

A FINANCIAL APPROACH TO CLIMATE CHANGE

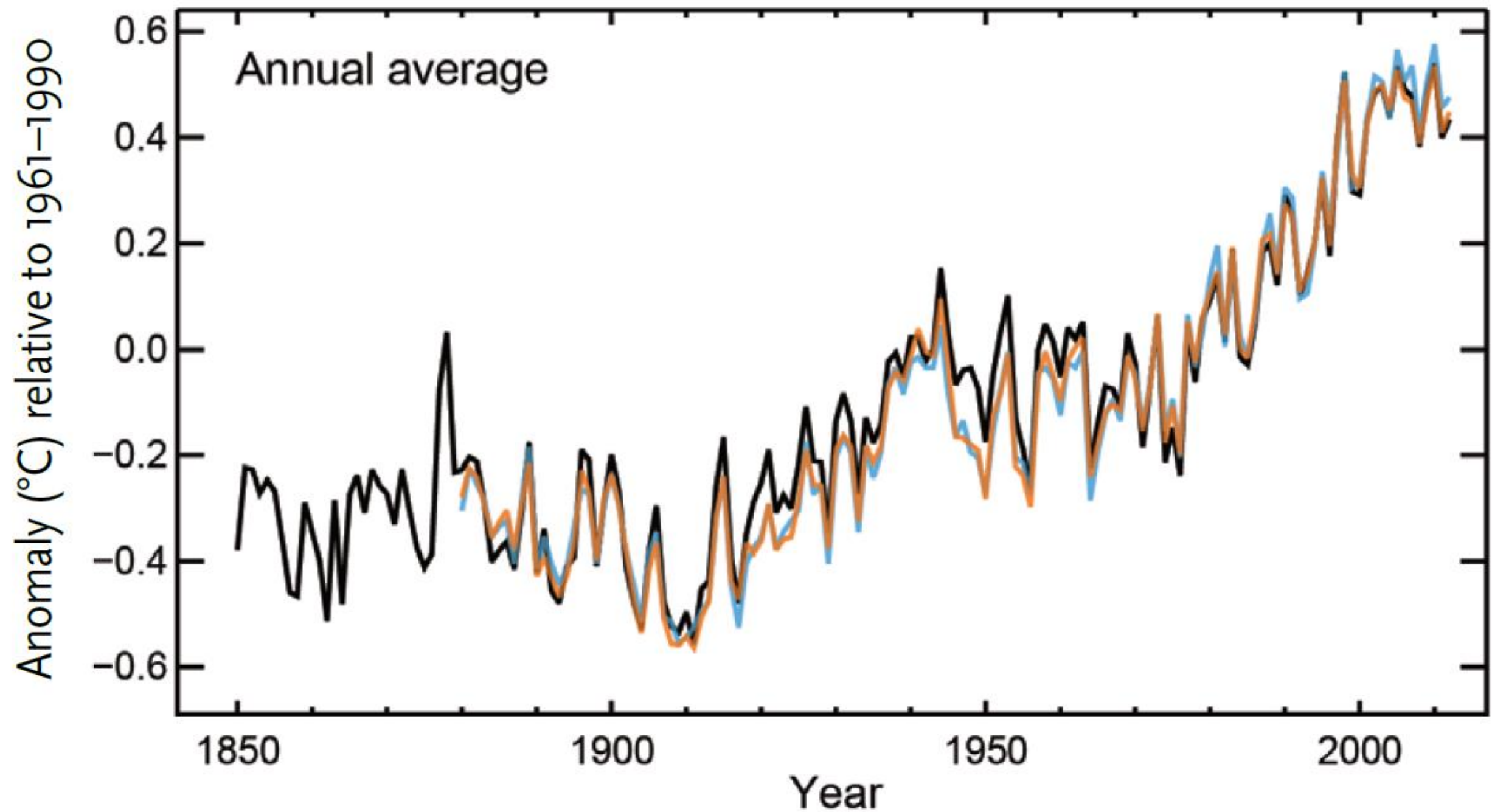
- Robert Engle
- Volatility Institute at NYU Stern
- September 30, 2019
- Central Bank of Greece, Athens

CLIMATE ASSESSMENT

- Scientists say the climate is changing.
- How bad will it be and what are the impacts on me and my children and their children?
- What will the governments of the world do?
- What new technologies might become available?
- There is clearly a great deal of uncertainty in these answers.

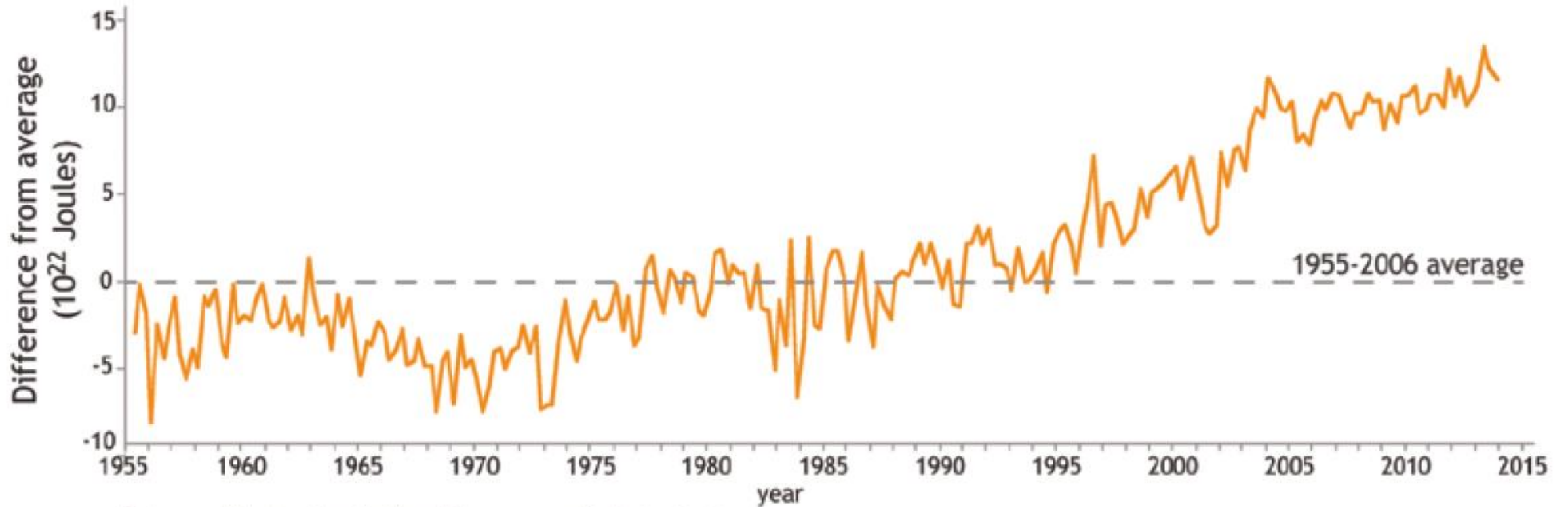
IS THE EARTH WARMING?

- How should we measure something like this? Time of day, time of year, location, land, water, atmosphere? These are all complexities.
- The temperature changes are relative to the global average surface temperature of 1961–1990.
- *Source: IPCC AR5, data from the HadCRUT4 dataset (black), UK Met Office Hadley Centre, the NCDC MLOST dataset (orange), US National Oceanic and Atmospheric Administration, and the NASA GISS dataset (blue), US National Aeronautics and Space Administration.*



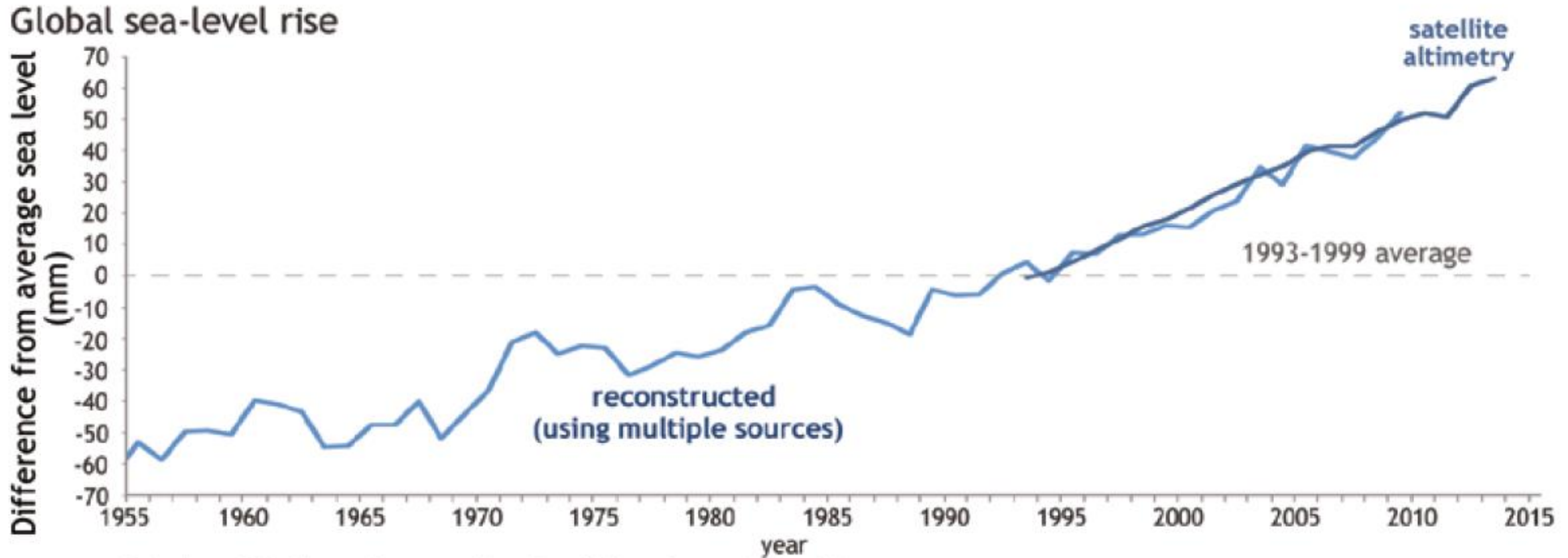
OCEAN HEAT CONTENT

Ocean heat content anomaly



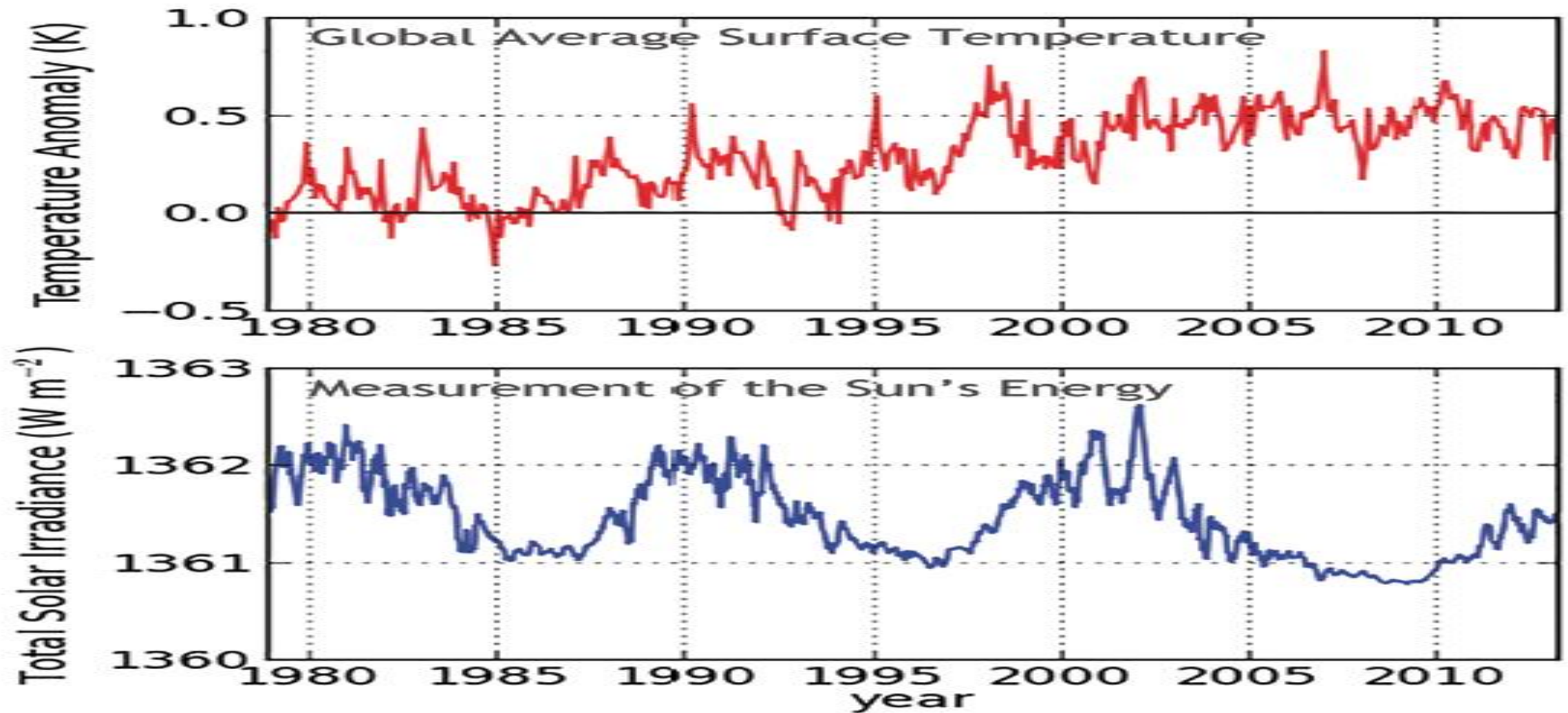
Data provided by the National Oceanographic Data Center.

GLOBAL SEA LEVEL



Data from C.K. Shum, Chungyen Kuo, Benoit Mtyssignac, Junkun Wan.

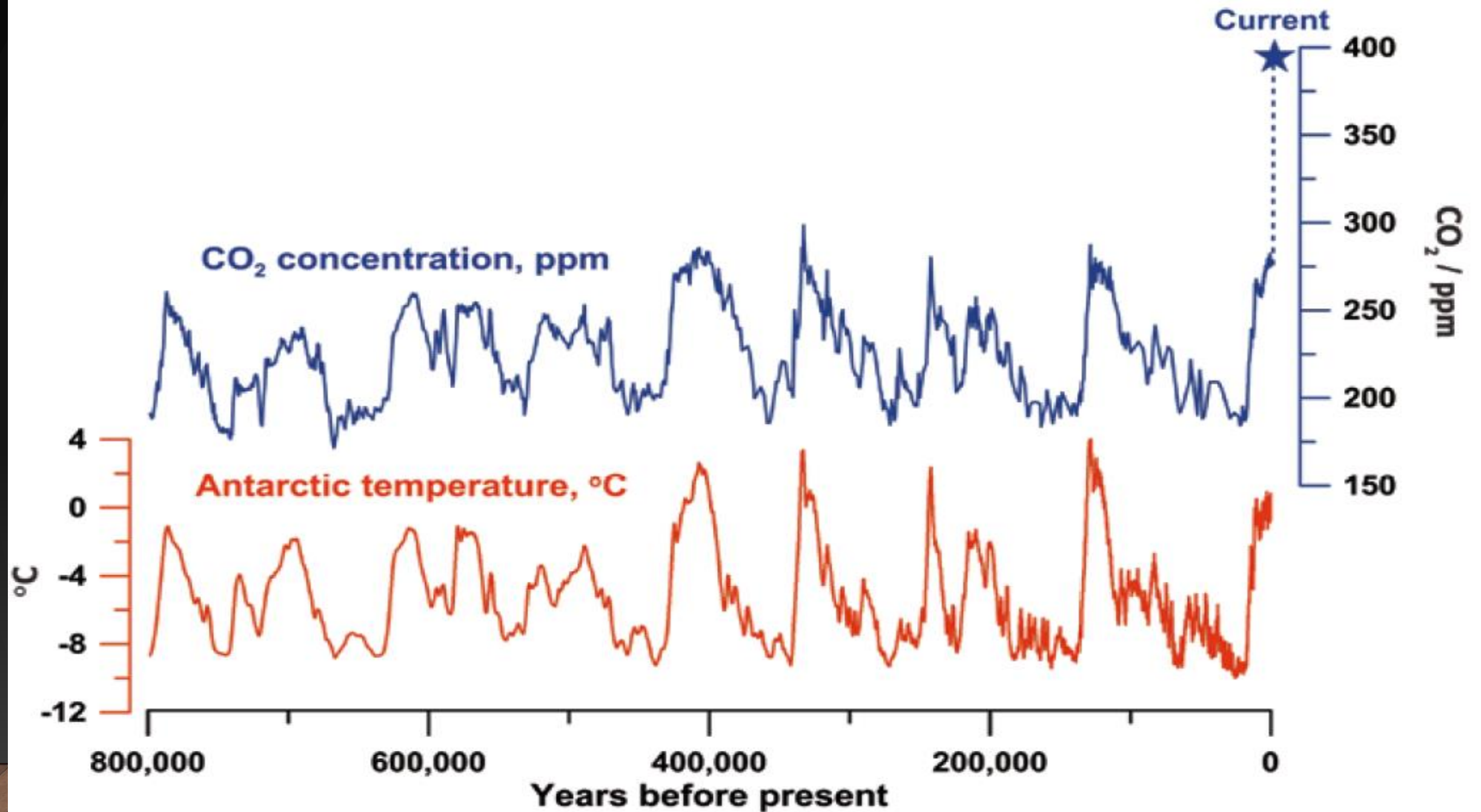
IS WARMING DUE TO THE SUN? NO!



THE ROLE OF GREENHOUSE GASES

- The most important is CO_2 or carbon dioxide. Also important are methane(CH_4), nitrous oxide(N_2O) and halocarbons.
- These gases absorb infra-red radiation that is re-radiated from earth and act like a blanket around the earth.
- Carbon dioxide lasts a long time and is therefore the most dangerous. Methane is very opaque to infra-red but decays rapidly. We have acted to restrict CFCs to protect the ozone layer; this also reduced GHG.





AN ECONOMIC VIEW OF THE PROBLEM AND THE SOLUTION

ECONOMIST ANSWER

- Externalities are the cause
 - The emission of GHGs is free but imposes costs on others. The market cannot solve this. It is called a free rider problem.
 - The primary solutions are either to price carbon emissions or to regulate them.
- Economists generally believe that if there is an appropriate price on carbon, the free market will optimally adjust to give the best mix of goods and services while taking into account the damages from climate change.

REGULATION

- An alternative is regulation and subsidies
- This risks making counter productive restrictions.
- It requires the regulator to set priorities
- Examples are LED lights, CAFÉ standards, Biofuels

THE SOCIAL COST OF CARBON

DEFINITION

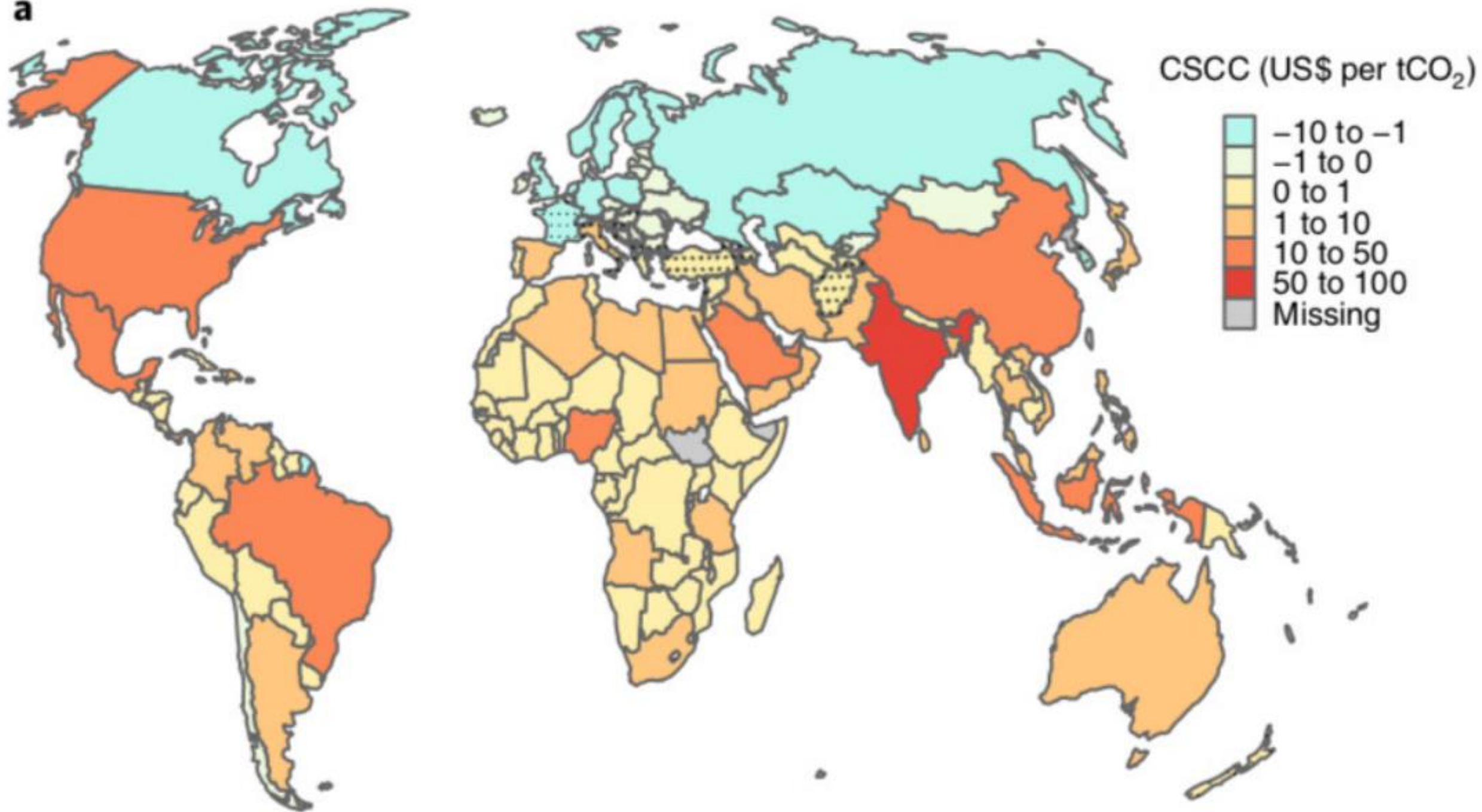
- It is the present discounted value of the welfare damages resulting from an additional ton of CO₂ emissions today.
- This assumes some baseline
- It assumes a damage model
- It assumes a discount rate
- It is the optimal Pigouvian tax and is also useful in cost benefit calculations

IAM

- The Integrated Assessment Models can be used for this calculation. These assume no mitigation and business as usual.
- Nordhaus gets \$25/ton from this. Obama administration \$45.
- Trump administration has used as little as \$1.
- This can also be done with “top down” damages. Ricke et al.(2018) in *Nature Climate Change* estimate \$417 .

RICKE'S APPROACH

- We observe that countries in temperate zones have higher per capital incomes and growth rates than either more tropical or colder countries.
- If this is structural (a big but potentially defensible assumption) then global warming will have different impacts on different regions of the world.
- The SCC is the sum of the global damages since a ton of carbon emitted anywhere affects the whole planet.

a

ECONOMISTS' RECOMENDATION

- A comprehensive global price for carbon emissions at a substantial level would raise money that could reduce other taxes or be rebated directly. i.e. a revenue neutral carbon tax.
- WHY?
 - It would encourage rapid shifts of resources to lower carbon technologies producing new jobs.
 - It would incentivize research and development of carbon capture and clean energy.
 - There are winners and losers, but it should produce the best outcome from a social welfare point of view.

GOVERNMENT RESPONSE

- Many governments are unwilling to take these steps.
 - Near term problems “trump” long term problems.
 - Electorate not clearly behind carbon pricing.
 - Paris accord is limited.
-
- So the consequences will come upon us
 - unless we are rescued by the private sector
 - or by technological advances

WHY IS A REVENUE NEUTRAL CARBON TAX CONTROVERSIAL?

- ☐ This will be ineffective. People will not change their behavior because of a tax. It will do little to reduce carbon emissions and will just bring higher taxes.
- ☐ This will be a disaster because it will kill growth, make energy too expensive, hurt exports, and paralyze the economy.
- ☐ These points of view are diametrically opposed. One says nothing will change and the other says the changes are so great that growth will stop. Which is correct? Neither?
- ☐ The economist view is that the free market is very good at adjusting to a change in prices.

IHS MARKIT: CARBON INDEX JUST RELEASED

- Weighted average of futures prices on carbon emissions
- All active cap and trade emissions
 - EU ETS
 - California
 - RGGI
- Soon to include others including potentially China, Korea, New Zealand when futures liquidity reaches certain level.
- Index is designed to support investment products



Figure 9: Major emerging global carbon markets³¹

Cross-Asset Comparison Between Major Asset

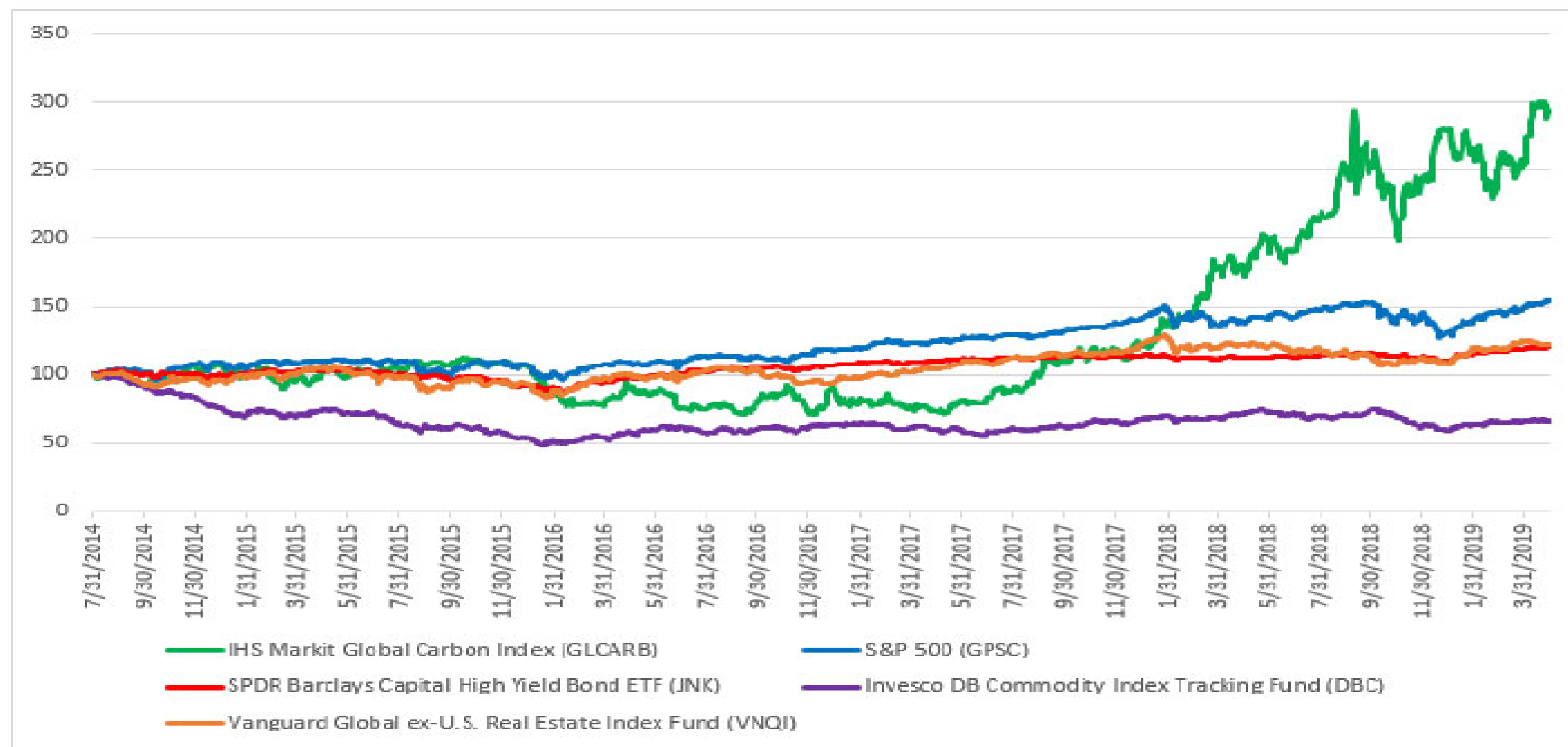


Figure 13: Cross-Asset Comparison Between Major Asset Classes from July 31st, 2014 through April 30th, 2019 ^{36,37}

PUBLICLY AVAILABLE INFORMATION ON CARBON EMISSIONS IS COMING.

This week, the technology nonprofit WattTime announced that, thanks to a \$1.7 million grant from Google.org, it will use satellite technology to measure air pollution from every large power plant in the world. This effort, which will combine data “from a variety of sensors operating at different wavelengths,” will also use artificial intelligence to analyze and calculate carbon emissions, according to David Roberts at Vox. The company plans to make these data available to the public.

WHAT CAN INVESTORS AND COMPANIES DO?

STRATEGIES

- INVEST SUSTAINABLY
 - ESG RATINGS ARE FOR
 - E IS ENVIRONMENT INCLUDING CLIMATE
 - S IS SOCIAL
 - G IS GOVERNANCE
- 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 will act as insurance and smooth consumption

THE STOCK MARKET

- With accurate foresight of climate change, companies can *adapt* by investing in lines of business and locations that will minimize costs of climate change.
- This includes energy efficiency **but not carbon efficiency**.
 - (Why? Because it costs money and does not increase profits)
- The stock market should give such firms higher valuations, leading to lower cost of capital.

WHY MIGHT FIRMS INVEST IN CARBON EFFICIENCY?

- Because it will pay off if a carbon price is eventually implemented.
- Because otherwise they may be hit with lawsuits for knowingly destroying the planet.
- Because bond ratings may fall from failure to adapt to climate change
- Because it should pay off in the long run if the climate becomes terrible;
- Because competitors are doing this too.
- *Because it is the right thing to do and maybe shareholders and customers and competitors will see it this way too.*

ASSET PRICING AND CLIMATE HEDGE PORTFOLIOS

- Climate risk is a pervasive factor that is probably 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 unless there is bad news on the climate.

SUSTAINABLE INVESTING

- Companies with high E, S, or G scores typically will have higher costs in the short run that are designed to provide better profitability in the long run.
- Thus sustainable investors are willing to take a longer term view of profitability and counteract the “short termism” of the stock market that listed companies often complain about.
- These portfolios may also have lower volatility and potentially lower or negative risk premiums.
- Improved measurement of E, S, and G scores is critical.

DYNAMIC HEDGE PORTFOLIOS

- Designing a portfolio that will protect against climate risk 50 years in the future, however, is an impossible task.
- Nevertheless, there are many sustainable investment vehicles offered in the market. We turn to evaluation of these.
- Then we will propose a dynamic strategy.



EVALUATING CLIMATE HEDGE PORTFOLIOS

PUBLICLY AVAILABLE PORTFOLIOS

- GREEN ETFs
 - ALTERNATIVE ENERGY
 - WIND
 - SOLAR
 - NUCLEAR
 - LOW CARBON
- MORNINGSTAR SELECTED FUNDS
 - LOW EXPOSURE TO FOSSIL RESERVES
 - CARBON FOOTPRINT < .5*SP500
 - HIGH RANKING ON E MEASURE OF ESG
 - INTERNATIONAL SUSTAINABLE

V-LAB CLIMATE RISK

VLAB NYU

Q

All

Images

News

Videos

Maps

More

Settings

Tools

About 16,500 results (0.43 seconds)

V-Lab: Real-time Financial Volatility, Correlation, And Risk ... - NYU

<https://vlab.stern.nyu.edu/en/> ▼

The Volatility Laboratory (V-Lab) provides real time measurement, modeling and forecasting of financial volatility, correlations and risk for a wide spectrum of ...

Systemic Risk Analysis

Risk Analysis Overview - All
Financials Total SRISK (US ...

Systemic Risk Analysis Of ...

Global Dynamic MES systemic risk
analysis for World Financials.

Models

V-Lab Logo V-Lab. Analyses ▾ ...
Documentation. Related ...

Climate Risk Analysis

Climate Risk. Last Update: May 9,
2018 at 1:14:26 AM GMT ...

Volatility Analysis

There are few guarantees in financial markets. However, we do know that volatility clusters and mean-reverts. But how long will it take to mean revert and, on average, to what level? Where are the 'host spots' of volatility in the world and in what sectors? We attempt to answer these questions and more in our Volatility Analysis section of V-Lab. Come see the many models meant to explain volatility and explore volatility dynamics.



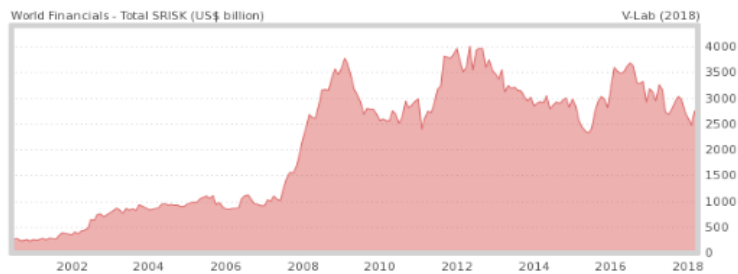
Correlation Analysis

The co-movement of asset prices is important in many financial market decisions, such as portfolio allocation, diversification, and hedging. In our Correlation Analysis section, we use econometric models to determine how these time series co-move, which assets are particularly correlated, and which are diverging in direction.



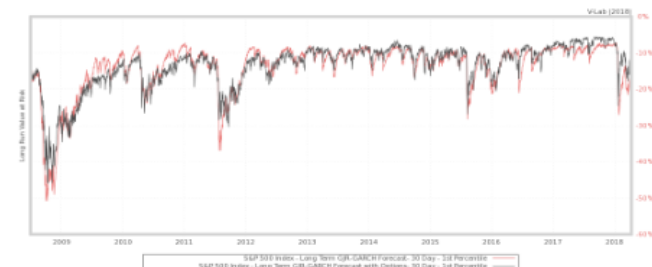
Systemic Risk Analysis

The Global Financial Crisis of 2008 revealed the degree of interconnectedness and fragility of the global financial system at the time. How badly would the equity values of financial institutions decline if there were another crisis today? What degree of capital shortfall would financial institutions suffer? Our Systemic Risk Analysis section of V-Lab simulates crises in domestic markets, as well as another global financial crisis, in an attempt to answer these questions.



Long-Run VaR Analysis

Often, volatility is assumed to grow with the square root of time. However, this assumes independence between observations each day (i.e. today's volatility has no bearing on what volatility will be tomorrow). Since this is not the case, one must defer to more sophisticated methods in order to estimate long-run volatility. Our Long-Run Value-at-Risk section simulates the 1 month and 1 year risk of holding financial assets, both using only returns and also conditioning average future volatility on current options market data.



Liquidity Analysis

The liquidity of a financial asset reflects transaction costs and the ability to unwind large trades at reasonable prices. 'Liquidity spirals' often exacerbate stock market declines, such as what we saw in the last Global Financial Crisis. In the liquidity section we estimate and forecast the liquidity of a broad spectrum of financial assets.



Fixed Income Analysis

The future direction of interest rates has large implications for the determination of discount rates, asset pricing, and firm capital structure. In addition, interest rates and their term structure are often used to infer economic forecasts of inflation, recession, and other key indicators. But where are rates headed in the long term? We forecast the distribution of treasury rates up to 5 years ahead from a 6-month bill to 30-year bond in the Fixed Income Section. We show upper and lower confidence intervals for future rates.



Climate Risk Analysis

Climate change is effecting the world via stronger, more severe weather events, rising sea levels, and in many other ways. Are these events and the risks imposed by climate change properly reflected in asset prices? Environmental risks can be thought of as long run risks which influence portfolio decisions. In our Climate Risk Analysis section. We examine the performance of publicly traded environmental portfolios, which can serve as a measure of the new information on environmental risk and a mechanism to hedge these risks.



WHAT DO WE EXPECT?

- Sustainable and Environmentally sound investments are very popular. Hence the prices are high.
- Other things being equal, we expect returns therefore to be low.
- We expect that these will differ from Markowitz optimal portfolios and therefore have lower Sharpe Ratios, just as we would expect for any insurance.
- If the climate surprises the market and is worse than expected, then these portfolios should outperform.
- The benefit from climate investing is long term, not short term.

Category

All

Time period

5 Years

Benchmark

Return

Volatility

Sharpe
Ratio

iShares MSCI EAFE ETF

0.98%

14.50%

-0.05

SPDR S&P 500 ETF Trust

9.00%

13.59%

0.54

SPY:US - XLE:US

18.89%

15.71%

1.20

Stranded Assets

18.75%

15.30%

1.23

Security

Return

Volatility

Sharpe
Ratio↓ α

Fama-French Factors

 β

SMB

HML

[VanEck Vectors
Environmental Services
ETF](#)

14.72%

19.26%

0.68

3.81
(0.73)0.70
(11.75)0.32
(3.55)0.27
(4.04)[Akre Focus Fund](#)

14.31%

13.28%

0.95

3.55
(1.58)0.88
(47.89)-0.03
(-1.43)-0.07
(-2.37)[First Trust Water ETF](#)

11.57%

15.52%

0.64

1.95
(0.60)0.92
(51.66)0.46
(15.83)0.31
(8.75)[WisdomTree U.S. Quality
Dividend Growth Fund](#)

9.33%

13.29%

0.58

-0.07
(-0.06)0.93
(83.98)-0.14
(-9.84)-0.01
(-0.58)[First Trust Capital
Strength ETF](#)

10.22%

12.89%

0.66

-0.64
(-0.43)0.88
(72.65)-0.17
(-10.89)-0.07
(-2.96)[Polen Growth Fund](#)

14.52%

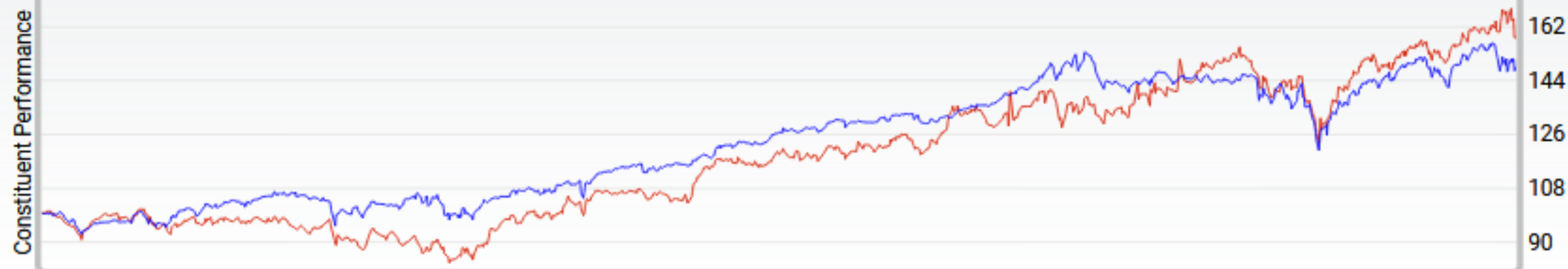
15.26%

0.84

-0.98
(-0.37)1.00
(72.60)-0.20
(-4.79)-0.45
(-19.04)

VanEck Vectors Environmental Services ETF

V-Lab (2019)



TOP 10 HOLDINGS OF VANECK VECTORS ENVIRONMENTAL SERVICES ETF

Top Holdings	
Steris plc	10.73%
Waste Management Inc	10.38%
Republic Services Inc	10.38%
Waste Connections Inc	9.72%
Cantel Medical Corp	4.18%
Casella Waste Systems Inc	4.10%
Evoqua Water Technologies Corp	4.07%
Tetra Tech Inc	3.88%
Clean Harbors Inc	3.87%
Tennant Co	3.83%

SPDR MSCI ACWI LOW CARBON TARGET ETF

Top Holdings	
Microsoft Corp	2.29%
Apple Inc	2.20%
Amazon.com Inc	1.66%
Facebook Inc	0.98%
Alphabet Inc	0.84%
Johnson & Johnson	0.82%
Alphabet Inc	0.78%
JPMorgan Chase & Co	0.78%
Visa Inc	0.76%
Nestle SA	0.75%

BUT MORE RECENTLY OVER THE LAST YEAR

Security	Return	Volatility	Sharpe Ratio	Fama-French Factors			
				1 - a	ß	2MS	HML
iShares Global Carbon ETF	91.69%	22.92%	1.57	22.27 (0.91)	-0.19 (-0.66)	-0.01 (-0.01)	-0.26 (-0.61)
Invesco Solar ETF	69.47%	22.51%	1.65	25.69 (1.96)	1.37 (10.74)	0.45 (3.89)	0.27 (1.57)
Invesco Wildcat Clean Energy ETF	19.59%	24.54%	0.69	25.93 (2.52)	1.14 (22.02)	0.73 (5.69)	0.24 (2.49)
iShares Global Clean Energy ETF	26.17%	16.92%	1.62	24.92 (2.77)	0.72 (11.52)	0.26 (2.19)	0.27 (1.00)
Global X YieldCo & Sustainable Income ETF	17.70%	12.22%	1.50	19.98 (2.51)	0.37 (11.94)	0.09 (1.04)	0.09 (0.99)
ALPS Clean Energy ETF	21.16%	16.92%	1.14	17.43 (2.52)	0.78 (11.07)	0.29 (2.92)	0.24 (2.99)
Invesco Water Resources ETF	16.10%	16.00%	0.69	15.14 (1.99)	0.25 (29.42)	0.19 (2.41)	0.15 (2.99)
Eaton Vance Water ETF	10.42%	16.92%	0.21	12.93 (1.88)	0.28 (27.66)	0.26 (4.72)	0.20 (2.61)
Templeton Global Water ESG Fund	6.79%	12.22%	0.26	10.09 (1.49)	0.21 (9.54)	0.25 (2.04)	0.24 (2.02)
Alps Focus Fund	19.94%	15.02%	1.09	9.96 (1.92)	0.79 (22.27)	-0.12 (-0.01)	-0.17 (-0.02)
VanEck Vectors Environmental Services ETF	6.99%	17.72%	0.29	9.69 (1.47)	0.75 (8.21)	0.21 (2.52)	0.27 (2.22)
VanEck Vectors Low Carbon Energy ETF	1.18%	22.17%	-0.22	8.99 (0.62)	0.92 (22.97)	0.24 (4.17)	0.06 (0.79)
Invesco CleanTech ETF	-4.20%	12.92%	-0.22	8.42 (1.14)	0.96 (22.77)	0.49 (4.79)	0.17 (2.22)
Invesco Global Water ETF	9.21%	16.07%	0.48	8.44 (1.14)	0.76 (10.62)	0.27 (2.94)	0.12 (2.04)
Eaton Vance Natural Clean Edge Green Energy Index Fund	6.99%	22.51%	0.19	8.42 (0.91)	1.12 (19.92)	0.22 (2.49)	0.10 (1.24)

Invesco Global Clean Energy ETF	6.21%	19.02%	0.12	7.97 (0.49)	0.29 (2.74)	0.25 (2.71)	0.19 (1.22)
Invesco S&P Global Water Index ETF	9.22%	12.66%	0.61	6.14 (0.22)	0.71 (16.42)	0.22 (0.97)	0.16 (2.99)
SPDR S&P 500 Feedback ETF	-0.22%	17.12%	-0.22	3.21 (0.99)	0.92 (29.21)	0.17 (4.72)	0.40 (12.19)
Columbia World Values International Equity Fund I	2.92%	12.02%	0.24	2.42 (0.21)	0.67 (11.52)	0.15 (1.54)	0.24 (2.99)
Invesco Wildcat Ill Responsible Energy ETF	0.46%	22.64%	-0.27	2.42 (0.41)	0.29 (16.62)	0.72 (7.49)	0.42 (4.49)
Eaton Vance Global Wind Energy ETF	1.26%	12.92%	-0.24	2.21 (0.22)	0.27 (12.94)	0.11 (1.22)	0.21 (2.22)
SPDR S&P Kinetic Infrastructure Securities ETF	-4.20%	22.94%	-0.29	1.96 (0.12)	0.22 (12.02)	0.22 (2.19)	0.27 (2.41)
Amundi Growth Fund	2.77%	17.04%	0.22	0.97 (0.17)	0.92 (22.02)	0.22 (0.99)	-0.24 (-2.42)
Vanguard Dividend Growth Fund	11.92%	12.22%	0.70	0.26 (0.21)	0.72 (24.94)	-0.22 (-4.72)	0.12 (2.49)
Eaton Vance Global Dividend Aristocrats ETF	-0.22%	12.27%	-0.22	-0.26 (-0.22)	1.22 (22.92)	0.12 (4.79)	0.22 (2.99)
Eaton Vance Capital Growth ETF	2.26%	16.02%	0.29	-0.22 (-0.12)	0.22 (21.27)	-0.12 (-4.22)	0.24 (1.79)
WisdomTree U.S. Quality Dividend Growth Fund	0.24%	16.01%	-0.29	-0.22 (-0.22)	0.22 (72.94)	-0.22 (-2.22)	0.29 (2.22)
Wisdom International Equity Fund	-0.22%	9.22%	-0.22	-1.01 (-0.12)	0.41 (11.27)	0.24 (0.22)	0.12 (2.22)

Security	Return	Volatility	Sharpe Ratio	↓ α	Fama-French Factors		
					β	SMB	HML
iPath Global Carbon ETN	91.68%	83.95%	1.07	53.27 (0.91)	-0.19 (-0.44)	-0.01 (-0.01)	-0.36 (-0.41)
Invesco Solar ETF	48.47%	28.21%	1.65	35.69 (1.96)	1.07 (10.74)	0.45 (3.59)	0.27 (1.57)
Invesco WilderHill Clean Energy ETF	18.50%	24.24%	0.69	25.30 (2.52)	1.14 (23.02)	0.70 (5.63)	0.24 (2.49)
iShares Global Clean Energy ETF	26.17%	16.95%	1.43	24.82 (2.77)	0.72 (11.20)	0.26 (2.19)	0.07 (1.00)
Global X YieldCo & Renewable Energy Income ETF	17.70%	13.22%	1.20	18.38 (2.51)	0.37 (11.36)	0.09 (1.04)	0.09 (0.98)
ALPS Clean Energy ETF	21.16%	16.92%	1.14	17.40 (2.05)	0.78 (11.07)	0.29 (2.50)	0.24 (2.39)
Invesco Water Resources ETF	16.10%	16.00%	0.89	15.14 (1.99)	0.85 (29.43)	0.19 (2.41)	0.15 (3.98)
First Trust Water ETF	10.42%	16.80%	0.51	12.30 (1.88)	0.88 (37.66)	0.36 (4.75)	0.20 (3.61)
Tortoise Global Water ESG Fund	6.78%	13.58%	0.36	10.03 (1.49)	0.51 (9.54)	0.25 (2.04)	0.34 (3.02)
Akre Focus Fund	18.04%	15.02%	1.08	9.96 (1.80)	0.79 (20.57)	-0.13 (-3.01)	-0.17 (-3.03)
VanEck Vectors Environmental Services ETF	6.98%	17.72%	0.29	9.69 (1.47)	0.75 (8.31)	0.31 (3.58)	0.27 (2.23)
VanEck Vectors Low Carbon Energy ETF	1.18%	20.17%	-0.03	8.99 (0.68)	0.98 (25.97)	0.34 (4.17)	0.06 (0.78)

WHY ARE SUSTAINABLE STOCKS DOING BETTER THIS YEAR?

- Partly because we have seen evidence that the climate is getting worse.
- Partly because the market itself is impacted by geopolitical risks such as the trade war.
- The top performing asset is an ETN based on futures of carbon credits primarily traded in EU. Maybe carbon will be priced more generally.

PERFORMANCE OF V-LAB FUNDS

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

TWO OBVIOUS PROBLEMS

- The cost of investing in sustainable funds appears high, as the alphas are typically worse than -5%/year.
- Unlike insurance, there is no guarantee that these funds will pay off if the climate is bad.



HEDGING CLIMATE CHANGE NEWS

Robert Engle	<i>NYU Stern</i>
Stefano Giglio	<i>Yale</i>
Bryan Kelly	<i>Yale</i>
Heebum Lee	<i>NYU Stern</i>
Johannes Stroebe	<i>NYU Stern</i>

RFS Climate Finance Workshop, October 2018

forthcoming Review of Financial Studies

THE IDEA FOR A DYNAMIC HEDGE PORTFOLIO

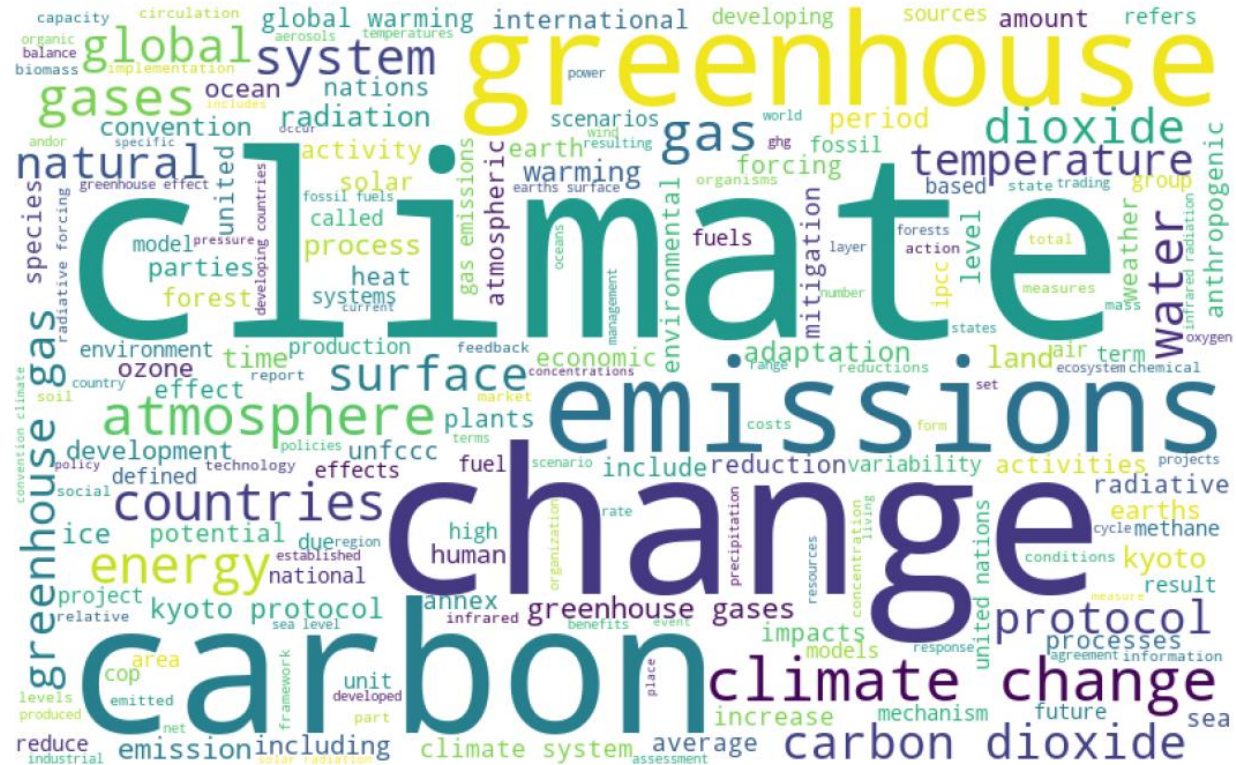
- When there is news that the climate is getting worse, which stocks go up and which go down? This is the portfolio you want to hold going forward.
- Ultimately you will hold a portfolio that outperforms in a bad climate state. It will naturally underperform if the climate does not deteriorate.

NEWS

- Textual analysis of Wall Street Journal stories over 20 years.
- Measure the similarity of the words and phrases to a collection of climate change dictionaries.
- When there is news reported in the WSJ on climate change, the similarity is high,
- Typically climate news is bad news.
- As a check we use an alternative series from Crimson Hexagon which measures sentiment.

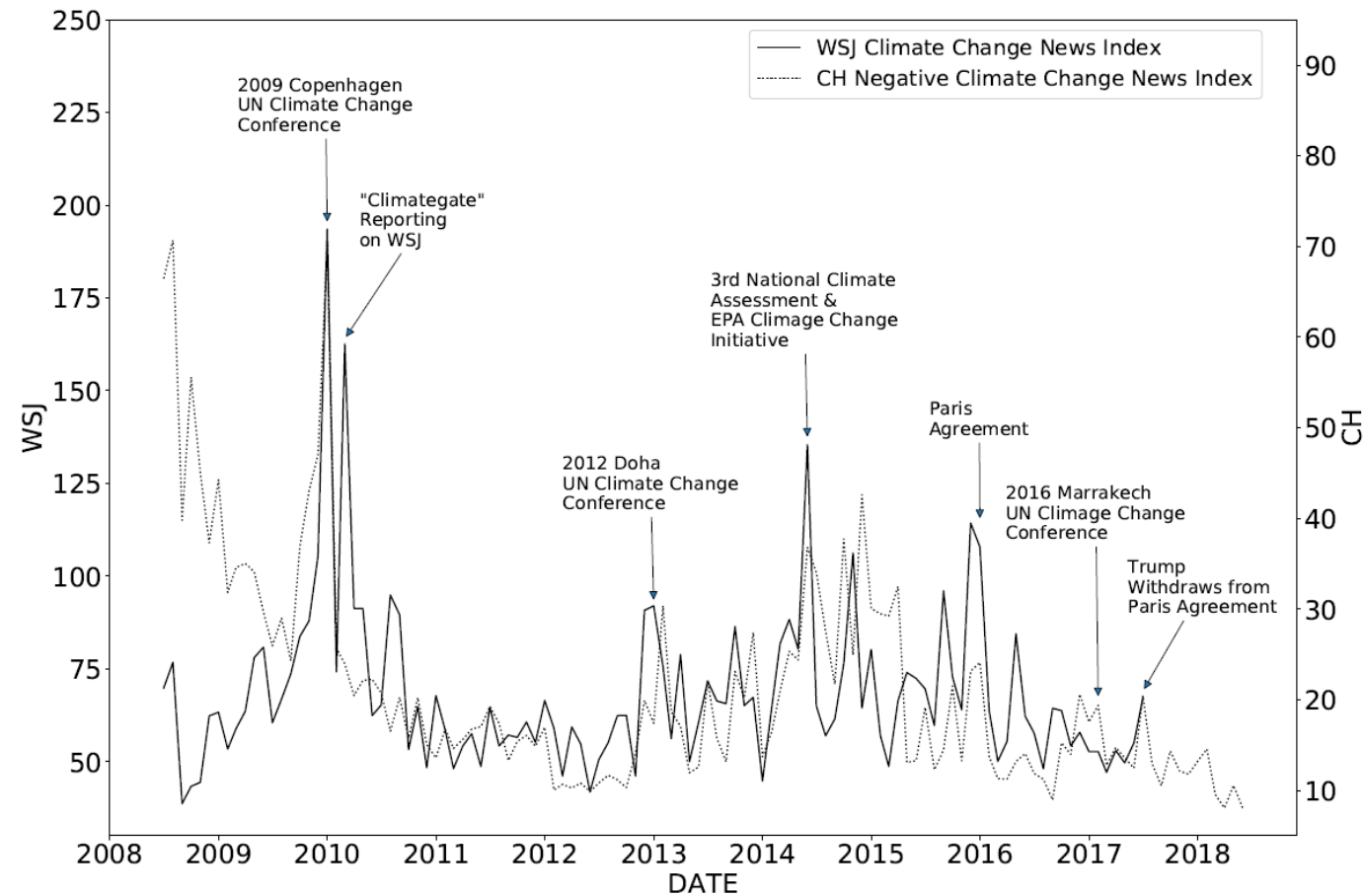
1. What News?

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.)



Two measures move together but not identically (e.g., idiosyncratic Climategate reporting by WSJ)

PORTFOLIOS

- We consider portfolios that are weighted by characteristics such as carbon footprint. We use several third party data sets.
- We seek factor mimicking portfolios that are maximally correlated with the text variable.
- In sample, we get correlations of 0.4 when using *sustainalytics* E score. Out of sample this is only 0.2.
- Better data and more sophisticated estimation can potentially improve these results. Nevertheless, the method appears promising.

NEXT STEPS ON V-LAB

PORTFOLIO CONSTRUCTION

- Create weekly climate text variable from NYU CC_NYT
- Predict correlations between individual stock returns and CC_NYT using DCC.
 - Data is windsorized at
 - DCC parameters are fixed at “typical” values
 - Forecast is done weekly.
- Portfolio is long the 20% stocks with highest correlation and short the 20% with lowest correlation
- Same strategy followed with 50 week and 100 week rolling betas.

Category

All

Time period

5 Years

Benchmark	Return	Volatility	Sharpe Ratio				
iShares MSCI EAFE ETF	1.23%	14.51%	-0.03				
SPDR S&P 500 ETF Trust	9.17%	13.60%	0.55				
SPY:US - XLE:US	18.30%	15.69%	1.17				
Stranded Assets	18.05%	15.30%	1.18				
Security	Return	Volatility	Sharpe Ratio	↓ α	Fama-French Factors		
					β	SMB	HML
Domini Impact Equity Fund	25.71%	34.50%	0.70	12.36 (0.91)	1.01 (48.15)	0.05 (1.59)	-0.10 (-1.03)
VanEck Vectors Environmental Services ETF	14.57%	19.27%	0.67	4.11 (1.01)	0.72 (19.57)	0.39 (5.62)	0.24 (4.64)
● V-Lab Portfolio - DCC	6.77%	5.64%	0.91	3.49 (1.69)	0.09 (3.68)	0.02 (0.54)	-0.27 (-6.47)
Akre Focus Fund	15.29%	13.23%	1.03	3.10 (1.49)	0.87 (47.29)	-0.03 (-1.44)	-0.07 (-2.43)
First Trust Water ETF	11.92%	15.54%	0.66	2.02 (0.63)	0.93 (51.86)	0.46 (16.31)	0.31 (8.88)
American Century Equity Income Fund	8.31%	10.05%	0.66	0.79 (0.45)	0.69 (69.55)	-0.10 (-7.43)	0.19 (9.82)
Polen Growth Fund	15.50%	15.20%	0.91	0.60 (0.31)	0.98 (72.23)	-0.17 (-7.33)	-0.43 (-20.15)

FIVE YEARS COMPARISON

V-Lab Portfolio - DCC Climate Risk Analysis with GJR

WHAT'S ON THIS PAGE? ?

COMPARE ▼

V-Lab Portfolio - DCC

V-Lab (2019)

Constituent Performance



Jul 2014 Jan 2015 Jul 2015 Jan 2016 Jul 2016 Jan 2017 Jul 2017 Jan 2018 Jul 2018 Jan 2019

CONCLUSIONS

- The best solution is a combination of global carbon pricing and regulation.
- Without government action, sustainable investing can encourage energy efficiency and possibly carbon efficiency. But better data is needed.
- Advocacy, Transparency, Legal and Political actions can further increase carbon efficiency.
- Much of the cost of adaptation will be borne by local, regional or federal governments and these liabilities may force action.
- Technology may be the most important solution and it must be encouraged.

These are my grandsons.
What is in their future?



BUT IF WE CAN TELL THEM THE PROBLEM
IS SOLVED...

