Countering Risk and Variability Exposure

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Slides at https://github.com/stevenokimbrough/presentations/blob/master/philosophy-dept-risk-senate-2019.pdf

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Thanks to

- Laurent Guy
- Max Kimbrough
- Tate Shafer

Outline

1. Risk Exposure
   - Observations
   - Proposal
   - Objections
   - Next
2. Faculty Senate Doings
3. End Matter

Speed Drill on a Speed Drill

- Risk is a thing.
- Observation #1: Often, mere exposure to risk or variability is harmful to the agent exposed.
  The “risk is harm” principle.
- Observation #2: Fuel price risk attends use of fossil fuels but is absent with renewable energy.
- Fuel price risk is generally harmful.
- Proposal: Shift risk exposure from electricity customers to fossil fuel producers by taxing fuel price risk and using the revenues to subsidize renewable energy.
- This would add a risk tax, along with a carbon tax and a health tax, to the tools for mitigating fossil fuel externalities.
- The consequences of this reasoning ramify greatly.

In the next ten minutes. . .

- Tell about a couple of topics I'm working on
- Hope to interest you in them
- Hope to get feedback from you in the interests of furthering my thinking

The topics:

1. Exposure to risk and variability
2. Penn Faculty Senate doings

One of the jobs of philosophy is

- To discern meaning and significance in under-appreciated facts
- Recall Peirce: Metaphysics is an empirical science

Am working in that mode.

In deference to speed. . .

- Risk $\approx$ an *unwanted event* which may or may not occur. [Hansson, 2018]
- To be *exposed* to a risk $\approx$ To be harmed if the risk materializes.
- To be exposed to variability $\approx$ To rely on something that is unreliable, that changes
- Martha Fineman [Fineman, 2008] speaks of *vulnerability*. Good stuff.
  Being vulnerable $\approx$ Exposed to risk or variability.

Exposure to risk (and variability)

Often, mere exposure to risk and/or variability is itself harmful (to the agent in question).

- (To become vulnerable is (often) to be harmed.)
- Examples
  - Risk of fire and flood $\rightsquigarrow$ purchasing home insurance
  - Russian roulette on someone else $\rightsquigarrow$ trauma, discomfort
  - Recognized in the law (assault in distinction to battery, etc.), by philosophers, by common intuitions
- But I have not seen the principle explicitly stated . . .
- Why harmful? Because you have to be prepared for what might happen, for what will happen with variability.

Exposure

Exposure to risk and variability is often costly to the target agent, who must prepare and adapt in consequence.

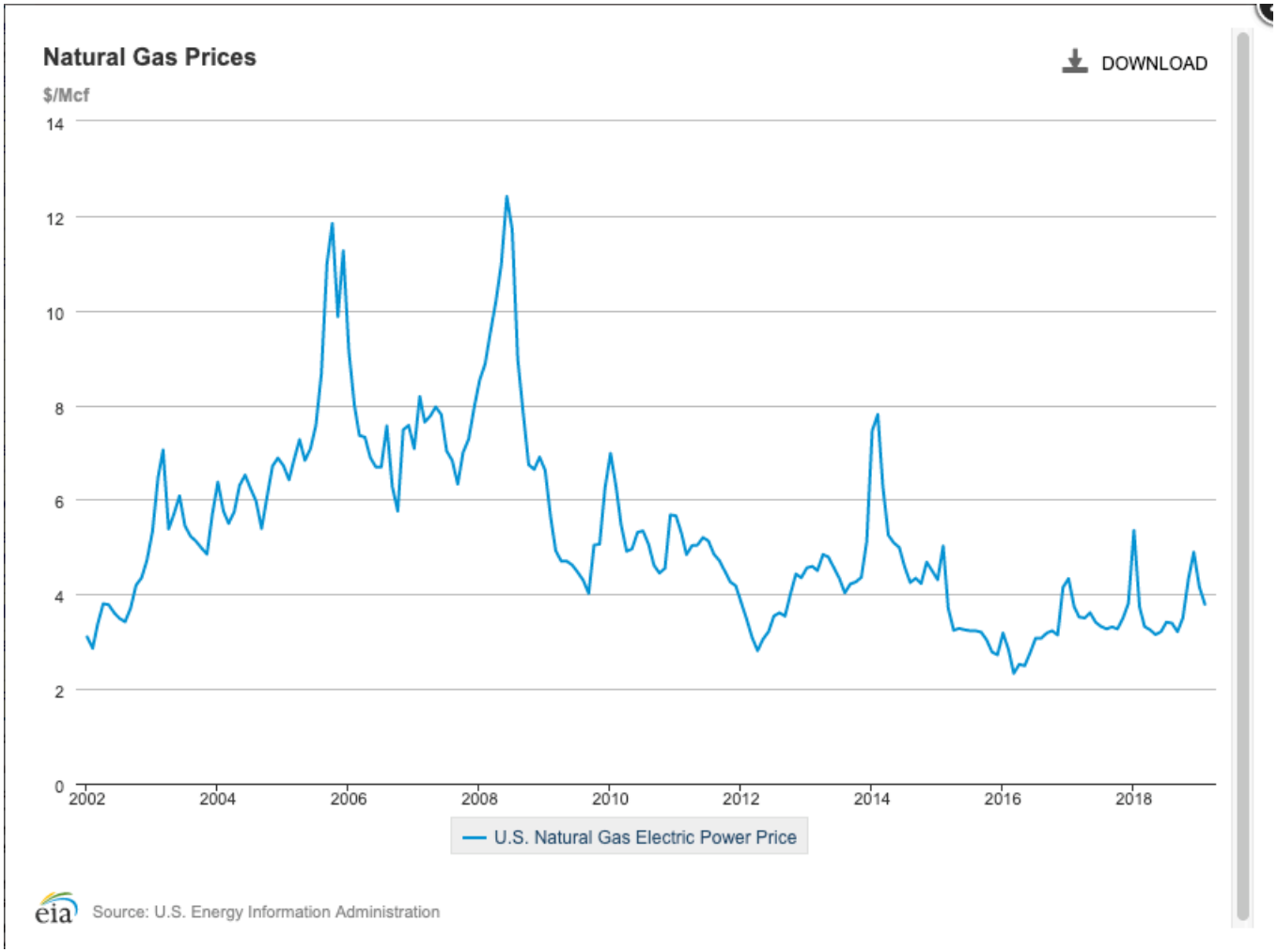
- Who gets exposed to risks (in harmful ways) is often socially conditioned or determined
- Not always from nature, e.g., with a hurricane
- Risk shifting is a major thing, e.g., from defined benefit pensions to defined contribution retirement accounts; reducing “social safety nets”; the gig economy
- Raises important issues of justice.
- What can be done?
- Well, let’s look at natural gas prices. Occasions further observations.

Observation: Natural Gas Power Plant

What will it cost you to produce a megawatt of electricity 15–20 years from now?

- Gas plant owner: I don't know; it depends on the price of natural gas.
- Mr. Market: Hedge with futures contacts.

What have the prices been?



https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm

What will the prices be? Thin market.

Month	Options	Charts	Last	Change	Prior Settle	Open	High	Low	Volume	Hi / Low Limit	Updated
DEC 2019	OPT		2.924	+0.007	2.917	2.924	2.925	2.924	12	No Limit / No Limit	20:05:24 CT 15 May 2019
JAN 2020	OPT		3.019	+0.013	3.006	3.014	3.019	3.013	19	No Limit / No Limit	20:06:43 CT 15 May 2019
FEB 2020	OPT		-	-	2.967	-	-	-	0	No Limit / No Limit	17:55:03 CT 15 May 2019

Figure: Henry Hub futures.

Simple futures contracts for total hedging (20 years) are not available in the market.
Rolling hedge?

https://www.cmegroup.com/trading/energy/natural-gas/natural-gas.html

Rolling hedge

- Monthly futures contracts are available for a few months out (see above).
- Hence: try a *rolling hedge*.
- It's complicated, but I modeled it approximately; good enough for present purposes.
- Finding: October 2019 futures contracts can be obtained at $2.419/MBtu. A rolling hedge can lock in this purchase price for 20 years (or whatever).
- But, there is no free lunch, and (assuming reasonable interest rates) the effective price to the buyer including opportunity costs is $5.64. Assuming gas-driven power generator of average efficiency, this works out to $0.0429/kWh.
- PPAs of 20 years are widely available today for VRE (wind and solar) in the $0.02–0.04 range.

Observation: Renewables

What will it cost you to produce a megawatt of electricity 15–20 years from now?

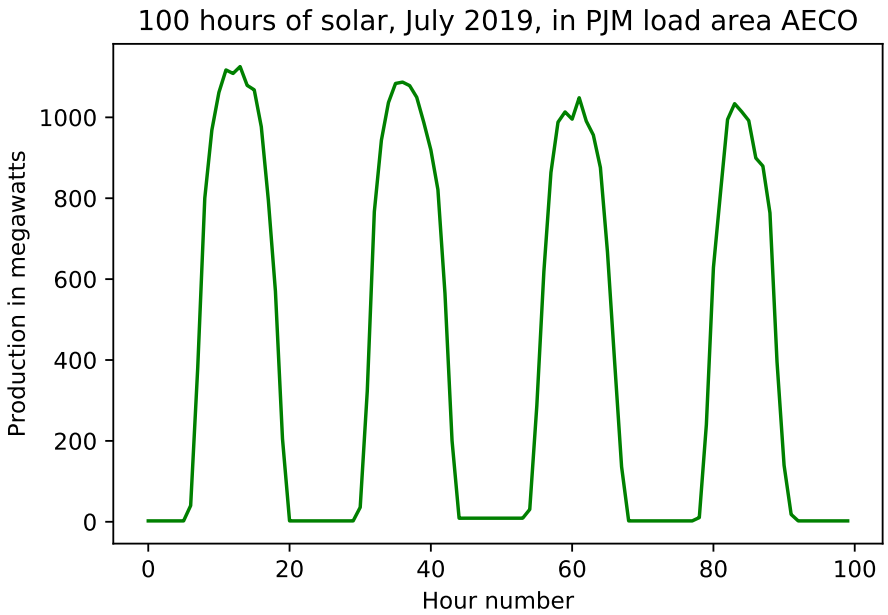
- Solar farm owner: Would you like to buy a power purchase agreement?
- Wind farm owner: Would you like to buy a power purchase agreement?

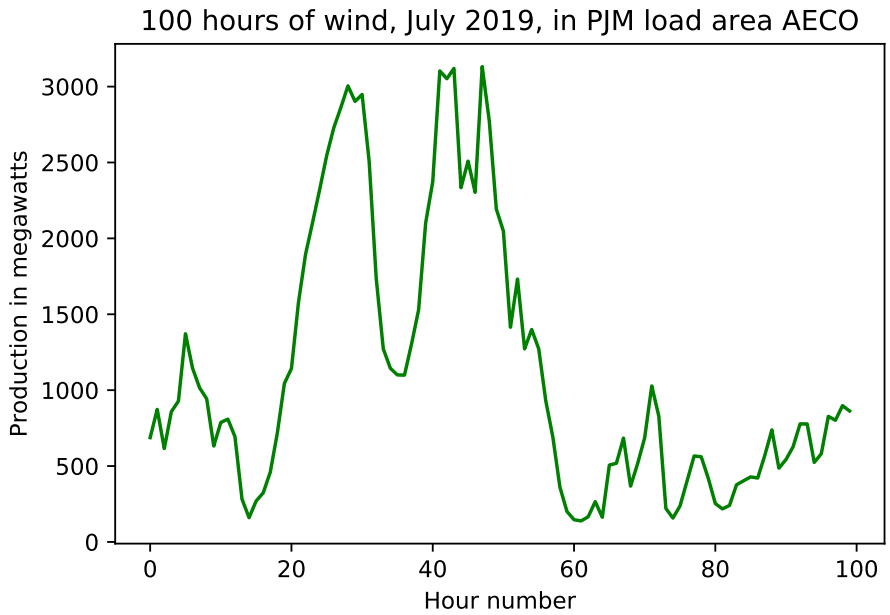
Low price risk. Production risk engineered at inception with a PPA (power purchase agreement).

The Idea

- Tax fuel price risk and use the revenues to subsidize substitution of VRE for gas in existing power plants.
  - Transfers risk from customers to producers.
  - A risk or volatility tax. Compare with a carbon tax, a health tax.
  - Like a “fee and dividend” carbon tax, but the benefits accrue mostly to the customers.
  - But, other mechanisms are possible, e.g., akin to RPSs, simply require a fixed price or full use of VRE.

But renewables are highly variable too!





- Yes, but. . .
- The proposal assumes an operating natural gas generator and encourages substitution of VRE (variable renewable energy) when it is available and nets out cheaper.
- (Load following costs for gas plants are under $1/MWh. Cheap.)

We've all lived with fuel price risk, what's the problem?

- How do you set the tax rate? What if the tax is higher than the benefit because people don't much care about fuel price risk?
- Natural gas is only slightly more expensive than VRE. All of the revenues go to increasing VRE. The net cost increase is very small.
- Happy to have a public debate and democratic decision making.
- Reduction of fuel price risk is a building block, one of many pluses of VRE.

What next?

- If we accept the principle that exposure to risk and volatility is often harmful, we can extend its application well beyond the current case.
- GHG emitters are forcing a costly need to adapt to a warming world . . . They are adding risk. Make them pay for adaptation to the risks of climate change.

Inviting, encouraging participation

- Scholarly communications
  And in particular: open access publishing, and stance towards Elsevier and other publishers.
  open access (pay to publish) vs subscription (pay to read) publishing. Justice? Morality?
- Climate change
  - mitigation
  - adaptation
  - transition

  Culture, norms for a flourishing, just society under climate change? Transition especially engages the entire university (and more).

Interesting models for discussion: Cultural Anthropology `https://culanth.org/`, Climate Risk Solutions `https://riskcenter.wharton.upenn.edu/climate-risk-solutions/`.


Fineman, M. A. (2008).
The Vulnerable Subject: Anchoring Equality in the Human Condition.
Yale Journal of Law and Feminism, 24(1):1–23.


Hansson, S. O. (2018).
Risk.
In Zalta, E. N., editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, fall 2018 edition.

Additional slides

A simple formula governs whether substitution by solar PV (and indeed any VRE generation) will be cheaper than the gas saved. This will occur when

$$C_R < R_H \times C_F \tag{1}$$

where C_R is the cost of renewable energy, measured in dollars per megawatt hour, R_H is the heat rate of the thermal (e.g., CCGT) plant, measured in millions of BTU per megawatt hour, and C_F is the fuel cost, measured in dollars per million BTU. Alternatively, this occurs when

$$LCOE_{VRE} < HeatRate \times FuelCost \tag{2}$$

Note the dimensional characteristics: $LCOE_{VRE}$ (LCOE, levelized cost of energy) is in \$/MWh, *HeatRate* is in MBtu/MWh, and *FuelCost* is in \$/MBtu. Suppressing subscripts we arrive at a simple formula. VRE is a cheaper substitute for gas if:

$$\frac{LCOE}{FuelCost} < HeatRate \tag{3}$$

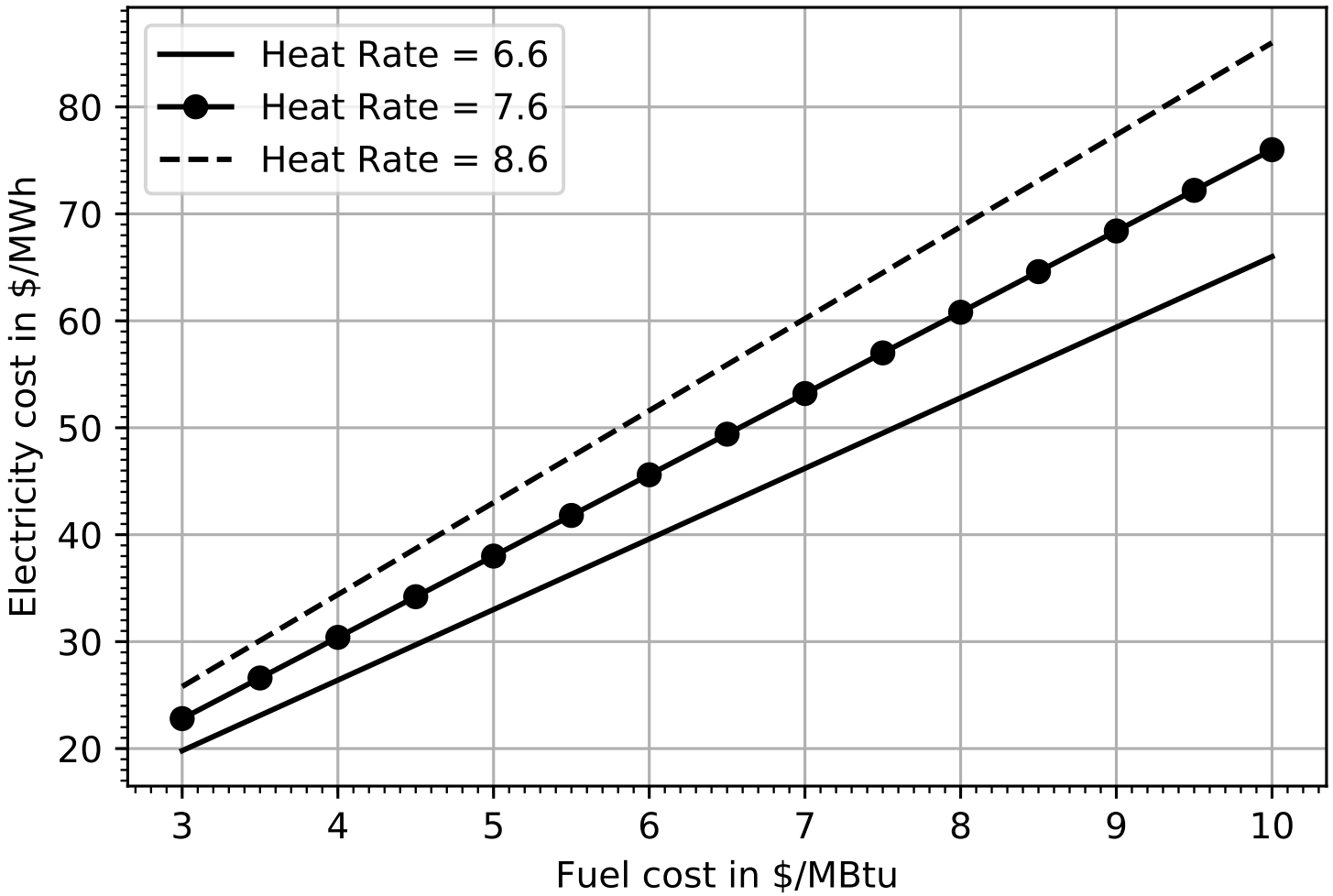


Figure: Electricity cost of fuel as a function of gas price at three different heat rates for CCGT plants. Roughly, 6.6 is a very efficient

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