Research idea summaries

April 3, 2024 Coly Elhai

1 Overview

My methane project with Toren has been somewhat stalled due to issues getting data. We have been working on tidying our workflow and gathering more industry background as we wait for data. Recently, I attended CERAWeek, the biggest annual energy industry conference, where I made new industry contacts and learned about how O&G industry people talk about emissions reductions. We've also discussed trying to take a trip to the field.

Outside of that project, I've been thinking about a few other research ideas (see below).

2 In Progress

1. **Methane and Markets: Firm Incentives to Emit** *with Toren Fronsdal*

   - **Purpose:** Understand the market drivers of methane emissions in order to determine how various policies would affect emissions from the upstream oil and gas sector.
   - **Motivation:** Methane is a powerful greenhouse gas, whose relatively short lifetime in the atmosphere has made its abatement a priority for global policymakers. However, we have little to no evidence on how producers will respond to different types of policies.
   - **Approach:** Use remote sensing data on emissions combined with production, drilling, and flaring records to assess how producer behavior varies with oil and gas prices. Build a dynamic model in which firms make production and flaring decisions in response to prices. Methane emissions arise from production (we assume wells release flat amounts of methane when drilled and every period thereafter) and from flaring, which on average destroys only 90-95% of the methane in natural gas.
   - **Results:** In both theory and empirics, we find that emissions from natural gas flaring and venting decrease with natural gas prices. However, overall emissions may increase with gas prices due to the extensive margin production response.
   - **Contribution:** With (soon to be acquired, hopefully) data on pipeline maintenance events, we will be able to estimate our model and predict the elasticities of drilling and flaring with respect to pipeline capacity. This will allow us to model counterfactuals, such as methane taxes/fees, policies addressing pipeline capacity, increases in drilling costs, and decreases in per-well emissions. We expect to find important interactions between these policies.

3 Ideas

1. **Cost-sharing, ordeals, and climate resilience infrastructure in the U.S.**

   - **Purpose:** Determine whether local cost-sharing requirements and arduous application processes help or hinder the targeting of climate resilience funds towards the communities most in need
   - **Motivation:** The U.S. federal government allocates funding for climate resilience through application-based programs (BRIC, FMA). Communities that receive grants must pay for some share (generally 25%) of total project costs. These requirements screen out applicants with the lowest private project valuations, but may also screen out credit-constrained (in money or labor) localities. The optimality of costly applications and cost-sharing depends on how accurately the government can assess social value of potential projects, as well as the correlation between locality ability to pay and project social value.
   - **Approach:**
     - **Theory:** In a simple model with localities and a central planner, show under what conditions quality of enacted projects, equity increases when the central planner increases application costs and required cost-sharing.

  - **Empirics:** Use data on BRIC, FMA program applications and selected projects to compare the characteristics (including climate risk levels) of applicants and non-applicants, grant recipients and rejects. Assess whether conditions from [Theory] are met, and whether outcomes would improve given changes to application costs and/or cost-sharing requirements.
- **Contribution:** This project will speak to the efficiency and equity impacts of funding climate resilience through competitive grants with cost-sharing requirements. It will suggest ways to improve these funding structures going forward, as climate resilience becomes ever more important.

2. **Emissions in Space: The Case of Manufacturing**

- **Purpose:** Determine the extent to which carbon intensity of manufacturing energy consumption varies across place. Estimate how costly it would be to shift existing production to (or establish new production in) places with more green energy. Does energy-intensive industry tend to locate in places with more or less green energy? Is green energy an important consideration in optimal place-based industrial policy?
- **Motivation:** Manufacturing consumes huge amounts of electricity, and the carbon intensity of electricity varies tremendously across space. Place-based industrial subsidies, such as those being implemented in the U.S., have the potential to shape where manufacturing happens in the long-run, given strong enough agglomeration forces.
- **Approach:** Use plant-level data on energy use, energy type, and production (Manufacturing Energy Consumption Survey + Economic Census for U.S., Annual Survey of Industry for India). First, establish patterns in which industries locate in which places, which industries spend the most on energy, and which places tend to have greener energy (or have greater green energy potential). Then, build a model of optimal firm location choice, accounting for input costs, trade costs, and agglomeration. Estimate model, examine production and emissions under counterfactuals (tariffs, changes in energy costs, place-based subsidies).
- **Contribution:** This project could demonstrate the scale of social welfare gains/losses associated with either relocating existing industry to places with more renewable electricity, or locating new industry in these places. This could be particularly important in countries with a still-developing industrial sector, or countries where long-distance electricity transmission capacity will be difficult to build.

3. **Which Companies Abate? Evidence from 10-Ks**

- **Purpose:** Determine some of the drivers of heterogeneity in abatement performance for pipeline companies and oil and gas producers. What explains variation in leak detection efforts and emissions reductions?
- **Motivation:** Anecdotally, shareholder pressure is one of the major reasons that public companies have increased efforts to reduce their methane emissions. Because different companies have different shareholders, it would be reasonable to expect that abatement effort varies across companies. What impact does this have on actual abatement? Do activist campaigns have any impact on the language around emissions in 10-Ks, or on emissions themselves?
- **Approach:** Using machine learning techniques, analyze what publicly traded producers and pipeline companies say in their 10-K statements (frequency of methane mentions, details on abatement strategies). Link 10-Ks with data on methane emissions. On the pipeline side, follow Hausman and Muehlenbachs (2019) in inferring leaked gas from data that pipelines must report to the EIA on gas purchased vs. sold. On the producer side, combine state regulator data on flaring with EPA GHG inventory data and results from top-down methane surveillance (aerial, drone, etc.).
- **Contribution:** This project will provide insight into how large companies make environmental decisions, and the impact that shareholders can have on public companies.

4 Other topics of interest

- Consolidation within oil and gas and implications for emissions
- Hydrogen Hubs
- Patterns in global methane emissions
- Landfills

- Taiwan Semiconductor Manufacturing Company and water usage
- Data centers and water/energy use