Impacts of U.S. Shale Gas Boom on European Electricity Prices
Introduction

Research Question: Did cheaper EU coal imports following the U.S. shale boom affect European Electricity prices?

We model Nord Pool Electricity price formation from 2008 to 2019 using ARDL model

Price drivers investigated:
• Hydrocarbon fuel source prices: Brent, North-West Europe (NWE) coal, NBP natural gas, Henry Hub Natural gas
• Wind and hydro renewables production
Coal vs. Natural Gas in U.S. Electricity Generation

Million MMbtu

- Coal
- Natural Gas

Prices of EU and US coal and natural gas

- Coal EU
- Coal US
- Natural Gas US
- Natural Gas EU

$/MMBtu

Nord Pool Electricity Price Determination

- **Dependent variable:** weekly average Nord-Pool system price in USD/Mwh. from week 1 in 2008 to week 20 in 2019

- **Independent Variables:**
  - Crude Oil (Brent spot), Coal (North-West Europe Front Month Forward), and Natural Gas (NBP ICE day ahead price)
  - Nord-Pool hydro reserve and wind power generation

- **Method:** ARDL model
U.K. Natural Gas Price Impact

EFFECT OF 1 STD SHOCK TO U.K. NATURAL GAS ON NORD POOL ELECTRICITY PRICE

Weeks
Hydro Reserve Impact on Electricity Price

EFFECT OF 1 STD SHOCK TO NORD POOL HYDRO RESERVE (10 000 MWh) ON NORD POOL ELECTRICITY PRICE

[Graph showing the effect of a shock to the hydro reserve on electricity price over weeks]
Wind Power Generation Impact on Nord Pool Price

EFFECT OF 1 STD SHOCK TO NORD POOL WIND POWER (10 000 MWh) ON NORD POOL ELECTRICITY PRICE

Weeks

USD/MWh

-20 -15 -10 -5 0 5
NWE Coal Price Impact on Nord Pool Price
What about U.S. natural gas?

- U.S. natural gas price Granger causes NWE coal price in the sample period
- U.S. natural gas price trend also Granger causes Nord Pool electricity price in trend in the sample period
  - Using HH natural gas as an instrument for NWE coal produces similar impact on the Nord pool electricity price as directly using the NWE coal price.
- Suggests the effect of NWE coal on depressing Nord Pool electricity price can be explained by the U.S. shale gas revolution
  - The U.S. phasing out coal domestically in favor of natural gas pushed additional coal onto the international market
Conclusion

- Relatively cheap coal in the period 2009-2019 contributed to cheaper European electricity prices
  - Effect similar to the effect of expanding wind power generation

- Results suggest the U.S. shale boom indirectly affected European energy markets through cheaper coal imports
  - Coal did not face the same export constraints in the U.S. as natural gas
  - Highlights the complex connections between energy markets through energy substitution and international trade.