Dissertation Proposal

October 4, 2024 Coly Elhai

1 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:** We use remote sensing data on emissions combined with production, drilling, and flaring records to assess how producer behavior varies with oil and gas prices. We build a model with both static and dynamic components. Firms make dynamic investment decisions that determine the path of future production. Every period, they also decide, for a given level of production, what share of produced gas to flare. Both decisions respond 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 does not completely destroy 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 or remain flat when gas prices increase due to the extensive margin production response. We use the results of our static model to predict the impact of several policies (methane fee, change in tax treatment of flared gas, reductions in pipeline congestion) on flaring.
   - **Future plans:** We plan to estimate the dynamic component of our model to establish how drilling responds to incentives, and how this dynamic response modifies static policy responses. With (soon to be acquired, hopefully) data on pipeline maintenance events, we will re-estimate our static model in a way that is robust to reverse causality between flaring and transmission prices. Possible follow-on projects include modeling the pipeline investment problem and investigating causes of cross-firm variation in emissions-intensity.

2 Early Stage

1. **Climate Grants: Fiscal Federalism in a Warming World** *with Simon Essig Aberg*

   - **Purpose:** Understand the extent to which the distribution of federal climate grants is distorted by the grant mechanism itself, and the costs of this distortion (if any). How expensive is it for localities to apply? Does this select for certain kinds of localities?
   - **Motivation:** Climate-focused infrastructure and resilience funds are being allocated in competitive grant programs comprising billions of dollars. To apply for and manage grant funds, localities must have grant-specific staff or hire contractors/consultants. These activities are costly- are they also welfare enhancing? Are the extra administrative burdens outweighed by better fund targeting, reduced moral hazard, and/or more equitable distribution relative to alternative fund distribution mechanisms?
   - **Approach:**
     - **Theory:** Build a simple model of how local planners trade off spending on local priorities vs. spending on grant applications. Show the conditions under which local planner optimization leads to the aggregate social optimum.
     - **Empirics:** First, characterize grant selection for all federal grant programs. Gather data on state and local grant recipients for all federal grant programs using the USA Spending platform. Use LinkedIn job postings for grant-related positions to assess the relationship between local grant writing capacity and grant acquisition, controlling for other local characteristics (median income, education, etc). Next, focus on FEMA's Hazard Mitigation Assistance program, for which we have data on which localities apply, the status of each application, and grant winners. Use exogenous variation in local capacity

(perhaps using the 5-year timing of Hazard Mitigation Plan deadlines) to test for a causal relationship between capacity and successfully applying for a grant.

- **Contribution:** This project will speak to the efficiency and equity impacts of funding climate resilience through competitive grants. It will also provide evidence on the importance of local government capacity. Our results may also point towards ways of enhancing grant equitability (reducing adminstrating burdens, streamlining processes, etc).

2. **Data Centers**

Data centers are unique in that 1) energy is by far the most important variable input, 2) growth is booming, and 3) the goods they produce are nearly instantaneously transported, meaning they have potential to substitute for electricity transmission. Furthermore, many states already offer substantial tax subsidies for data centers. All these factors make them both intellectually intellectually interested and policy-relevant. Below, I outline the potential components of this project:

- **Part 1: Where are data centers?** There is some data on where data centers locate, but most datasets cover primarily colocation centers and not hyperscale or self-build facilities. We will build our own dataset of data center locations and opening dates using public records, press coverage, and utilities data. To evaluate how data centers impact local amenities (through noise, strain on public utilities, etc.), we will use CoreLogic data to measure the capitalization of data centers into local property values.
- **Part 2: Data centers and the geography of energy demand** Data center energy demand is growing rapidly, constituting an ever larger share of total U.S. electricity consumption. The carbon intensity of electricity generation varies tremendously by place. In general, do data centers tend to locate in places with green or dirty energy? How does the construction of a data center affect the carbon-intensity of electricity generation in a given place? We will combine our measure of data center locations and start dates with public data on utility power generation and GHG emissions from utilities to determine the impact of data centers on fossil fuel consumption.

  There are reasons to hope that data center locations might line up with green energy availability. For one, places with well-functioning electrical utilities might be both better at adding renewable generation to the grid and at coordinating with data centers to provide high volumes of reliable electricity. For another, places with abundant wind and solar energy might have lower electricity prices, making them attractive to energy-intensive industries like data centers. However, the high upfront costs of renewable generation might lead to higher industrial electricity costs, driving data centers towards locations with less renewable generation. The need for low latency might also lead data centers to locate near urban centers, in places with less renewable potential. What is the net effect of these forces, and what are the implications for energy policy?
- **Part 3: What drives data center location decisions?** From speaking with a few people in the industry, it seems like power availability and reliability is one of the biggest drivers of data center location decisions right now. Latency concerns are also very important. I'd like to quantify how important the (fairly substantial) subsidies offered by state and local governments are as compared to other factors to inform optimal policy. I will try to acquire data (compiled by Cailin Slattery) on state and local industrial incentives. I can combine subsidies data with data on latency and electricity prices to estimate a model of firm location decisions.

3 Other Ideas

- **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:** We will collaborate with Insight M, a company that runs methane surveillance aerial campaigns in the Permian Basin. They have methane emissions data attributed to specific producers and pipeline operators. Combined with data on how much gas each company produces or transports, we will derive company-specific measures of operations-normalized emissions. We will then explore what variables predict variation in this measure. For producers, we can look at the scale of production, producer and site gas-oil ratios, costs/contracting, climate commitments, and corporate board makeup. For pipeline operators, we can look at the kind of regulation applied to each pipeline (esp. comparing interstate to intrastate pipelines), frequency and type of maintenance and equipment upgrades, and corporate characteristics (climate commitments, ownership type, earnings reports).
- **Contribution:** This project will provide insight into how companies make emissions decisions.

- **Regulating Emissions: The Impact of New Mexico's Flaring Rules**
  - **Purpose:** Test the impact of New Mexico's rules on flaring and venting on emissions in the state.
  - **Motivation:** In March 2021, New Mexico announced rules that would eliminate routine natural gas flaring by 2026. The rules called for operators to reduce flaring and venting starting May 2021, with the goal of achieving 98% capture by 2026. Given the challenges of enforcing flaring regulation (especially with limited state budgets), it is not obvious that rules alone would reduce flaring. Any flaring reductions in recent years could also be atttributed to voluntary corporate commitments (by Exxon, Chevron, etc.) to curtail routine flaring in order to reduce emissions.
  - **Approach:** Compare flaring and venting across Texas and New Mexico after these new rules took effect. Focus in particular on the Delaware Basin, since this basin spans the border between Texas and New Mexico. Use producer-reported data and satellite data to assess changes in trend around the time of New Mexico's policy change.
  - **Contribution:** As policymakers decide how best to reduce emissions from the oil and gas sector, it is important that we better understand how producers respond to regulation. Constraints to local regulators' enforcement capacity may limit the effectiveness of new regualtion.