

Comments on Linn & Fell (2011)

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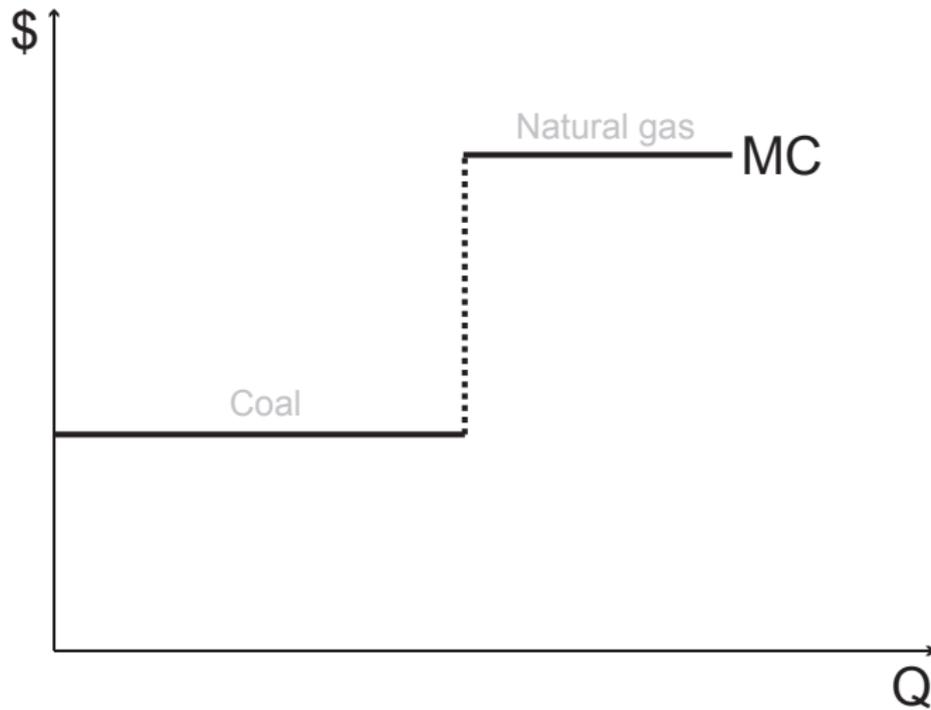
RFF-Chicago Energy Policy Symposium

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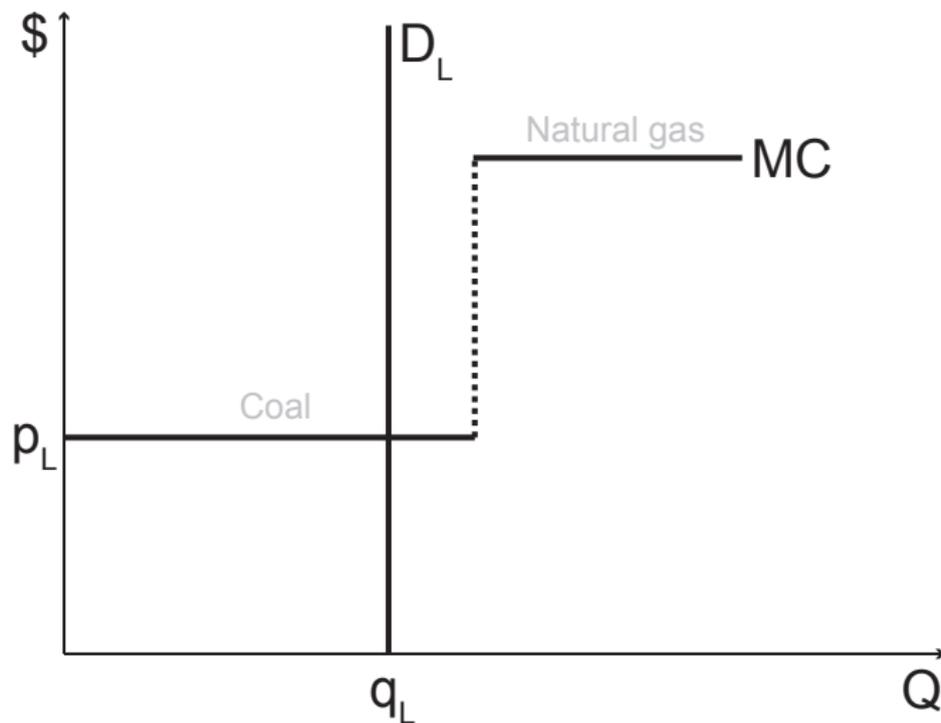
Heterogeneity in environmental value of wind generators

- Several recent papers on the heterogeneity of emissions reductions from wind generation
 - Use short-run fluctuations in wind
 - Capital stock (renewable and non-renewable) held fixed
 - 1 MWh of wind has different emissions reductions in California than in Texas
- This paper: what is the long-run effect of this wind heterogeneity on investment in generation?
 - Both renewable and non-renewable generation
- Modelling heterogeneity is important for analyzing effects of renewables policies
 - RPS / emissions price / feed-in tariff / production subsidies

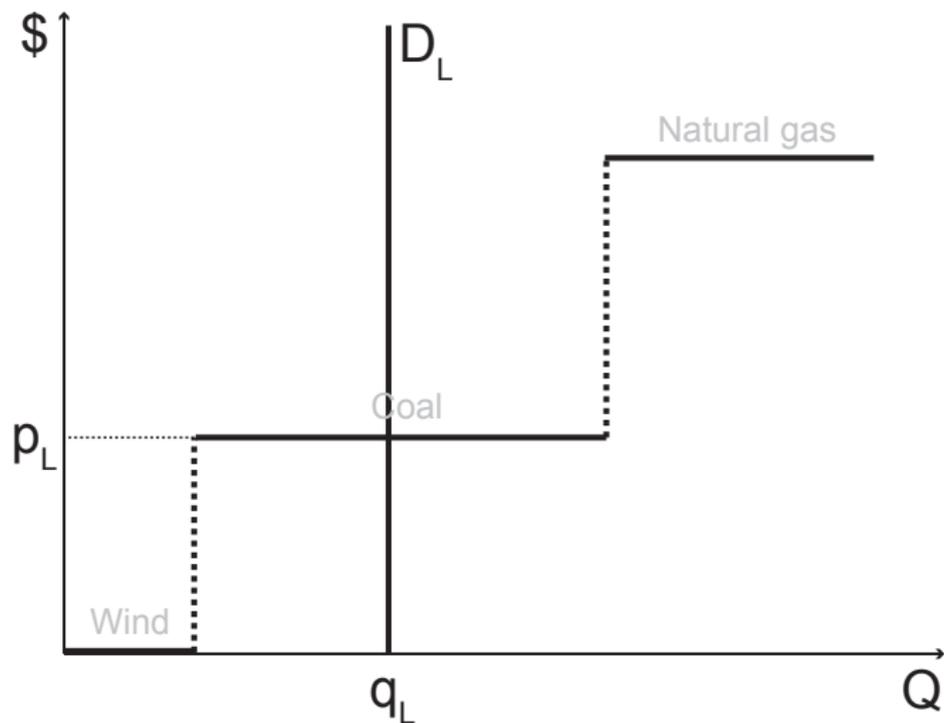
Marginal cost of thermal generators



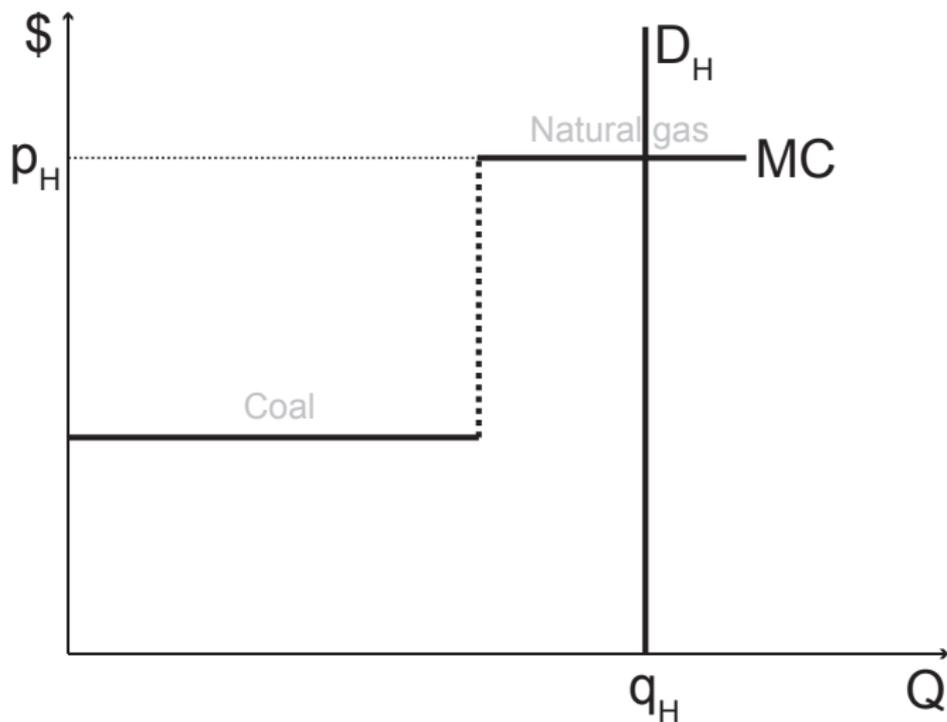
Only coal runs during low-demand, low-price periods



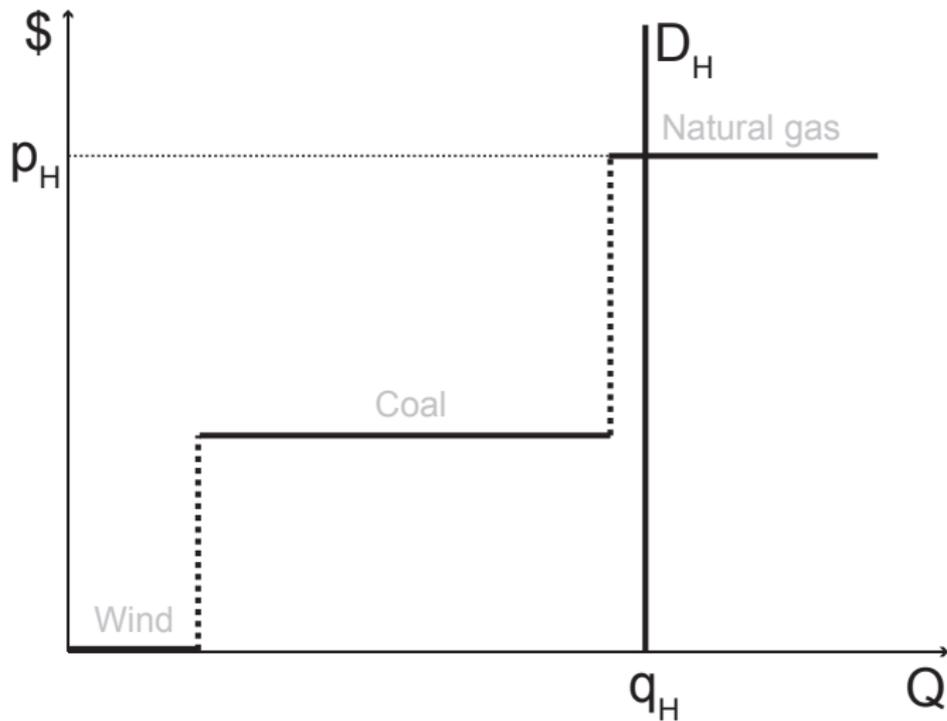
Wind during low-demand periods displaces coal



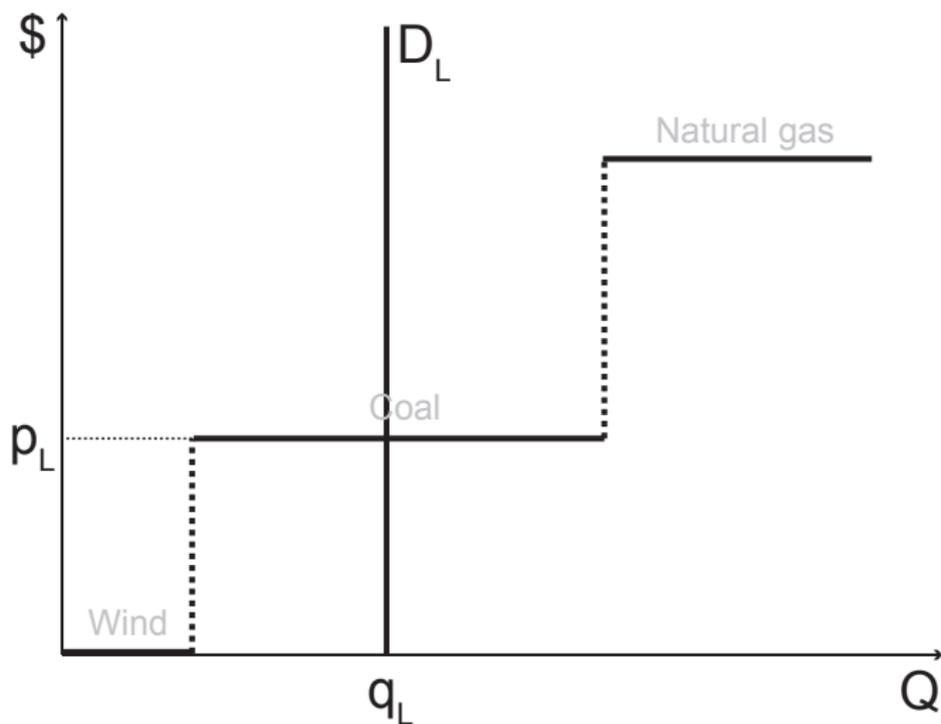
Both natural gas and coal run during high-demand periods



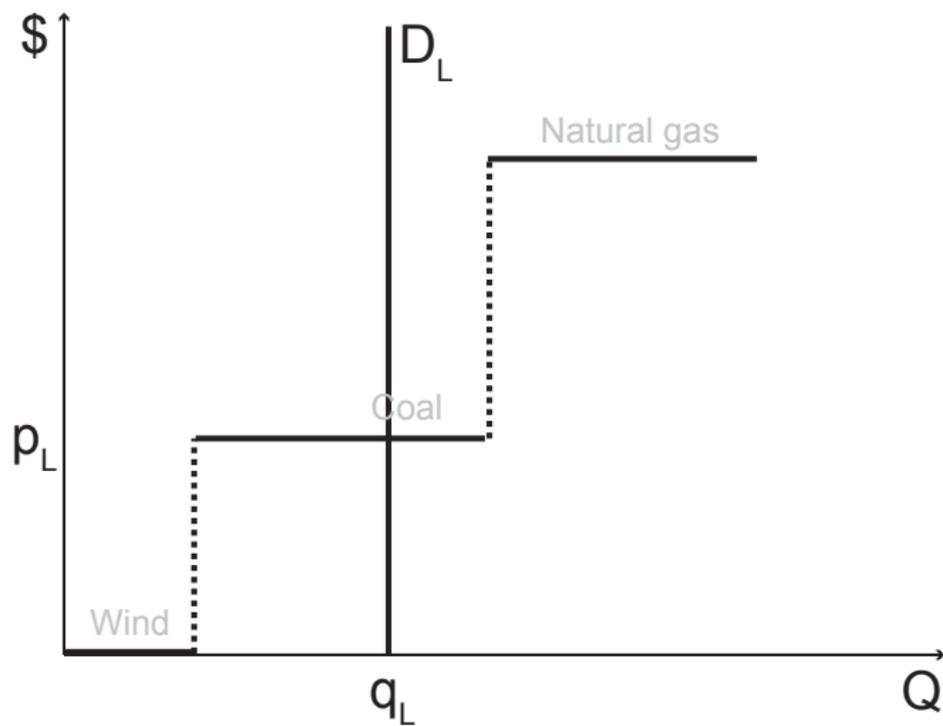
Wind during high-demand periods displaces natural gas



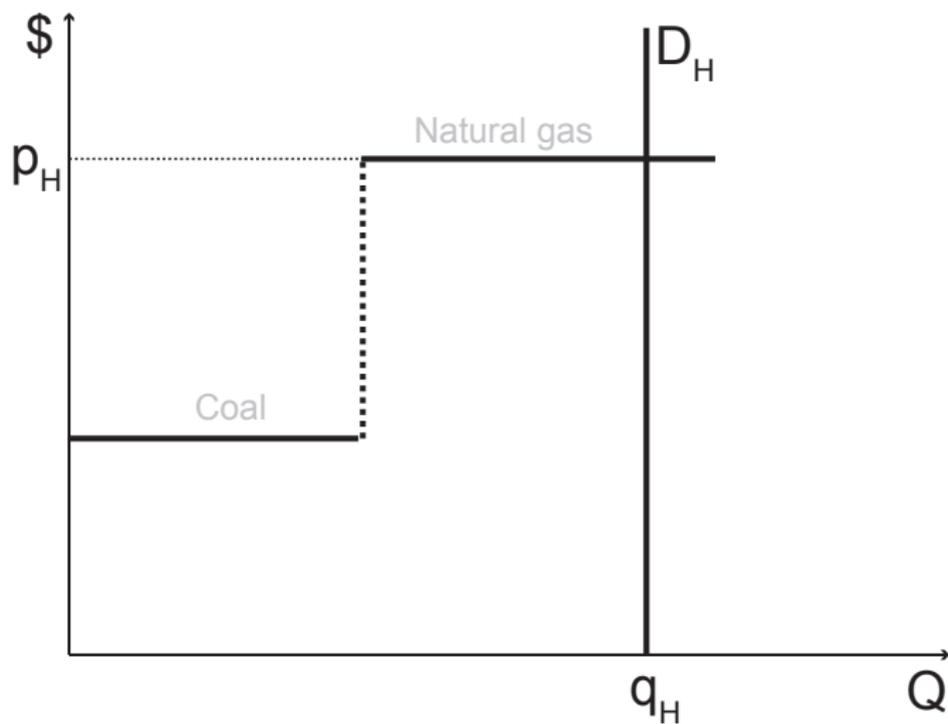
Wind in low-demand periods reduces coal generation...



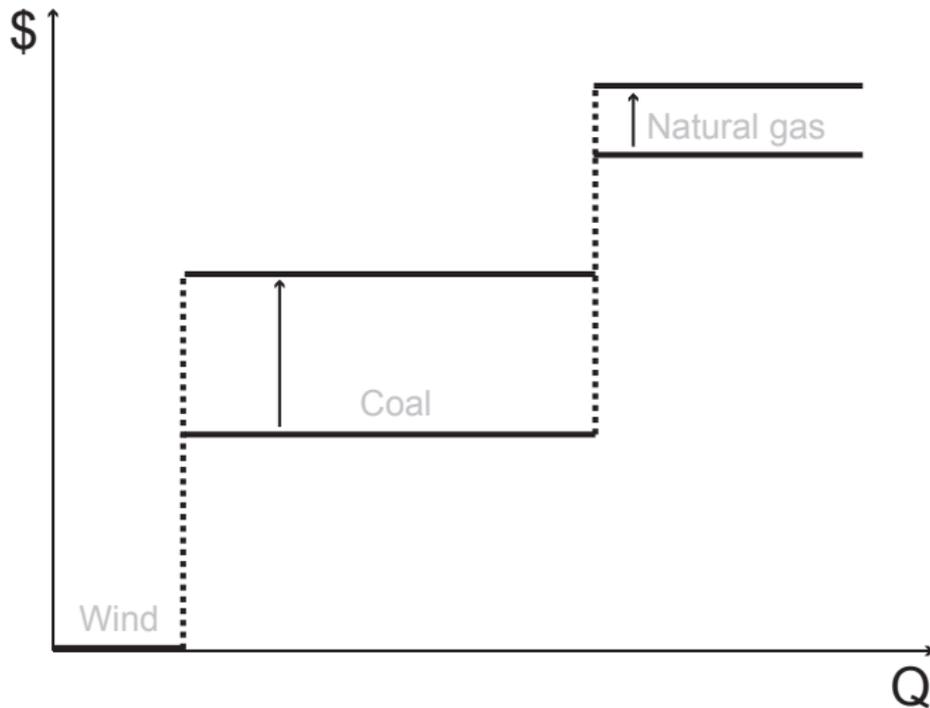
...causing some coal plants to exit...



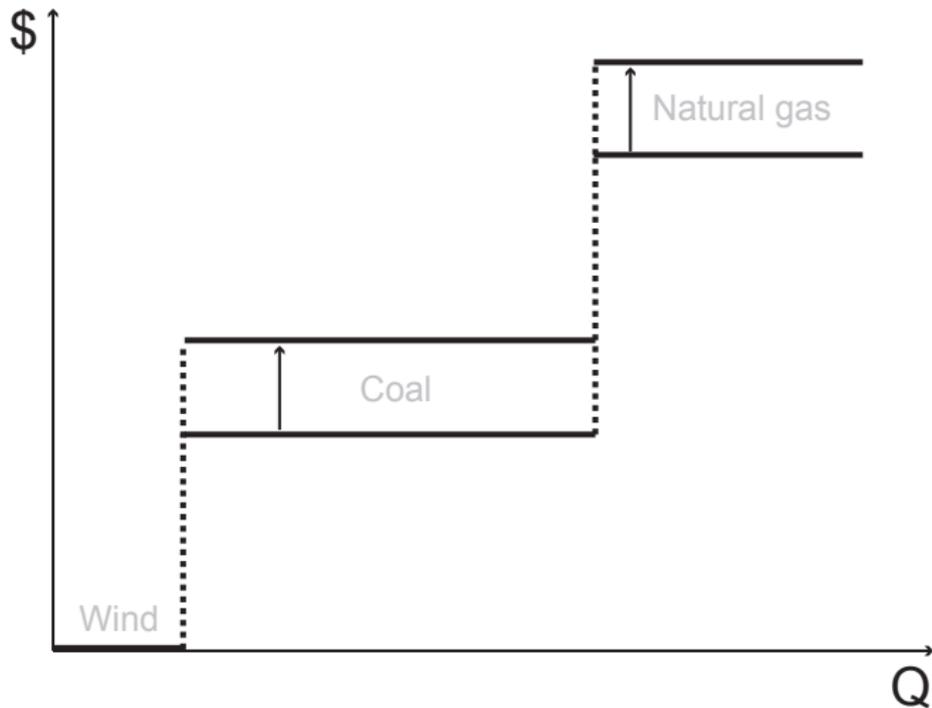
...increasing natural gas generation when demand is high



Emission price effect is bigger for “low-demand” wind



“High-demand” wind does better under an RPS



Questions/comments on model

Time horizon of model

- Major issue of interest: relationship between wind generation and demand
 - Simulated wind data for ERCOT in 2006
- What varies over the 25-year horizon of the model?
 - Investment takes place in first period
 - No exit of existing units?
 - Demand growth (1%)
 - Natural gas prices (exogenous)
- What could you get by modelling one year in detail and capitalizing?

Heterogeneity of simulated wind entrants

- What varies across the possible wind entrants in the model?
 - Capacity factor
 - Correlation with electricity price (high/low demand periods)
- What does not vary across the possible wind entrants in the model?
 - Capital costs
 - Fixed operating costs
- What is the empirical relationship between capital costs, capacity factors, and the correlation with demand?
 - Site preparation and construction costs for wind farms can be very large
- Model assumes that sites with the highest capacity factor are constructed first
 - To what extent does this correspond to the observed pattern of wind investment in Texas?

Effect of storage technology on policy results

- Storage could eliminate the intermittency of wind and solar generation
 - For example, hydro is used in many markets to balance wind
- But might total emissions rise with a storage technology (shift all generation to high-price periods)?
- Detailed model of wind and demand correlation could be used to analyze value of storage

Comparison to model without wind heterogeneity

- What results from the model are due specifically to the heterogeneity of wind?
 - Compare (for example) to Palmer, Paul, Woerman (2011)
 - Different set of modelling assumptions makes this difficult
- Model a scenario with constant wind generation and everything else kept the same
 - Isolate the effect of the wind heterogeneity on the policy comparisons