

Taxes and Emission Trading



US\$/tCO₂

168 — SWEDEN (TAX)

95 — TOKYO (ETS)

69 — NORWAY (upper) (TAX)
68 — SWITZERLAND (TAX)

48 — FINLAND (TAX)

31 — DENMARK (TAX)
28 — BRITISH COLUMBIA (TAX)
IRELAND (TAX)

16 — UNITED KINGDOM (price floor) (TAX)

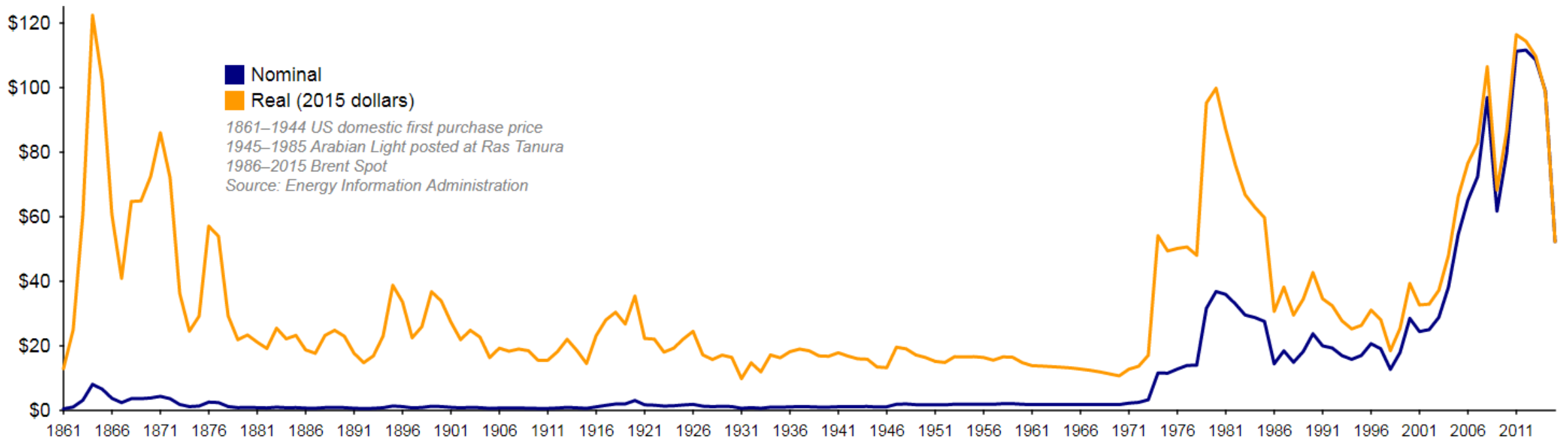
ICELAND (TAX)
GUANGDONG (ETS) 10
QUÉBEC (ETS) 10
CALIFORNIA (ETS) 11
SHENZHEN (ETS) 11
BEIJING (ETS) 9
EU (ETS) 9

MEXICO (upper) (TAX)
TIANJIN (ETS) 4
NORWAY (lower) (TAX)
5 SHANGHAI (ETS)

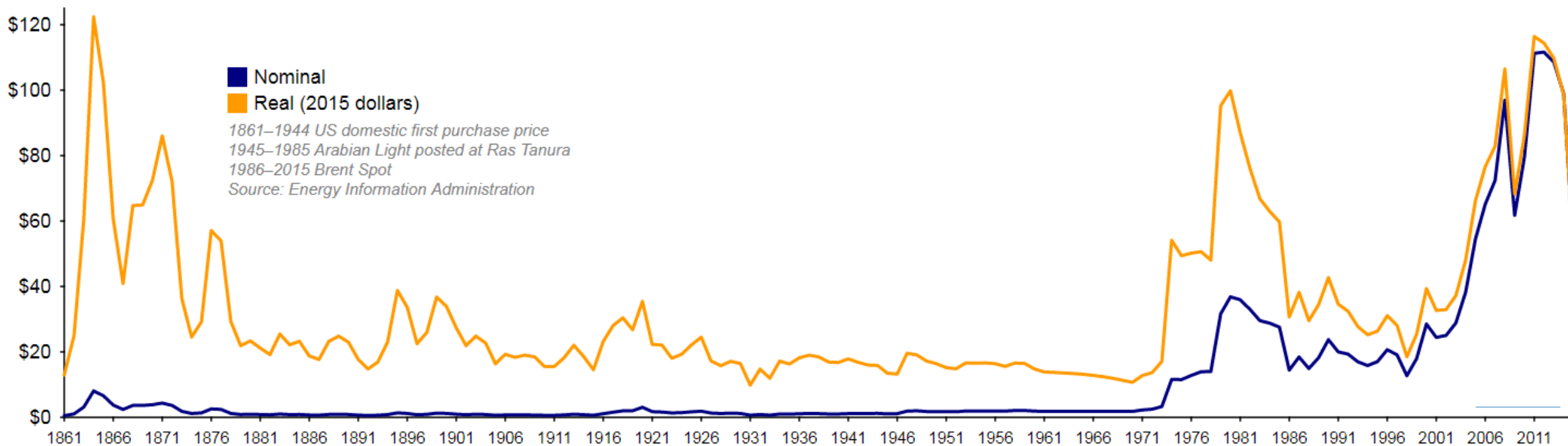
3 RGGI (ETS)

JAPAN (TAX) 2
MEXICO (lower) (TAX)
NEW ZEALAND (ETS) 1

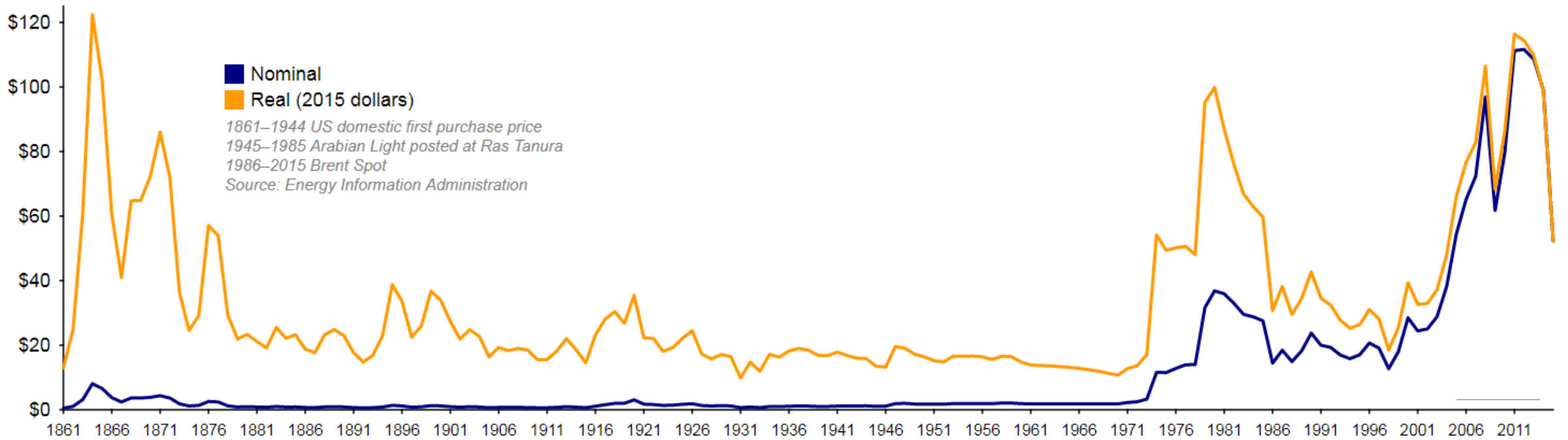
Oil prices, and Various Climate policies



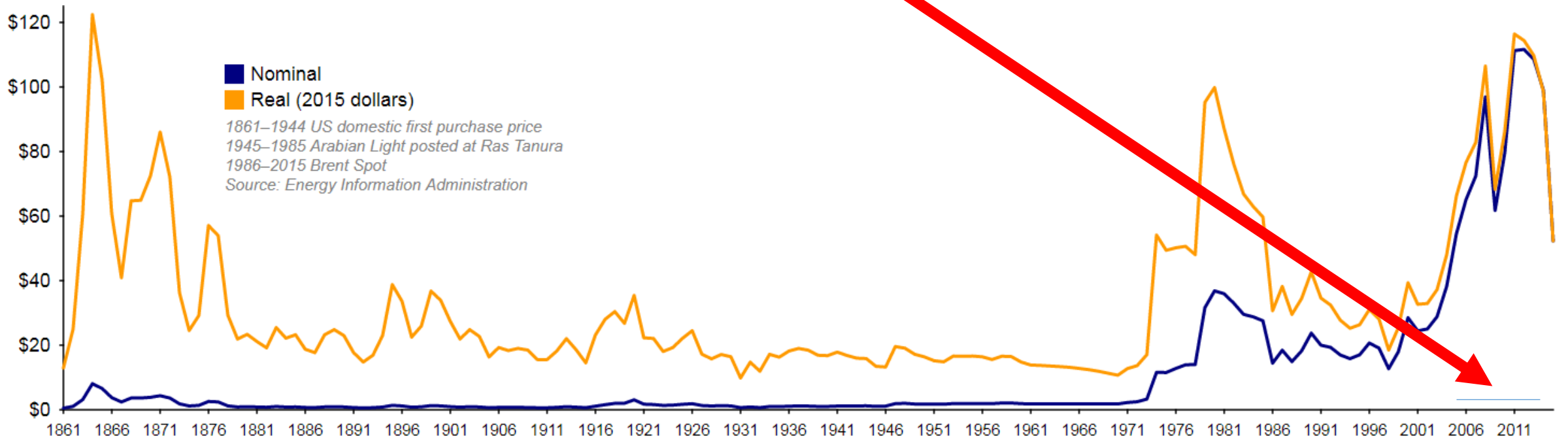
Tough climate policies...?



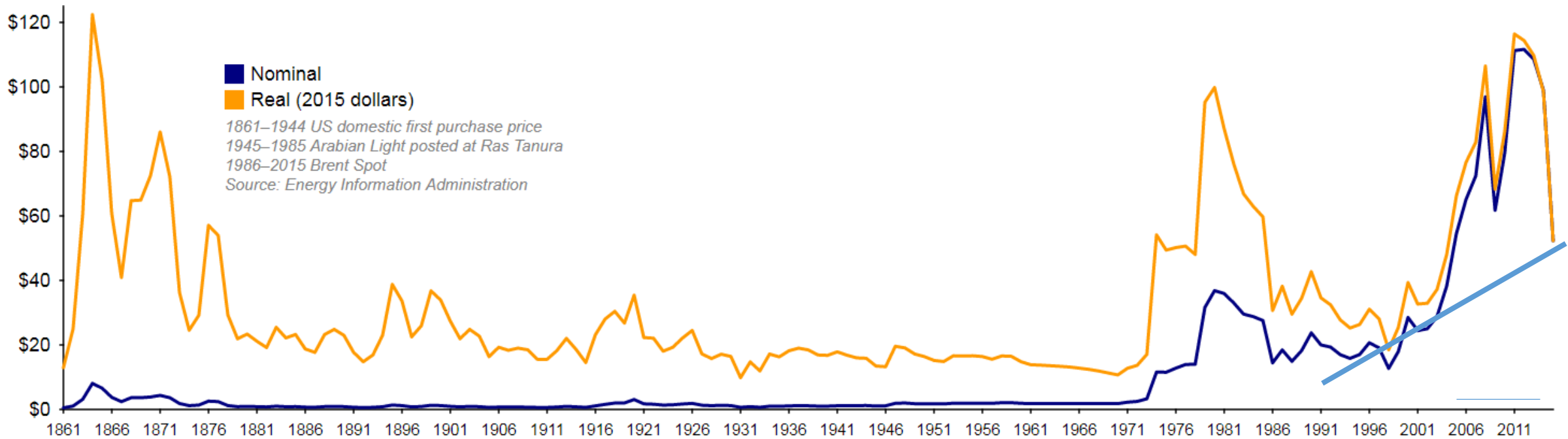
CO2 prices



CO2 prices



CO2 prices SWEDISH CARBON TAX



Copenhagen Failed...



Paris: Succé



Paris: Succé ... or not?



Do Markets Trump Politics?

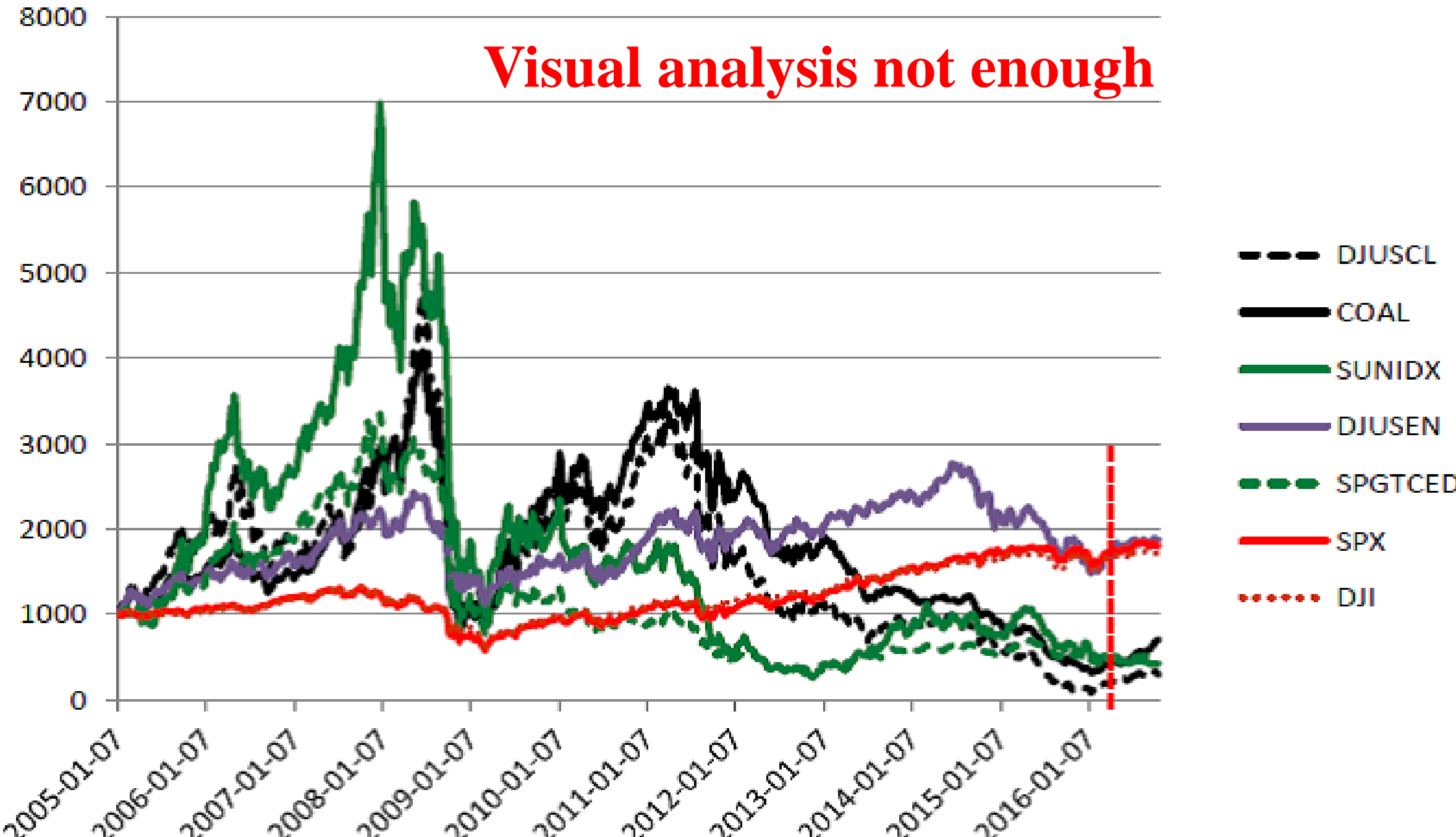
Evidence from Fossil Market Reactions

Samson Mukanjari and Thomas Sterner

University of Gothenburg

February 2018

Visual analysis not enough



Methodology How judge 'success' of Paris?

1. Event Study Methodology

- Efficient Market Hypothesis
- Unexpected new information → abnormal returns.
- Natural experiment.

2. Impulse Indicator Saturation (IIS)

Methodology

Estimating Abnormal Returns

Market Model

$$r_{it} = \alpha_i + \beta_i r_{mt} + \epsilon_{it} \quad (1)$$

$$E[\epsilon_{it}] = 0 \text{ and } Var[\epsilon_{it}] = \sigma_{\epsilon_i}^2$$

$$AR_{it} = r_{it} - (\hat{\alpha}_i + \hat{\beta}_i r_{mt})$$

- In the absence of unexpected news, the expected value of the abnormal returns ϵ_{it} is zero.

Figure 1: The Event Study Time line

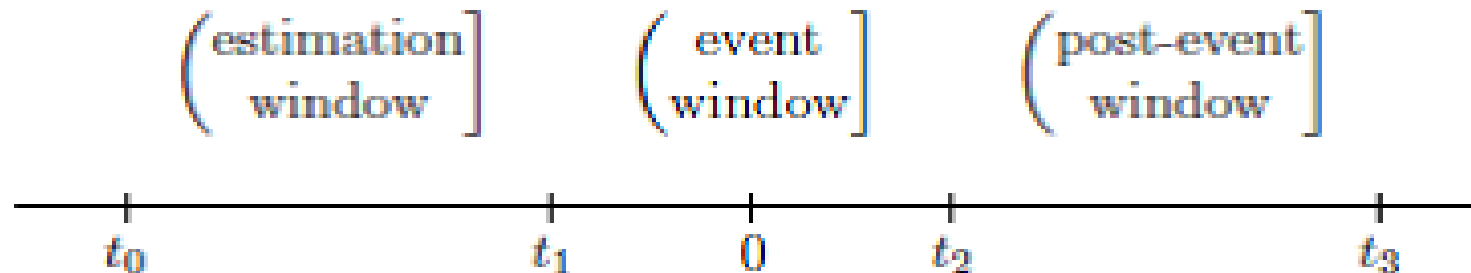


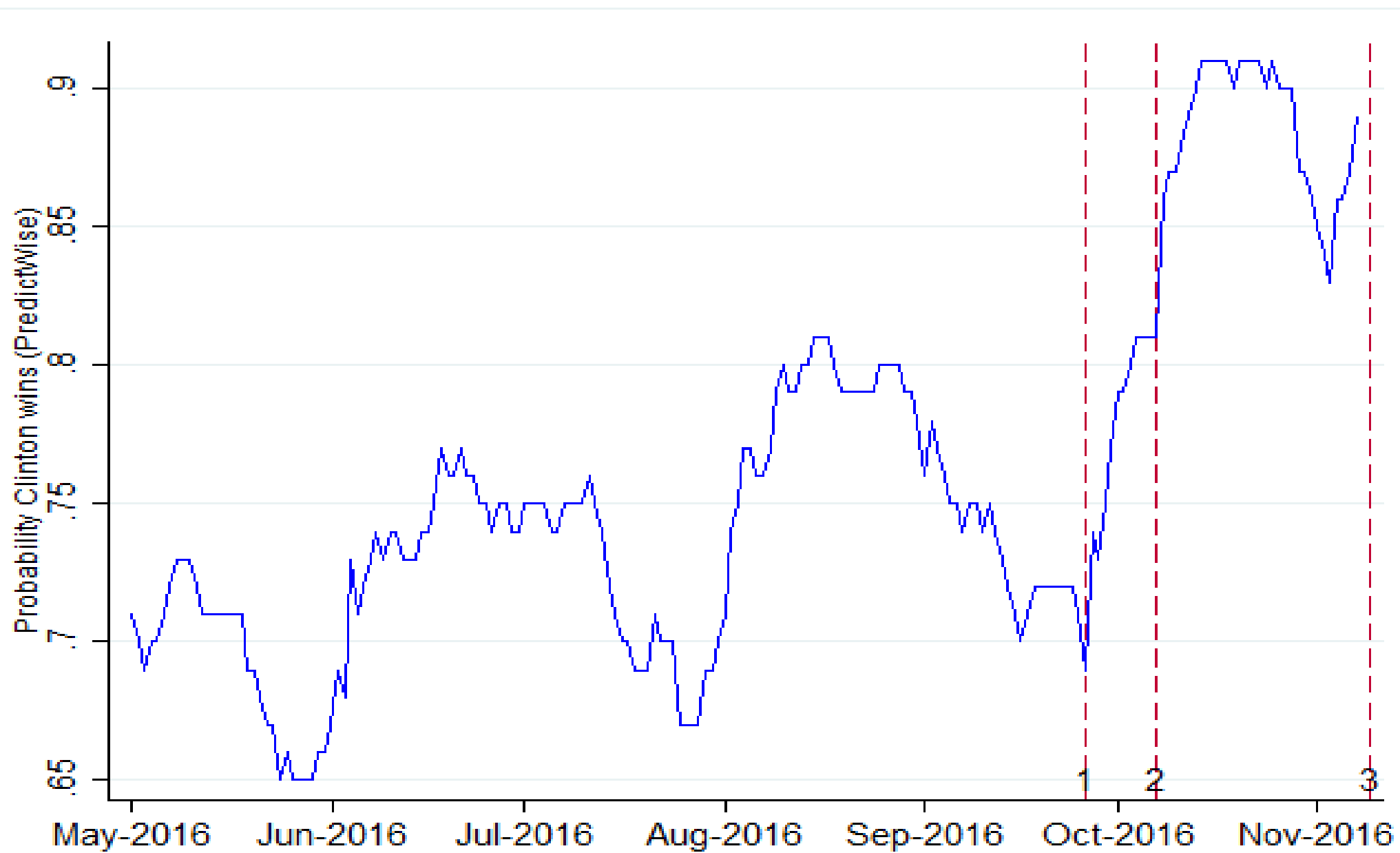
Table 1: Summary Statistics for Exchange-Traded Funds

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	<u>Number of</u> ETFs	<u>Average # of</u> Stocks	<u>Mean ETF</u> <u>Size</u> (M\$)	<u>Average</u> <u># of</u> <u>Countries</u>
<u>Natural Gas</u>	4	51	94	3
<u>Coal</u>	1	31	102	12
<u>Oil</u>	4	57	325	3
<u>Nuclear Energy</u>	1	51	34	9
Clean Energy	7	47	61	12
Solar Energy	2	31	89	9
<u>Wind Energy</u>	1	46	75	17

Timeline

Date	Event
12 Dec 2014	COP 20 in Lima ends
31 March 2015	Countries start submitting INDCs
01 Oct 2015	Deadline for submitting INDCs
30 Nov 2015	Climate negotiation start in Paris
12 Dec 2015	Agreement reached by 195 countries
22 April 2016	Paris Agreement opened for signature on Earth Day
22 April 2016	15 countries submit their instruments of ratification
3 Sep 2016	U.S. and China ratify
21 Sep 2016	55 countries ratify the agreement (first threshold)
2 Oct 2016	India ratifies
4 Oct 2016	EU ratifies (second threshold passed)
4 Nov 2016	Agreement enters into force
8 Nov 2016	COP 22 begins in Marrakech
9 Nov 2016	U.S. presidential results announced
1 June 2017	Trump announces withdrawal from Paris



	Coal	Oil	Natural Gas	Solar	Wind	Alternative Energy	Nuclear
CAAR _{-2,0}	-4.23% (-2.01)**	-1.74% (-0.61)	-3.86% (-1.23)	3.63% (1.20)	-1.14% (-0.75)	-0.22% (-0.18)	-1.37% (-1.01)
CAAR _{-1,0}	-3.09% (-1.80)*	-2.55% (-1.10)	-4.91% (-1.92)*	3.74% (1.51)	-0.26% (-0.21)	0.55% (0.54)	-0.56% (-0.51)
CAAR ₀	-1.48% (-1.22)	-0.39% (-0.24)	-2.13% (-1.18)	4.45% (2.55)**	0.79% (0.90)	0.76% (1.04)	-0.55% (-0.70)
CAAR _{0,+1}	-1.88% (-1.10)	1.74% (0.75)	-0.82% (-0.32)	7.06% (2.86)***	0.39% (0.32)	1.28% (1.24)	0.34% (0.31)
CAAR _{0,+2}	-0.35% (-0.17)	-1.90% (-0.67)	-4.68% (-1.49)	12.91% (4.26)***	2.15% (1.41)	4.20% (3.31)***	1.10% (0.81)
CAAR _{-1,+1}	-3.49% (-1.66)*	-0.42% (-0.15)	-3.60% (-1.15)	6.35% (2.10)**	-0.66% (-0.43)	1.08% (0.84)	0.33% (0.24)
CAAR _{-2,+2}	-3.10% (-1.14)	-3.26% (-0.89)	-6.42% (-1.59)	12.09% (3.10)***	0.22% (0.11)	3.22% (1.97)**	0.28% (0.16)
CAAR _{-10,+2}	-8.36% (-1.91)*	-11.32% (-1.91)*	-15.96% (-2.45)**	16.86% (2.68)***	1.94% (0.61)	4.74% (1.79)*	0.79% (0.28)
Number of stocks	1	4	3	3	1	7	1

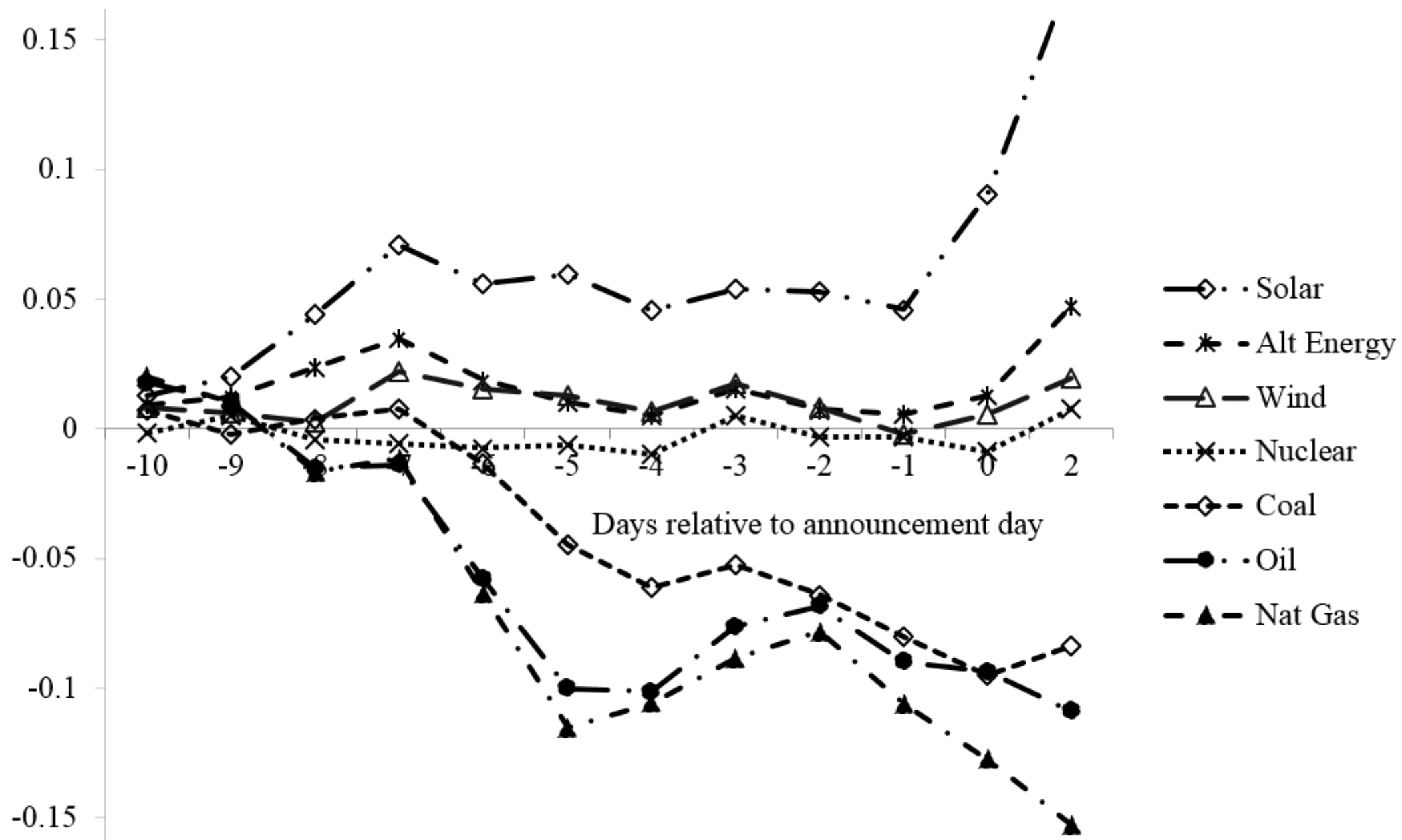
Skip Gas, Wind, Nuclear...

	Coal	Oil	Solar	En eff
CAR _{0,1}	-0.0189	-0.0151**	0.0702**	0.0167
CAR _{0,2}	-0.0036	-0.0128	0.1281**	0.0423*
CAR _{-1,0}	-0.0308	-0.0051	0.0380	0.0090
CAR _{-2,0}	-0.0422	-0.0075	0.0369	-0.0005
CAR _{-1,1}	-0.0349	-0.0125	0.0638	0.0166
CAR _{-2,2}	-0.0310	-0.0126	0.1207	0.0328
CAR _{0,5}	0.0267	-0.0202	0.1995	0.0714*
CAR _{-5,5}	-0.0399	-0.0202	0.1912	0.0582
CAR _{-10,5}	-0.0533	-0.0061	0.2590	0.0739

5. Energy Indices

	Coal	Oil and Gas	Solar	Alternative Energy
CAAR _{-2,0}	-3.06% (-1.25)	-0.50% (-0.28)	3.40% (1.20)	-0.48% (-0.27)
CAAR _{-1,0}	-2.05% (-1.02)	-1.00% (-0.67)	4.11% (1.77)*	1.07% (0.72)
CAAR ₀	-1.97% (-1.39)	0.16% (0.15)	3.92% (2.39)**	1.53% (1.46)
CAAR _{0,+1}	-2.77% (-1.38)	1.82% (1.22)	5.51% (2.37)**	2.33% (1.57)
CAAR _{0,+2}	-1.44% (-0.59)	-0.35% (-0.19)	11.70% (4.12)***	5.84% (3.21)***
CAAR _{-1,+1}	-2.84% (-1.16)	0.65% (0.36)	5.70% (2.00)**	1.86% (1.02)
CAAR _{-2,+2}	-2.53% (-0.80)	-1.01% (-0.43)	11.18% (3.05)***	3.82% (1.63)
CAAR _{-10,+2}	-7.47% (-1.46)	-6.74% (-1.78)*	18.76% (3.17)***	6.09% (1.61)

Cumulative mean abnormal returns



6 Paris Coal
diff countries
No effect in
China, Japan,
Russia etc
US big cumulative
but not sign.

	Australia	India	Indonesia	South Africa
CAAR _{-2,0}	-3.87% (-1.23)	5.37% (1.69)*	-2.08% (-1.27)	-3.25% (-1.03)
CAAR _{-1,0}	-3.41% (-1.32)	5.17% (1.99)**	-0.24% (-0.18)	-5.81% (-2.26)**
CAAR ₀	-2.55% (-1.40)	2.81% (1.53)	-0.04% (-0.04)	-3.68% (-2.03)**
CAAR _{0,+1}	-5.94%	1.28%	1.09%	-2.44%
	(-2.31)**	(0.49)	(0.82)	(-0.95)
CAAR _{0,+2}	-5.19%	-0.89%	-0.08%	2.86%
	(-1.65)*	(-0.28)	(-0.05)	(0.91)
CAAR _{-1,+1}	-6.76%	3.64%	0.89%	-4.57%
	(-2.14)**	(1.14)	(0.54)	(-1.45)
CAAR _{-2,+2}	-6.39% (-1.57)	1.68% (0.41)	-2.12% (-1.01)	3.30% (0.81)
CAAR _{10,+2}	-9.63%	-0.33%	-7.37%	-6.02%

8 Cumulative effects of Trump

	Coal	Oil	Natural	Solar	Wind	Alternative	Nuclear
			Gas			Energy	
CAAR _{-5,-1}	-2.81%	-1.79%	-3.49%	-1.33%	-2.88%	-0.76%	0.27%
	(-0.83)	(-0.48)	(-0.44)	(-0.41)	(-1.52)	(-0.50)	(0.17)
CAAR ₀							
	0.45%	0.84%	1.02%	-6.44%	-4.38%	-2.83%	-4.49%
	(0.29)	(0.50)	(0.29)	(-4.48)***	(-5.17)***	(-4.18)***	(-6.41)***
CAAR _{0,+1}							
	-1.71%	0.98%	0.45%	-6.76%	-7.46%	-3.55%	-3.73%
	(-0.80)	(0.42)	(0.09)	(-3.33)***	(-6.23)***	(-3.71)***	(-3.77)***
CAAR _{0,+2}							
	-2.50%	-1.19%	-2.26%	-8.17%	-8.00%	-2.88%	-5.06%

10 Coal industry
reactions in
other countries
to Trump
election
US industries
very positive

	Australia	Indonesia	Thailand	South Africa
CAAR _{-5,-1}	-2.65%	6.70%	1.16%	-1.37%
	(-0.79)	(1.53)	(0.34)	(-0.39)
CAAR ₀	-4.34%	0.48%	3.58%	1.52%
	(-2.88)***	(0.25)	(2.34)**	(0.96)
CAAR _{0,+1}	-1.39%	4.66%	3.39%	4.64%
	(-0.65)	(1.69)*	(1.56)	(2.08)**
CAAR _{0,+2}	-0.73%	6.16%	4.05%	6.46%
	(-0.28)	(1.82)*	(1.53)	(2.37)**
CAAR _{0,+5}	-3.51%	0.46%	0.18%	1.56%
	(-0.95)	(0.10)	(0.05)	(0.41)
Number of stocks	24	15	5	8

Table 12: U.S. election country-level announcement mean abnormal returns for coal

	United States				
	Full Sample		NYSE		NASDAQ
	I	II [†]	III	IV [†]	V
-5	-0.91% (-0.36)	-0.88% (-0.39)	-0.94% (-0.33)	-0.90% (-0.35)	-0.83% (-0.37)
-4	1.96% (0.78)	2.00% (0.88)	2.23% (0.77)	2.33% (0.92)	1.33% (0.59)
-3	0.80% (0.32)	0.88% (0.39)	-0.16% (-0.05)	-0.15% (-0.06)	2.95% (1.30)
-2	-3.62% (-1.45)	-3.99% (-1.75)*	-3.15% (-1.09)	-3.66% (-1.44)	-4.66% (-2.06)**
-1	-1.07% (-0.43)	-0.92% (-0.41)	-1.48% (-0.51)	-1.31% (-0.52)	-0.15% (-0.07)
0	10.74% (4.30)***	7.72% (3.39)***	10.07% (3.48)***	5.46% (2.15)*	12.24% (5.41)***
+1	1.18% (0.47)	0.10% (0.04)	1.21% (0.42)	-0.41% (-0.16)	1.12% (0.49)
+2	0.25% (0.10)	1.65% (0.73)	-0.84% (-0.29)	1.12% (0.44)	2.71% (1.20)

Table 13: Output from impulse indicator saturation to detect relevant climate-related political and market events between January 2015 and 2017

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	I	II	III	IV	V
Market Returns	0.3123*** (0.0837)	0.3194*** (0.0840)	0.3332*** (0.0844)	0.3194*** (0.0840)	0.3116*** (0.0850)
Paris	0.0668*** (0.0169)	0.0664*** (0.0169)	0.0666*** (0.0171)	0.0664*** (0.0169)	0.0663*** (0.0171)
US Election	-0.0611*** (0.0169)	-0.0635*** (0.0169)	-0.0615*** (0.0171)	-0.0635*** (0.0169)	-0.0637*** (0.0171)
$r_{sc(t-1)}$		0.1419*** (0.0412)		0.1419*** (0.0412)	0.1528*** (0.0416)
04 March 2015	0.0648*** (0.0169)	0.0604*** (0.0170)	0.0648*** (0.0171)	0.0604*** (0.0170)	
05 March 2015	0.0736*** (0.0169)	0.0644*** (0.0171)	0.0734*** (0.0171)	0.0644*** (0.0171)	0.0636*** (0.0173)
20 May 2015	-0.0628*** (0.0169)	-0.0634*** (0.0169)	-0.0629*** (0.0171)	-0.0634*** (0.0169)	-0.0636*** (0.0171)
19 June 2015	-0.0597*** (0.0169)	-0.0619*** (0.0169)	-0.0597*** (0.0171)	-0.0619*** (0.0169)	-0.0622*** (0.0171)
16-dec-15	0.0596*** (0.0169)				

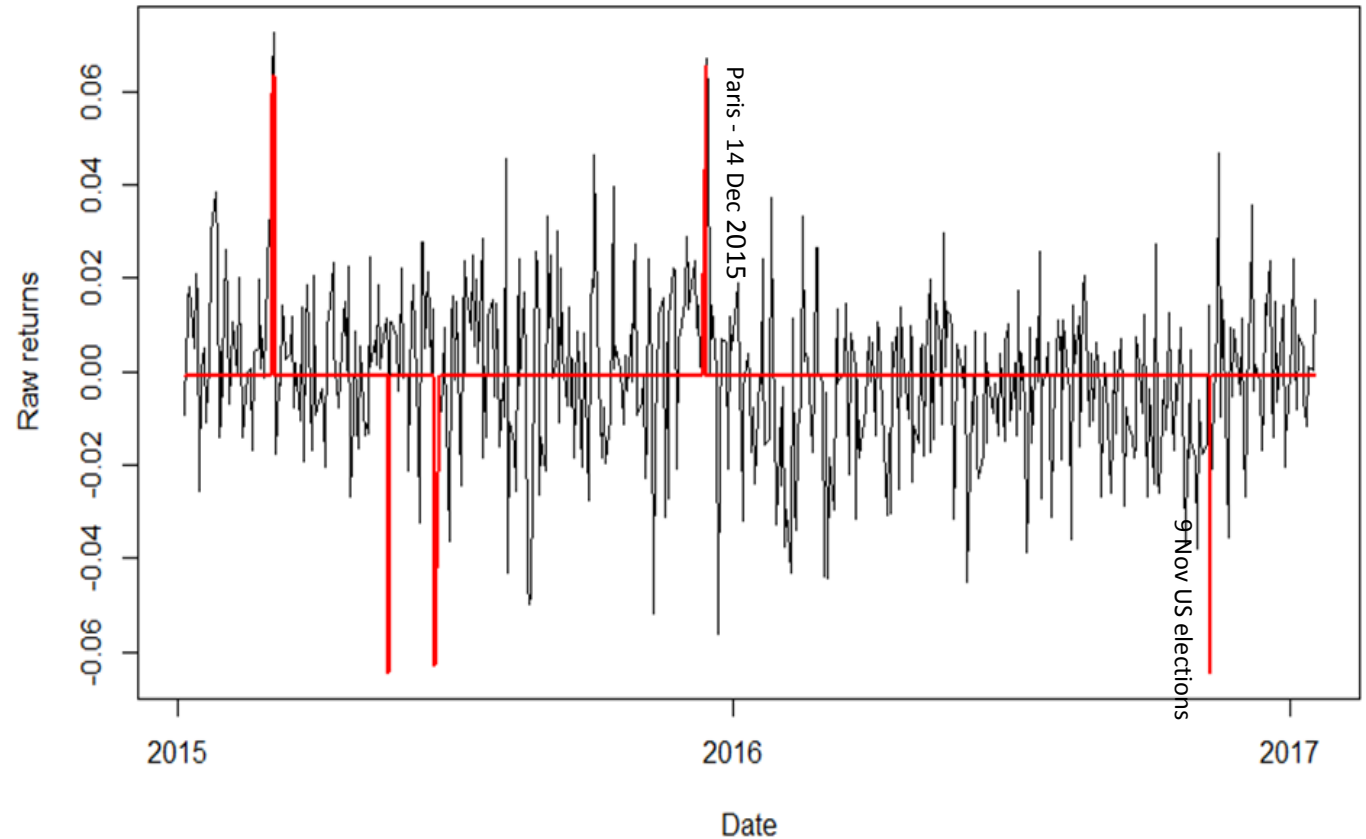
IIS Results

Six additional dates identified by IIS:

1. 4 March 2015
2. 05 March 2015
3. 20 May 2015
4. 19 June 2015
5. 16 December 2015
6. 22 December 2015

All associated with significant events in fossil and renewable markets.

Impulse indicator saturation detected climate-related political and market events between January 2015 and 2017



Other Dates

- Premier Li Keqiang said Beijing would move forward with a proposal to reduce energy intensity and hold down coal consumption growth in 'key areas' (*Herald Sun*, 5 March 2015 23:36)
- On 5 March 2015, Bloomberg also reported that energy storage in the US will more than triple
- 20 May. President Hollande gave an important speech at UNESCO voicing concern for how difficult the Paris negotiations would be
- On 19 June, negative returns for renewables could be explained by several pieces of bad news for wind power in the UK, with large protests against investments and, simultaneously, news of important reductions in UK subsidies

PARIS

- Limited market response
- Contrast media huge `success'.

Two key words:

1. Surprising

2. Strong

Conclusion

- No significant effects for coal.
- Unexpected ?

Conclusion

- Little effect of Paris
- What about Trump?
- Again: little effect.
- Some + renewables, but small

Conclusion

- No significant effects for coal.
- Unexpected ?
- What about Trump?
- Again: little effect.
- Some + renewables, but small
- **No Copenhagen fairness. No Price. No Paris**