Did Paris solve the Problem?

Thomas Sterner
Univ of Gothenburg, EfD, EDF, ..
1. Climate Change & Environment
2. Stiglitz plenary 1%, inequality, AI – Land
3. Price on Carbon
4. Climate negotiations; Fairness
5. Paris
6. Technology & Green Finance
Inertia
Latest CO₂ reading
December 16, 2017
407.08 ppm

Carbon dioxide concentration at Mauna Loa Observatory

Year ending December 16, 2017

- Daily average
- Weekly average
- Monthly average

CO₂ Concentration (ppm)
What is 400 ppm?
4 Million years ago sealevel + 25 M
OM SKIHALLEN
Deaths Toll in India’s Intense Heat Wave Soars to Over 1,100

Temperatures in parts of the country have neared 122°F (50°C)

India’s heat wave has now claimed over 1,100 lives, with spiking temperatures melting roads in the
Local heating in °C per +1°C global average temperature
Mourning the Holocene
Higher costs of climate change

An attempt to reconcile the effects of temperature on economic productivity at the micro and macro levels produces predictions of global economic losses due to climate change that are much higher than previous estimates.

THOMAS STERNER

We are already experiencing the economic impacts of climate change—heatwaves, for example, are increasing hospital absenteeism, as well as sickness in general. But attempts to calculate the economic effects of climate change have produced conflicting results, particularly between estimates at the micro and macro levels. The microeconomic impacts include damages prevented and losses incurred that are reflected in the market, while the macroeconomic impacts involve losses to the whole economy that are not captured in market prices.

The analysis of a regional climate change study of the United States and Canada, published in the Proceedings of the National Academy of Sciences, suggests that heatwaves are already costing the United States an estimated $7.2 billion a year in increased hospital admissions and lost productivity. And that’s just in the United States.

Thomas Sterner
Swiss Federal Institute of Technology in Zurich

The United Nations Intergovernmental Panel on Climate Change, the Intergovernmental Panel on Climate Change, has estimated that the costs of climate change will be $1 trillion annually by 2050. But even if we could accurately calculate the effects to cover the whole economy without double counting or missing vital parts. One thing is certain, the costs are likely to be much higher than we thought.
GLOBAL NON-LINEAR EFFECT OF TEMPERATURE ON ECONOMIC PRODUCTION

Marshall Burke,1,2‡, Solomon M. Hsiang,3,4‡ Edward Miguel4,5
The Impact of Temperature on Productivity and Labor Supply
Evidence from Indian Manufacturing

E. Somanathan¹
Rohini Somanathan²
Anant Sudarshan³
Meenu Tewari⁴

Hot days: Increasing absenteeism
Hot days: Decreasing output
Weaving, steel, diamond polishing...
Stiglitz:
AI take-over: GDP grows, Wages Const. → PROFIT

\[
\pi = \frac{(H + M)F_{LL}}{\text{decline in wage bill}} + \frac{KF_{KL}}{\text{increase in return to } K} = 0
\]
Stable Wages. Rising returns to C, Techn, Land

End of scarcity
The 1% richer
MassUnEmp, UBI
”Land”
Challenge 1 Surplus or scarcity? Role of Land

A  Millions of taxidrivers & physicians replaced → massive joblessness in spite of GDP growth.

B  Worse off! Lost honeybees, fish & ecosystem services

\[ Q = f(K, H + M, L) \]
Also GDP, CO2, CH4, Population Water Dams Urbanis. Fertilizer Fishing..
Planetary Boundaries 2.0

Steffen et al. (2015)
Planetary Boundaries 2.0

Steffen et al. (2015)

= LAND

Climate
Ocean Acidific
Biodiversity
Chemicals
O₃, N, P,
Aerosols
#Planetary Boundaries# = LAND

Policies for Planetary boundaries Depend on the issue.
For biodiversity property rights,
For Climate change:
* An abatement Plan
* A price on C
Challenge 2: Is $P_{\text{carbon}}$ important?

- Heterogeneity
- Links to other sectors
- Effects on technology
- Leakage and border tax issues

- Is economics failing to be relevant?
Taxes and Emission Trading

Source: State and Trends of Carbon Pricing, May 2014, World Bank
Oil prices, and Various Climate policies
Tough climate policies...?
CO2 prices

Source: Energy Information Administration
CO2 prices

- Nominal
- Real (2015 dollars)

1861–1944 US domestic first purchase price
1945–1955 Arabian Light posted at Ras Tanura
1986–2015 Brent Spot

Source: Energy Information Administration
CO2 prices  SWEDISH CARBON TAX

- Nominal
- Real (2015 dollars)

1861–1944 US domestic first purchase price
1945–1985 Arabian Light posted at Ras Tanura
1986–2015 Brent Spot

Source: Energy Information Administration
CO2 per GDP indices

- C/Y World
- C/Y Norway
- C/Y OECD
- C/Y US
- C/Y Denmark
- C/Y UK
- C/Y Sweden
District heating 1970-2006

2007 54 TWh (+ 32 % > 1990) & Bio 24 → 70 %
50 % of total heat. 76 % of flats.
EU promises 20% reduction in carbon emissions by 2020

Ian Traynor and David Gow in Brussels
Wednesday 21 February 2007 00.07 GMT
### FAIRNESS

Different burden allocations

<table>
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<th>Current</th>
<th>GF</th>
<th>Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>5600</td>
<td>2800</td>
<td>800</td>
</tr>
<tr>
<td>INDIA</td>
<td>2400</td>
<td>1200</td>
<td>3200</td>
</tr>
<tr>
<td>Total</td>
<td>8000</td>
<td>4000</td>
<td>4000</td>
</tr>
</tbody>
</table>
CO$_2$ emissions per capita (as C)

Population (billions)

Emissions of CO$_2$ (tC/cap)

USA
Canada, Australia, New Zealand
Russia
Japan
Western Europe (OECD)
Eastern Europe
Middle east
China
Latin America
Asia
Africa
India
Global mean
Copenhagen Failed...
Paris: Succé

Nations Unies
Conférence sur les Changements Climatiques 2015
COP21/CMP11
Paris, France
Paris: Succé ... or not?
Do Markets Trump Politics?
Evidence from Fossil Market Reactions

Samson Mukanjari and Thomas Sterner
University of Gothenburg
February 2016
Visual analysis not enough
Methodology How judge `success' of Paris?

1. Event Study Methodology
   • Efficient Market Hypothesis
   • Unexpected new information $\rightarrow$ 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 \(\epsilon_{it}\) is zero.

*Figure 1: The Event Study Time line*
Response to Paris using Exchange Traded Funds

<table>
<thead>
<tr>
<th>CAR, t</th>
<th>Coal</th>
<th>Oil</th>
<th>Gas</th>
<th>Solar</th>
<th>Wind</th>
<th>Energy</th>
<th>Nuclear</th>
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<td>0.1</td>
<td>-0.0189</td>
<td>-0.0151**</td>
<td>-0.0278</td>
<td>0.0702**</td>
<td>0.0040</td>
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<td>-1.2155</td>
<td>2.0016</td>
<td>0.2220</td>
<td>1.1537</td>
<td>0.2381</td>
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<tr>
<td>0.2</td>
<td>-0.0036</td>
<td>-0.0128</td>
<td>-0.0446</td>
<td>0.1281**</td>
<td>0.0216</td>
<td>0.0423*</td>
<td>0.0116</td>
</tr>
<tr>
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<th>N</th>
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<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>7</th>
<th>1</th>
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</table>

N = 1, 4, 3, 2, 1, 7, 1
<table>
<thead>
<tr>
<th></th>
<th>Coal</th>
<th>Oil</th>
<th>Solar</th>
<th>En eff</th>
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<tr>
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<td>-0.0189</td>
<td>-0.0151**</td>
<td>0.0702**</td>
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<td>CAR&lt;sub&gt;0,2&lt;/sub&gt;</td>
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<td>0.0369</td>
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<td>CAR&lt;sub&gt;-1,1&lt;/sub&gt;</td>
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<td>-0.0310</td>
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<td>0.0328</td>
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<td>-0.0533</td>
<td>-0.0061</td>
<td>0.2590</td>
<td>0.0739</td>
</tr>
</tbody>
</table>

Skip Gas, Wind, Nuclear...
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.
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
Finow Tower I&II, Germany
10 000 roofs?
Indias largest solar farm Kamuthi
Solar bids now within range of Coal fired in India.
Possibility demonstrated
But long way to go
Green finance

• Gothenburg 100 M$ 
• France 10 B€
Green finance

• Gothenburg 100 M$ 
• France 10 B€ 
• Actually renewable investments in trillions 
• Green bonds not cheaper than others. 
• Desinvestment movement has little immediate effect.
Is Technology & Finance enough?

• Technical progress in fossil too

• **Timing of policy**... Weakening Fossil lobby

  • (echo Dixit: no perfect route):
  • Support renewables, green finance, non-gov agents,
  • In the end get a price when fossils are already ½ dead
THANK you and welcome...

6th World Congress of Environmental and Resource Economists

WCERE 2018, Gothenburg Sweden

25–29 June
www.wcere2018.org

Very welcome to the 6th World Congress of Environmental and Resource Economists located at the School of Business, Economics and Law, University of Gothenburg. We welcome you to our campus situated right in the heart of the city.

Call for papers – you are invited to submit theoretical and applied papers in all areas of environmental and resource economics. Suggestions for special invited sessions are also welcome.
11 Benefits of Green Tea That You Didn’t Know About
Summary

• Land alias PB key to conciliating growth, distrib
• Burden sharing did not work
• Cap and trade will not work
• Taxes do not work (outside sweden)
• International agreements do not work
• Fossil interests have captured goverment
• We do not believe in technology policy?
• Green Finance does not work
Thomas Sterner Chaire Développement durable - Environnement, énergie et société
2 simultaneous crises: a Coincidence?
2 simultaneous crises: a Coincidence?
5 KANSKE SKIPPA International climate negotiations

• Efficiency (=Price)
• Sovereignty
• Fairness
• Weitzman Price argument
• Nordhaus club arguments
• Technology .. Changing focuses of lobbyism
“We, economics students of the world, declare ourselves to be generally dissatisfied with the teaching that we receive... We wish to escape from imaginary worlds!”

Challenges to economics both in teaching RESEARCH and Policy
Prices do work if given a chance!
Transport Fuel Use in OECD
Gtons fuel (and \( \sim C^{(12/14)} \))

<table>
<thead>
<tr>
<th>Fuel use</th>
<th>Real UK prices</th>
<th>Real US prices</th>
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<tr>
<td>1.13</td>
<td>0.72</td>
<td>1.47</td>
</tr>
<tr>
<td>-36%</td>
<td>+30%</td>
<td></td>
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</table>
PRICE ON CARBON EMISSIONS  ETS or Tax

• Anyone builds a metro → would be rewarded
• Or a clean factory
• Solar cells, hydroplants, windpower
• Or planted a forest

• REQUIRES ”Fair” allocation of permits
The allocation between US and India
The right to emit valuable
20 Gtons CO2 à 50 $/t = 1000 B$

<table>
<thead>
<tr>
<th></th>
<th>Grand father</th>
<th>Per capita</th>
</tr>
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<tbody>
<tr>
<td>INDIA</td>
<td>4%</td>
<td>16%</td>
</tr>
<tr>
<td>USA</td>
<td>16%</td>
<td>4%</td>
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