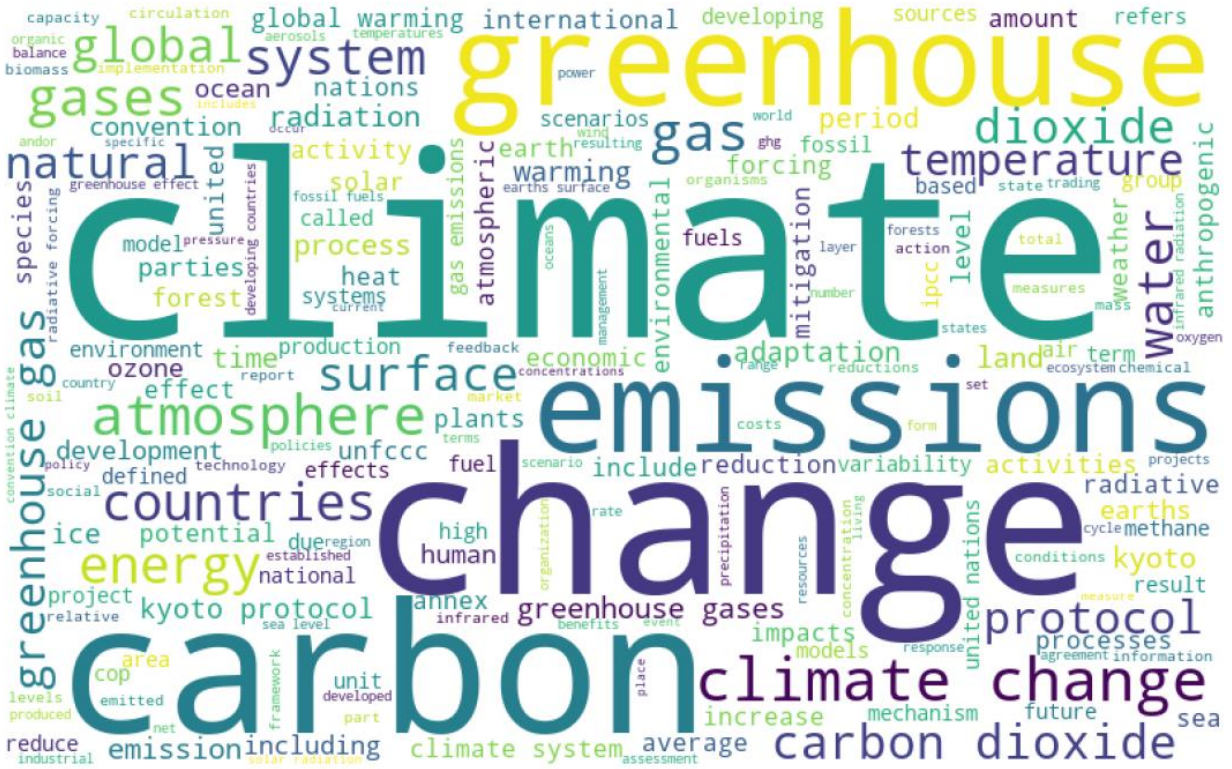
- The value of a climate hedge portfolio will change when there is news about future climate risks.
- Suppose we learn that climate change is happening faster than expected. This should make long positions in a climate hedge increase in value and short positions fall in value leading to appreciation of the portfolio.
- This appreciation should be reflected in the alpha.
- If the market view on climate change is that it is unimportant, then any news will make expectations more pessimistic and lead to appreciation of hedge portfolios.

Climate News Performance

- A tool for validating a climate hedge portfolio is to see whether it responds positively to climate news.
- In V-LAB we have two climate news measures from the NY Times. One is simply a count of articles which are classified as about either *global warming* or *climate change.*
- A more sophisticated measure using natural language processing tools measures the word frequency in the newspaper and compares it with word frequency in climate references.
- This is called cosine similarity.
- These are measured weekly and updated every day.

1. What News?

WSJ CC Index - Climate Change Vocabulary



Construct Climate Change Vocabulary from authoritative texts

- 19 climate change white papers on from the IPCC, EPA, USGCRP
- 55 climate change glossaries (UN, BBC, IPCC, NASA, EPA, etc.)

TOP 10 1Y CORRELATION WITH CCTAG

Security	Return	Volatility	Sharpe Ratio	Correlation		α	β
				Cos Sim	↓ Tag Index		
Invesco Solar ETF	139.05%	51.36%	2.70	0.031	0.195	53.90 (1.65)	1.17 (32.09)
Guinness Atkinson Funds - Alternative Energy Fund	61.30%	35.43%	1.73	0.011	0.176	36.45 (3.03)	0.88 (40.32)
Touchstone International ESG Equity Fund	11.18%	27.52%	0.40	0.009	0.166	-1.17 (-0.12)	0.74 (50.28)
Firsthand Alternative Energy Fund	76.14%	43.24%	1.76	-0.021	0.146	37.36 (2.23)	1.04 (48.45)
Tortoise Energy Evolution Fund	-12.80%	40.94%	-0.32	0.008	0.146	-16.15 (-1.27)	1.03 (17.78)
Amplify Advanced Battery Metals and Materials ETF	9.01%	40.18%	0.22	0.155	0.145	-1.84 (-0.08)	0.92 (31.27)
Invesco Cleantech ETF	40.35%	36.66%	1.10	0.019	0.143	20.46 (3.26)	0.94 (55.62)
UBS Engage for Impact Fund	10.82%	29.41%	0.36	0.028	0.141	1.67 (0.25)	0.80 (88.25)
iShares Global Clean Energy ETF	82.61%	41.71%	1.98	-0.014	0.140	40.69 (2.05)	1.02 (35.29)
Essex Environmental Opportunities Fund	30.03%	35.40%	0.84	0.066	0.139	12.91 (1.35)	0.89 (62.59)


Constructing climate hedge portfolios

CONSTRUCTING CLIMATE HEDGE PORTFOLIOS

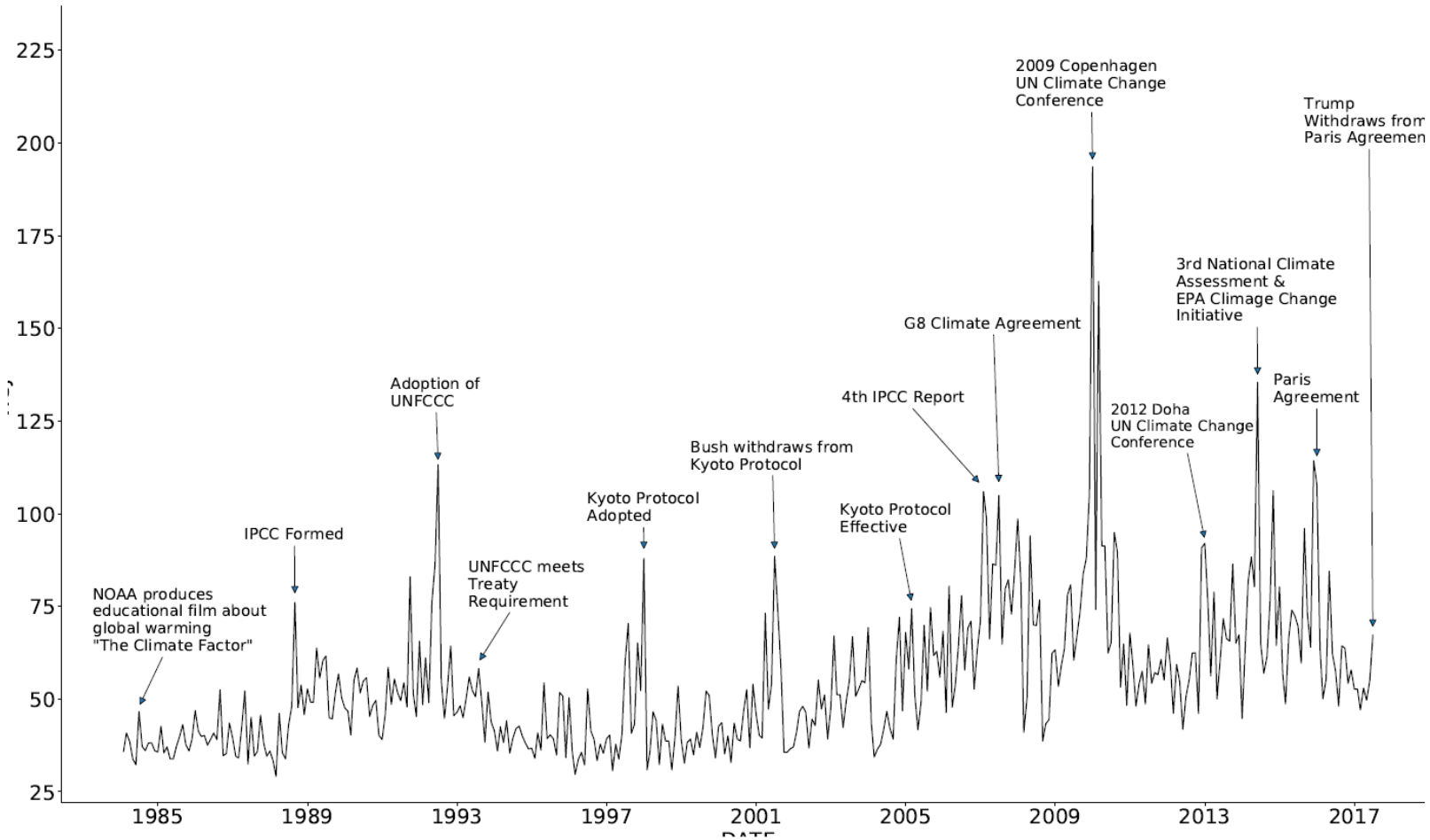
- Find a portfolio that will outperform when climate turns out to be worse than expected and will underperform otherwise. This portfolio provides insurance and smooths consumption.
- To construct such a portfolio you need to know what business models will look like many years in the future.
- Data for such stock selection is typically from ESG measures. But how do you use these data?
- Ideally, disclosure would report climate winners and losers but it does not do this.

DYNAMIC CLIMATE HEDGE PORTFOLIOS

- Instead treat this as a dynamic problem. Hold a portfolio that is long stocks that rise with climate news and short stocks that fall on climate news.
- Adjust this portfolio over time.

HOW TO BUILD A HEDGE PORTFOLIO

- Engle, Giglio, Kelly, Lee, and Stroebel(2019) seek portfolios that are long stocks that go up when there is bad climate news, and short stocks that go down on this news.
- They use textual analysis from the Wall Street Journal, and observe that long short portfolios with weights based on high E scores respond positively to bad climate news.



This is a *level* measure. Climate change news shocks are AR(1) *innovations* to monthly index

Results

Full-Sample Regression : WSJ Climate Change News Index

	(1)	(2)	(3)	(4)	(5)
$Z_{t-1}^{SUS\_A\prime} r_t$	1.416***				
	(0.436)				
$Z_{t-1}^{SUS\_R\prime} r_t$		67.789***			
		(17.834)			
$Z_{t-1}^{MSCI\_A\prime} r_t$			12.658*		
			(6.849)		
$Z_{t-1}^{MSCI\_R\prime} r_t$				53.743*	
				(27.401)	
r_t^{XLE}					0.085
					(0.810)
r_t^{PBD}					0.208
					(0.630)
$Z_{t-1}^{HML\prime} r_t$	1.221	2.309	-5.862	-5.941	-6.772
	(7.019)	(6.873)	(6.878)	(6.858)	(8.093)
$Z_{t-1}^{SIZE\prime} r_t$	-5.680**	-6.034**	-5.511*	-5.459**	-2.765
	(2.350)	(2.289)	(2.773)	(2.696)	(2.474)
$Z_{t-1}^{MKT\prime} r_t$	0.783	0.789	0.841	0.789	0.091
	(0.642)	(0.628)	(0.692)	(0.680)	(1.285)
Constant	2.894	2.673	4.659*	4.891*	5.959**
	(2.681)	(2.613)	(2.700)	(2.669)	(2.897)
R-Squared	0.153	0.187	0.083	0.088	0.047
N	88	88	88	88	88

- Portfolios based on the Sustainaltyics E-Scores hedge 19% of the in-sample variation in climate news
- Outperforms hedges based on XLE and PBD


Factor mimicking portfolio
coming soon to v-lab

WHAT IS THE BEST WAY TO USE ESG?

- There are many vendors of ESG data
- There are many ways to incorporate these data into portfolio construction.
- Some portfolios are passive and some are active

- Is there one optimal answer or does it change over time?

DYNAMIC LONG ONLY INVESTIBLE PORTFOLIO

- Factor Mimicking Portfolio is a long only weighted average of the Morningstar candidate funds. It is designed to have highest future beta on climate news. These all have some ESG input but use different vendors and may use it differently.
- Regress fund returns on factors and news over a short period.
- Form portfolios going forward from the estimated weights on the news.
- This portfolio is considered to be a factor mimicking portfolio of the climate news. When we include stranded assets as a factor, then this portfolio might be called a physical risk portfolio. Naming factors is perilous.
- Here is what it does.

AVERAGE PERFORMANCE OF CLIMATE MIMICKING PORTFOLIOS: *ALPHA*

4.3%/YEAR

Dependent Variable: CCPHYSRISK
Method: Least Squares
Date: 10/08/20 Time: 13:24
Sample (adjusted): 10/04/2000 7/17/2020
Included observations: 4977 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017256	0.005496	3.139601	0.0017
CCSA	-0.061895	0.004393	-14.09099	0.0000
MKTFACTOR	0.873606	0.004688	186.3456	0.0000
HMLFACTOR	-0.008840	0.005060	-1.747062	0.0807
SMBFACTOR	0.055658	0.004485	12.40903	0.0000
ROIL	0.101623	0.174190	0.583402	0.5596

10.6%/YEAR

Dependent Variable: CCSA
Method: Least Squares
Date: 10/08/20 Time: 13:26
Sample (adjusted): 10/04/2000 7/17/2020
Included observations: 4977 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.041946	0.017410	2.409340	0.0160
CCPHYSRISK	-0.620548	0.044039	-14.09099	0.0000
MKTFACTOR	0.422221	0.041518	10.16961	0.0000
HMLFACTOR	-0.230647	0.015689	-14.70109	0.0000
SMBFACTOR	-0.083246	0.014372	-5.792230	0.0000
ROIL	-11.84410	0.525365	-22.54453	0.0000

TOP 20 BETAs ON PHYSICAL RISK INDEX 7/17/20

	TODAYBETACS	TODAYBETASA	TICKER	NAME
155	1.682114	-0.131293	TAN	Invesco Solar ETF
118	1.660162	-0.011282	PBW	Invesco WilderHill Clean Energy ETF
32	1.543286	0.079959	CNRG	SPDR S&P Kensho Clean Power ETF
133	1.528115	0.001116	QCLN	First Trust NASDAQ Clean Edge Green Energy Index Fund
1	1.449529	0.010295	ACES	ALPS Clean Energy ETF
79	1.326589	-0.080679	ICLN	iShares Global Clean Energy ETF
90	1.324268	-0.196442	KGRN	KraneShares MSCI China Environment Index ETF
93	1.320024	-0.036124	LIT	Global X Lithium & Battery Tech ETF
4	1.159667	0.010143	ALTEX	Firsthand Alternative Energy Fund
117	1.115372	0.029128	PBD	Invesco Global Clean Energy ETF
63	0.974408	-0.113688	GAAEX	Guinness Atkinson Funds - Alternative Energy Fund
145	0.938130	-0.217991	SMOG	VanEck Vectors Low Carbon Energy ETF
105	0.921943	0.155391	NALFX	New Alternatives Fund Inc/Fund
74	0.921870	-0.294215	GRN	iPath Series B Carbon ETN
58	0.842031	0.041837	FAN	First Trust Global Wind Energy ETF
73	0.825219	0.040991	GRID	First Trust NASDAQ Clean Edge Smart Grid Infrastructure ...
179	0.785717	1.91E-05	YLCO	Global X YieldCo & Renewable Energy Income ETF
26	0.767386	-0.044905	CGAEX	Calvert Global Energy Solutions Fund

NAME	AUM	FOSSIL_...	LOW_CAR...	LOW_ENVI...	SUSTAINA...
Invesco Solar ETF	632.4173	1	0	0	1
Invesco WilderHill Clean Energy ETF	362.4491	1	0	0	1
SPDR S&P Kensho Clean Power ETF	28.92334	0	0	0	1
First Trust NASDAQ Clean Edge Green Energy Index Fund	244.8871	1	0	0	1
ALPS Clean Energy ETF	208.8967	0	0	0	1
iShares Global Clean Energy ETF	721.3380	0	0	0	1
KraneShares MSCI China Environment Index ETF	2.149805	1	0	0	0
Global X Lithium & Battery Tech ETF	570.1308	0	0	0	0
Firsthand Alternative Energy Fund	5.732673	1	0	0	1
Invesco Global Clean Energy ETF	66.87033	0	0	0	1
Guinness Atkinson Funds - Alternative Energy Fund	9.592359	0	0	0	1
VanEck Vectors Low Carbon Energy ETF	112.9877	0	0	0	1
New Alternatives Fund Inc/Fund	252.1433	0	0	0	1
iPath Series B Carbon ETN	5.517603	0	0	0	0
First Trust Global Wind Energy ETF	104.6288	0	0	0	1
First Trust NASDAQ Clean Edge Smart Grid Infrastructure ...	38.35152	0	0	0	1
Global X YieldCo & Renewable Energy Income ETF	48.34107	0	0	0	0
Calvert Global Energy Solutions Fund	91.31897	0	0	0	1

BETA ON PHYSICAL RISK OF TAN

TOP 20 BETA ON TRANSITION RISK ON 7/17/20

	TODAYBETACS	TODAYBETASA	TICKER	NAME
85	0.434524	0.360187	JHJAX	John Hancock ESG Large Cap Core Fund
86	0.478373	0.354849	JHKRX	John Hancock ESG All Cap Core Fund
120	0.378306	0.340480	PHO	Invesco Water Resources ETF
46	0.510964	0.315551	ECLN	First Trust EIP Carbon Impact ETF
28	0.458368	0.269912	CGW	Invesco S&P Global Water Index ETF
168	0.600777	0.265119	VGSRX	Vert Global Sustainable Real Estate Fund
59	0.396260	0.243548	FIW	First Trust Water ETF
12	0.368761	0.237481	AWTPX	AllianzGI Water Fund
156	0.590034	0.234466	TBLU	Tortoise Global Water ESG Fund
107	0.448596	0.221443	NLR	VanEck Vectors Uranium+Nuclear Energy ETF
165	0.284571	0.191276	VDIGX	Vanguard Dividend Growth Fund
57	0.573854	0.186833	EVX	VanEck Vectors Environmental Services ETF
166	0.288678	0.185619	VEGN	US Vegan Climate ETF
173	0.374128	0.180852	WAMFX	Walden Midcap Fund
55	0.448142	0.179285	ETIDX	Eventide Dividend Opportunities Fund
83	0.279053	0.178249	JENSX	Jensen Quality Growth Fund
34	0.321230	0.174750	CSIEX	Calvert Equity Fund
139	0.247211	0.172217	RIVEX	Riverbridge Eco Leaders Fund

NAME	AUM	FOSSIL_...	LOW_CAR...	LOW_ENVI...	SUSTAINA...
John Hancock ESG Large Cap Core Fund	61.13836	0	1	0	0
John Hancock ESG All Cap Core Fund	26.93153	0	1	0	0
Invesco Water Resources ETF	1017.287	1	0	0	0
First Trust EIP Carbon Impact ETF	1.956213	0	0	0	1
Invesco S&P Global Water Index ETF	639.1921	0	0	0	0
Vert Global Sustainable Real Estate Fund	50.52038	1	0	0	1
First Trust Water ETF	490.0866	0	0	0	1
AllianzGI Water Fund	629.6311	0	1	0	0
Tortoise Global Water ESG Fund	15.52167	1	0	0	1
VanEck Vectors Uranium+Nuclear Energy ETF	17.69673	0	0	0	1
Vanguard Dividend Growth Fund	40270.60	1	1	0	0
VanEck Vectors Environmental Services ETF	32.56572	1	0	0	1
US Vegan Climate ETF	20.57078	0	0	0	1
Walden Midcap Fund	65.30780	0	1	0	0
Eventide Dividend Opportunities Fund	67.51418	0	1	0	0
Jensen Quality Growth Fund	8851.060	1	0	1	0
Calvert Equity Fund	4661.550	1	1	0	0
Riverbridge Eco Leaders Fund	9.433939	1	1	0	0

BETA ON JHJAX

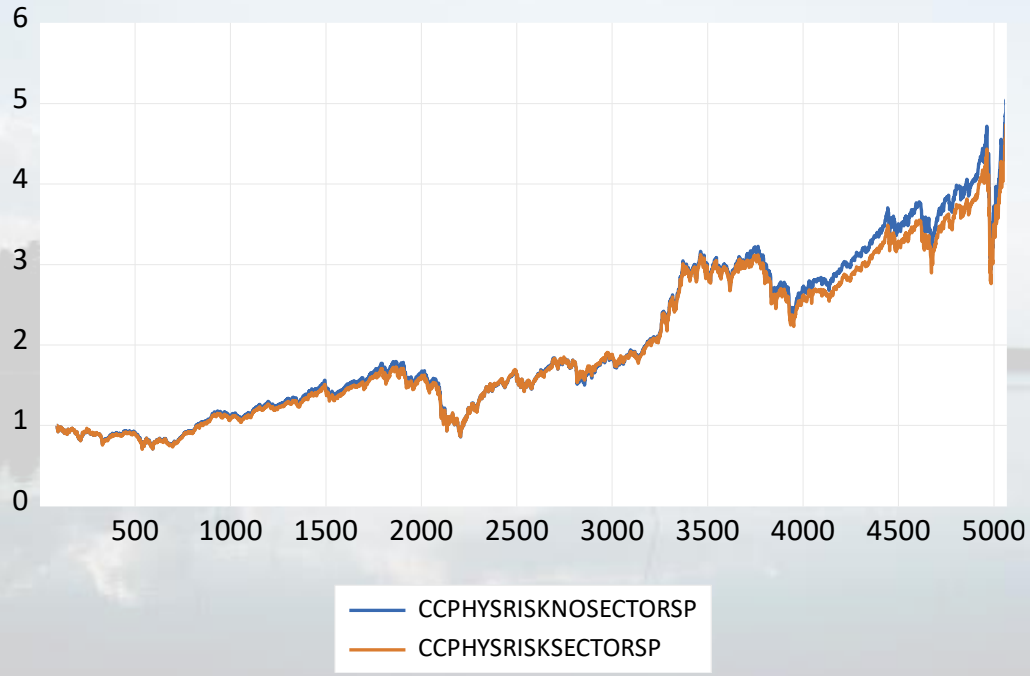
VALIDATION OF PHYSICAL RISK

Dependent Variable: CCPHYSRISK
Method: Least Squares
Date: 10/08/20 Time: 13:13
Sample (adjusted): 10/04/2000 7/16/2020
Included observations: 4976 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CCCS	0.056829	0.018440	3.081815	0.0021
CCSA	-0.061915	0.004391	-14.10092	0.0000
MKTFACTOR	0.873631	0.004686	186.4233	0.0000
HMLFACTOR	-0.008661	0.005058	-1.712246	0.0869
SMBFACTOR	0.055649	0.004484	12.41171	0.0000
ROIL	0.101216	0.174124	0.581288	0.5611

R-squared	0.895463	Mean dependent var	0.032615

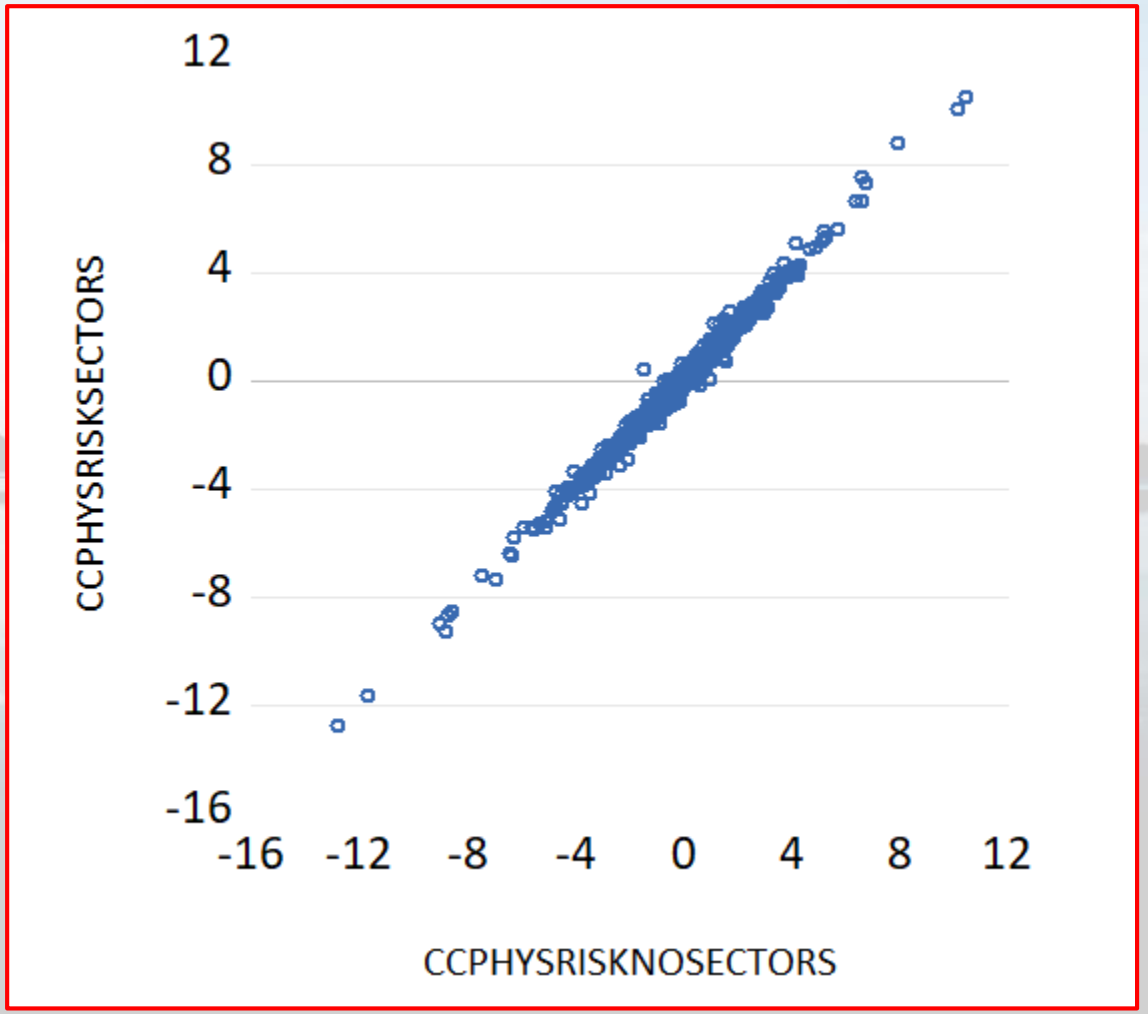
PLACEBO CHECK - ADDING 9 SECTOR ETFs DOES FACTOR MIMICKING PORTFOLIO CHANGE?



	CCPHYSRISKNOSECTORS	CCPHYSRISKSECTORS
Mean	0.032461	0.031212
Median	0.081836	0.077167
Maximum	10.48852	10.48852
Minimum	-12.74262	-12.74262
Std. Dev.	1.201449	1.208779
Skewness	-0.668986	-0.624372
Kurtosis	15.18989	15.43322
Jarque-Bera	31185.78	32380.44
Probability	0.000000	0.000000
Sum	161.5564	155.3443
Sum Sq. Dev.	7182.753	7270.666
Observations	4977	4977

COMPARING WITH PLACEBO SECTORS

CORRELATION = .9959



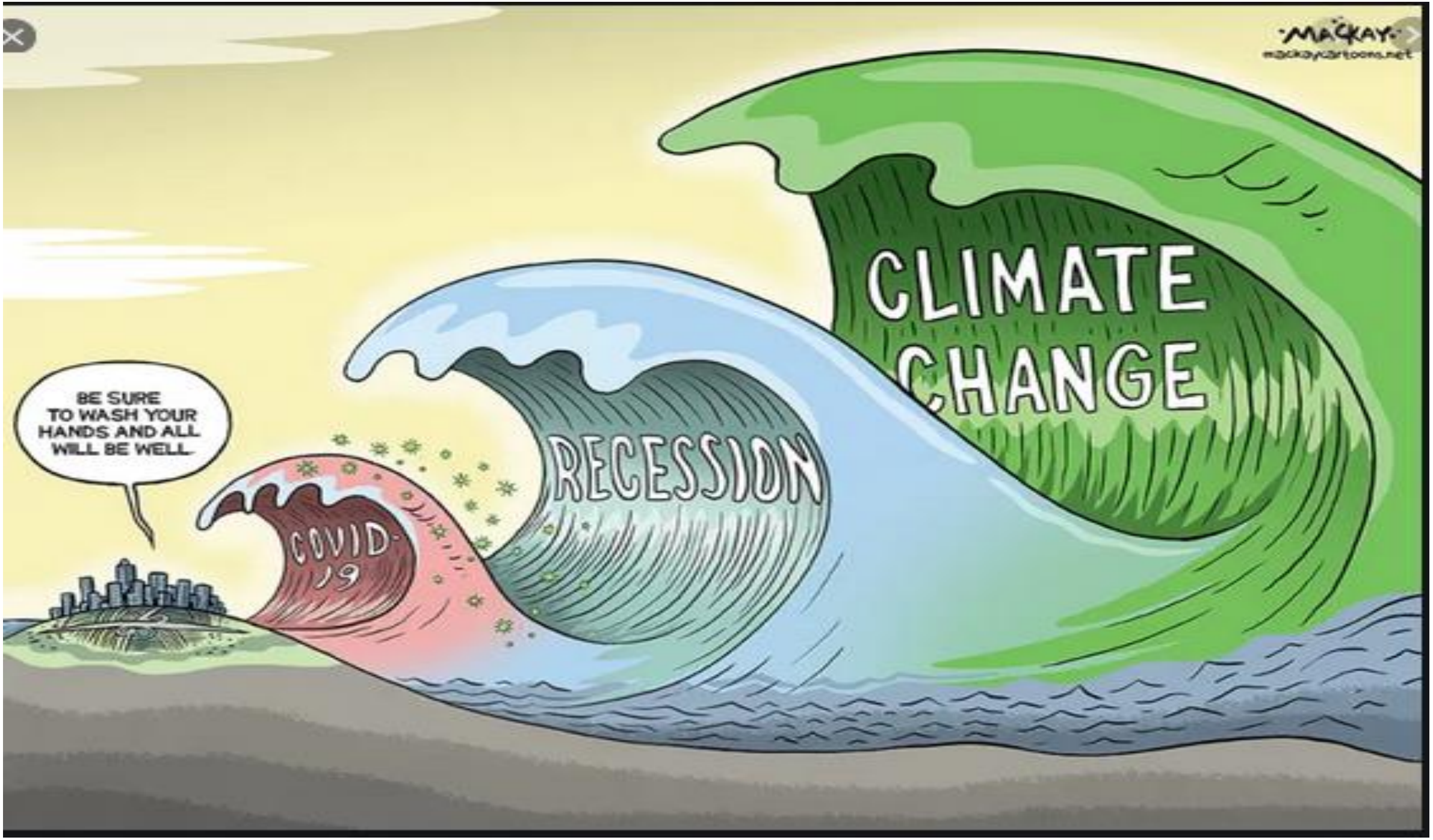
PERFORMANCE IN 2020

TOP 20 CS FUNDS AT END OF 2019

	TODAYBETACS	TODAYBETASA	TICKER	NAME
155	4.287844	0.012908	TAN	Invesco Solar ETF
118	2.064799	-0.082016	PBW	Invesco WilderHill Clean Energy ETF
79	1.970379	-0.033087	ICLN	iShares Global Clean Energy ETF
133	1.529258	-0.137364	QCLN	First Trust NASDAQ Clean Edge Green Energy Index Fund
73	1.275779	-0.148448	GRID	First Trust NASDAQ Clean Edge Smart Grid Infrastructure Index Fund
117	1.180934	-0.043318	PBD	Invesco Global Clean Energy ETF
65	1.077781	-0.180204	GCCHX	GMO Climate Change Fund
67	1.077413	-0.182374	GCHPX	GMO Climate Change Series Fund Class PS
63	1.046108	-0.149619	GAAEX	Guinness Atkinson Funds - Alternative Energy Fund
156	0.968513	0.086898	TBLU	Tortoise Global Water ESG Fund
145	0.958111	-0.142210	SMOG	VanEck Vectors Low Carbon Energy ETF
93	0.844861	-0.477807	LIT	Global X Lithium & Battery Tech ETF
70	0.794586	-0.104969	GEOSX	Essex Environmental Opportunities Fund
140	0.667343	-0.056814	SDG	iShares MSCI Global Impact ETF
131	0.635409	-0.064057	PZD	Invesco Cleantech ETF
84	0.628272	0.042836	JETIX	Aberdeen Global Equity Impact Fund
90	0.581005	-0.413557	KGRN	KraneShares MSCI China Environment Index ETF
107	0.526151	0.088662	NLR	VanEck Vectors Uranium+Nuclear Energy ETF

TOP 20 SA FUNDS AT 2019

	TODAYBETACS	TODAYBETASA	TICKER	NAME
168	0.212120	0.155284	VGSRX	Vert Global Sustainable Real Estate Fund
104	0.040031	0.152237	MSIGX	Invesco Oppenheimer Main Street Fund
57	0.471346	0.138596	EVX	VanEck Vectors Environmental Services ETF
165	0.146032	0.134453	VDIGX	Vanguard Dividend Growth Fund
59	0.293864	0.120949	FIW	First Trust Water ETF
120	0.331301	0.117779	PHO	Invesco Water Resources ETF
105	0.457138	0.117485	NALFX	New Alternatives Fund Inc/Fund
91	0.399869	0.107792	LCISX	ClearBridge Sustainability Leaders Fund
55	0.199028	0.096346	ETIDX	Eventide Dividend Opportunities Fund
62	0.121316	0.093204	FTCS	First Trust Capital Strength ETF
107	0.526151	0.088662	NLR	VanEck Vectors Uranium+Nuclear Energy ETF
156	0.968513	0.086898	TBLU	Tortoise Global Water ESG Fund
92	0.224347	0.086427	LEVOX	Lazard US Equity Concentrated Portfolio
99	0.263771	0.083256	MGQIX	MSIF Global Quality Portfolio
146	0.111734	0.082258	SOPAX	ClearBridge Dividend Strategy Fund
137	0.184105	0.076385	REQAX	Russell Sustainable Equity Fund
114	0.027114	0.067199	PARMX	Parnassus Mid Cap Fund
83	-0.000450	0.057151	JENSX	Jensen Quality Growth Fund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BE SURE TO WASH YOUR HANDS AND ALL WILL BE WELL
COVID-19
RECESSION
CLIMATE CHANGE

PERFORMANCE IN 2020

- ANNUALIZED INVESTMENT IN CCPHYSICAL RISK: ALPHA=**48.3**%
- ANNUALIZED INVESTMENT IN STRANDED ASSETS: ALPHA=**59.3**%
- These results complement the Morningstar and Blackrock analyses but are not sector neutral and consequently have much higher returns.

CONCLUSIONS

- FIND NEW FACTORS REFLECTING TRANSITION AND PHYSICAL RISK OF CLIMATE CHANGE.
- THESE ARE MODELLED AS HAVING TIME VARYING LOADINGS ON CLIMATE NEWS AND OTHER FACTORS
- THESE FACTORS HAVE PERFORMED VERY WELL DURING THE PANDEMIC.
- THE MOST USEFUL DISCLOSURE WOULD REVEAL WHETHER FIRMS WILL BE FAVORABLY OR UNFAVORABLY IMPACTED BY CLIMATE CHANGE. ESG SCORES ARE ONLY A PART OF THE ANSWER.