



# **CAPER**

**Center for Advanced Power  
Engineering Research**

**2017 Summer Research Planning Workshop**

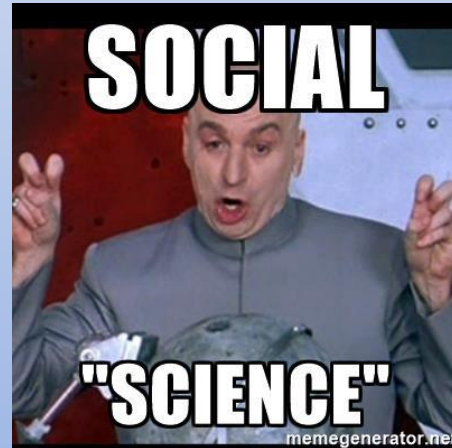
**Energy Economics 101: A Primer on the Economics and Markets of Energy**

**Presented By:**

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College of Charleston**

# What is economics?

- Its a social science
- Study of how society manages its scarce resources



# What is energy economics?

- “Broad scientific [and] economic topics related to the use of energy in [society]”
- Applied sub-discipline of economics



# Study draws heavily from...

- Within economics
  - Econometrics, environmental economics, finance, industrial organization, resource economics, micro- and macroeconomics
- Outside of economics
  - Engineering, geology, political ecology, among others



# Popular topics include...

- Climate change and policy
- Energy markets
- Energy and economic growth
- Energy and environmental policy
- Energy prices, derivatives, and forecasting
- Sustainability
- Demand response

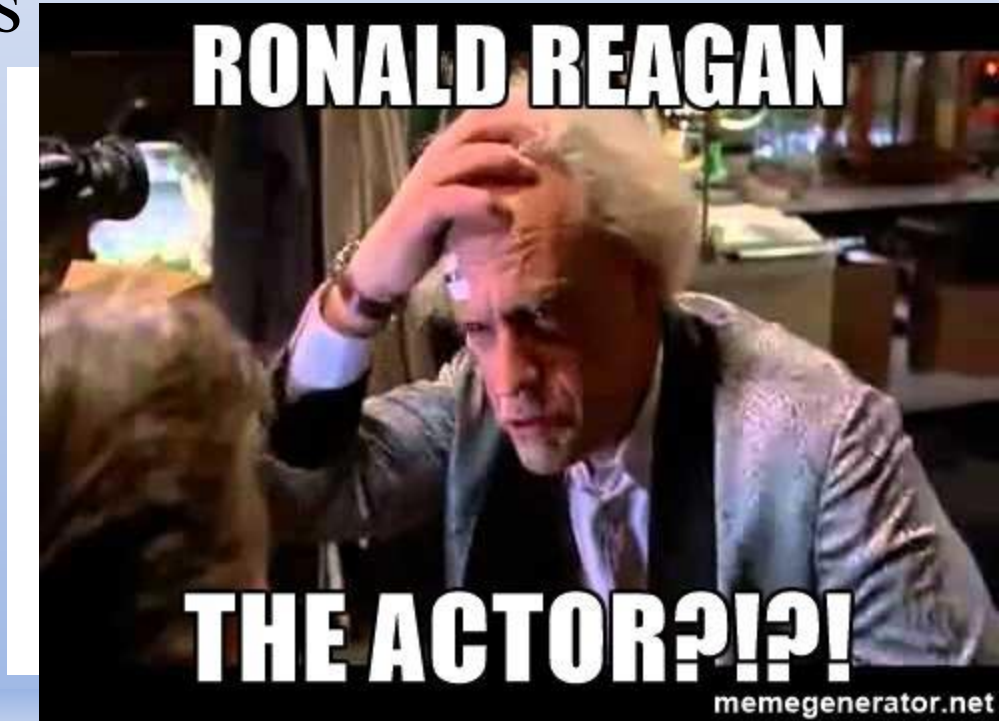
# History of energy econ

- Prior to the 1973 oil crisis
  - Supply side focus
  - Hotelling's (1931) rule
- Starting with the 1973 oil crisis
  - Increasing focus on demand side
  - Renewed interest in Jevons' (1865) hypothesis



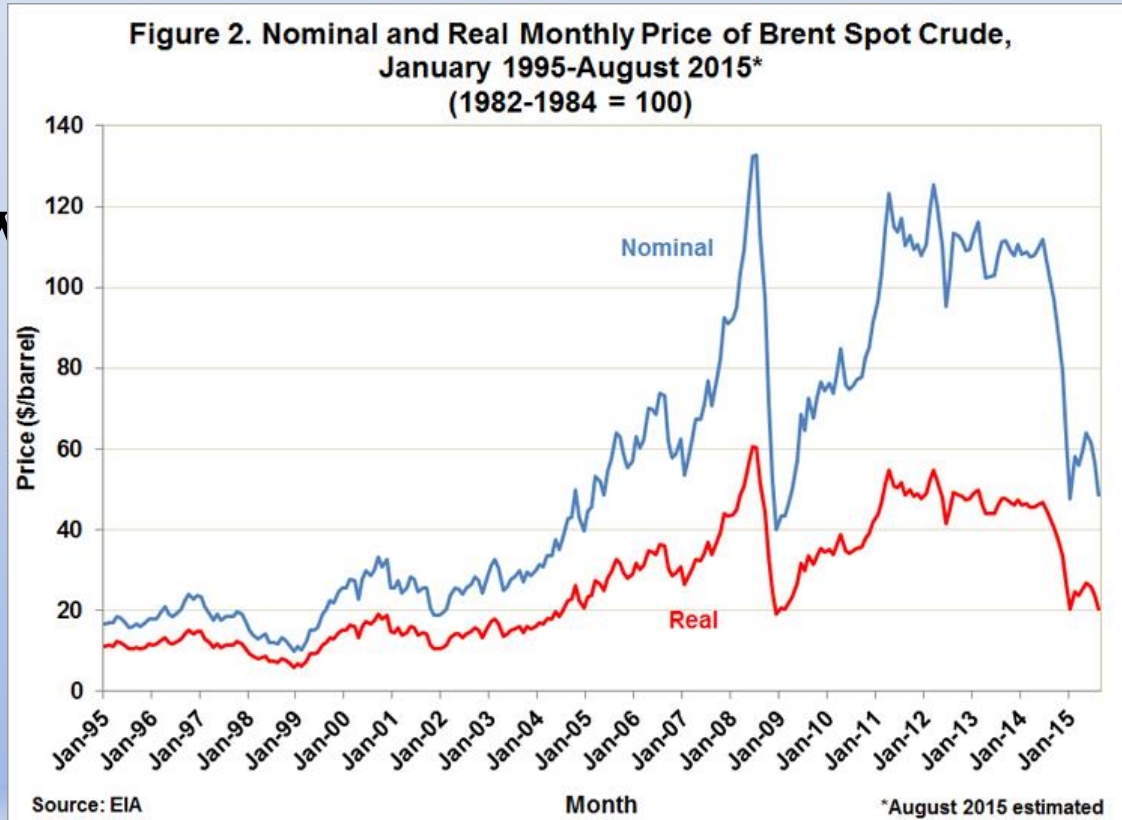
# History of energy econ cont'd

- 1980's



# History of energy econ cont'd

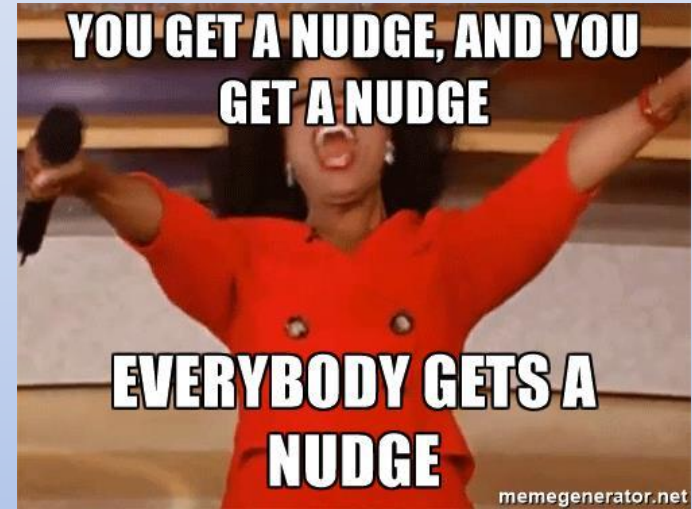
- 2000s
- Renew





# Popular topics

- Efficiency gap
- Experimental studies
  - “Nudge” literature
- Positive/Negative impacts
  - “Resource curse” literature



# Engineering vs Economics

- Definition of engineering w/o econ
  - “*Engineering is the art of directing the great sources of power in nature for the use and convenience of man*” – Tredgold
  - “*... even an uneducated farmer would be classified as an engineer if Tredgold’s language were taken literature...*” - Gillette
- Definition w/ economics
  - “Engineering is the conscious application of science to the problems of economic production” - Gillette

# Engineering and econ are complements

- Development of the steam engine
  - An engineer may seek to reduce the cost of transport from source to destination
  - In the absence of economics, an engineer may think that the source and destination are connected completely by the steel rails of a railway
  - An economist is likely to consider the opportunity cost of the constructing and locating the railway terminals

# Energy efficiency gap

- What does it mean?
  - McKinsey estimates that the energy efficiency gap is worth over US\$ 100B
  - Potential in the US is 10% energy efficiency
  - The difference between the current energy efficiency and the minimizing level of energy efficiency
- Why do the two disciplines disagree?
  - Rebound effects (human behavior)



# Electricity research

Article

## Spatially Explicit Prediction of Wholesale Electricity Prices

International Regional Science Review  
2017, Vol. 40(2) 99-140  
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sagepub.com/journalsPermissions.nav  
DOI: 10.1177/0160017615607055  
journals.sagepub.com/home/irx



James Wesley Burnett<sup>1</sup> and Xueting Zhao<sup>2</sup>

### Abstract

Transmission constraints often limit the flow of electricity in a regional transmission network leading to strong interaction effects across different geographically distributed points within the system. In modern wholesale electricity markets, these transmission constraints lead to spatial patterns within the nodal electricity spot prices. This study exploits these spatial patterns to better predict spot prices within a wholesale electricity market. More specifically, we use the latest spatial panel data econometric models to compare within-sample and out-of-sample forecasts against nonspatial panel data models. The spatial panel data approach is explained by demonstrating a simple network optimization model. We find that a dynamic, spatial panel data model provides the best predictions within a forecasting error context. Our results may suggest that the spatial autocorrelation between node prices extends beyond the current market-defined zonal boundaries, which calls into question whether the zonal boundaries accurately reflect the congestion boundaries within the system.

### Keywords

forecasting, electricity prices, spatial panel data econometrics, locational marginal pricing

# Shameless plug

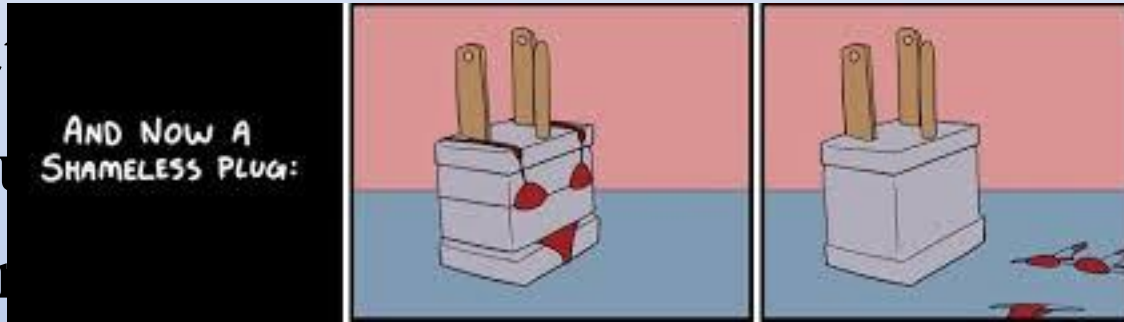
- Burned

- Ind

- Estim

- \$3750 - \$4500 per household

- \$540 - \$650M in total damages (144K households residing)



# Shameless plug cont'd

- Weber, Burnett, and Xiarchos (2016)
  - Economic impacts of nat gas Barnett Shale
  - Expansion in oil and gas taxes led to a decline in effective property tax rate
  - Housing appreciated by 23% at the peak of boom
  - \$1 per student increase in oil and gas tax led to \$0.15 increase in average housing values

Thanks !

