Dissertation Proposal

November 6, 2024 Coly Elhai

1 Questions

I include in section 2 all of the projects I'm currently working on, and in section 3 some other (methane-related) ideas. We don't need to discuss all of these projects: given time constraints, I'd like to prioritize the following questions.

- Methane
  - Thanks for your comments on the slides!
  - Is this a good time to update and post the draft? We think we have all the components we need for a full paper, except for dynamic estimates.
  - Is it worth doing the analysis on the subset of pipeline contracts we observe, as recommended by Ed/Ariel? Or can we get away with just referencing the existence of a liquid secondary market, as you reference in your comment?
  - How much should we worry about the fact that the unit of observation we use for our static estimations is a producing company, and some of these companies produce a large share of total Permian production? The atomistic agent assumption may be violated. Does it make more sense to switch to lease-level regressions with company FE?
- Grants
  - It will take some investment of time to figure out how useful the LinkedIn data is. What do you see as the first fail-point we should try and look for?
  - The local government capacity question is likely to yield interesting results, but not necessarily in the realm of climate policy and/or disaster resilience. Is that okay?
- General
  - Advice on how to structure the multi-adviser meeting?
  - Advice on how to navigate this political moment?

2 Projects

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.
   - **Status:** The main part of our analysis is complete. 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. We still need to estimate GE effects in our static model, as well as the dynamic part of our model,

- **Challenges:** It has proved difficult to estimate our static model in a way that yields a reasonable cost function, perhaps due to simultaneity bias coming from production shocks that increase both flaring and transmission costs. We've been trying for over a year now to acquire data on pipeline maintenance events, which we hope to use to re-estimate our static model in a more robust way.

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

   - **Purpose:** Understand the extent to which local government capacity impacts localities' ability to apply for and win competitive grants. Does the distribution of federal climate resilience money via competitive grants select for high capacity localities? Does it select for the most vulnerable communities?
   - **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 dedicate many staff hours to grant administration and paperwork, or hire contractors/consultants. These activities may be out of budget for some localities, even those that would benefit from resilience funds.
   - **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 to test for a causal relationship between capacity and successfully applying for a grant.
   - **Status:** Ed is very excited about the idea of using LinkedIn to measure local government capacity, and has promised funding and an RA to help build this dataset. We've spoken with climate resilience folks in several localities, and are scoping out potential options for exogenous variation in local capacity.
   - **Challenges:** Exogenous variation in local government capacity is hard to find. Options we've considered: applications for/recipience of (non-financial) Direct Technical Assistance from FEMA; receiving an AmeriCorps fellow through a program focused on building local capacity; the 5-year timing cycle of Hazard Mitigation Plans (which are time-intensive to write and are a pre-requisite for receiving FEMA grants). We're also concerned that we have no measures of how well localities implement grants, and so can't speak to the efficiency of grant allocations.

3. **Data Centers**

   Data centers are unique in that 1) energy is by far their most important variable input, 2) industry growth is booming, and 3) the goods they produce are nearly instantaneously transported, meaning they can locate near green power generation without incurring high transport costs (thus avoiding the need for expensive, long-distance electricity transmission). Furthermore, many states already offer substantial tax subsidies for data centers. All these factors make them both intellectually interesting and policy-relevant. Below, I outline the planned components of this project:

   - **Part 1: Where are data centers?** There is some data on where data centers are located, but most datasets cover primarily colocation centers rather than hyperscale, self-built, or cryptomining facilities. Using public records, media coverage, and utility data, we will create a novel dataset of data center locations, opening dates, and other characteristics. This dataset will be a valuable resource for researchers and stakeholders interested in exploring the impacts of data centers on various economic outcomes. To date, there is no comprehensive, publicly available dataset on where data centers are located. The private companies that collect such data primarily sell it to industry participants, set their prices in the hundreds of thousands of dollars, and may restrict how researchers can use this information.
   - **Part 2: How do data centers impact local residents?** While integral to the digital economy, data centers may generate local negative externalities. One particularly salient externality is noise produced by data centers' cooling systems. These have been covered in the media and are the subject of ongoing lawsuits by communities seeking injunctions against data centers. Using a difference-in-differences research design, we will explore whether data center noise affects housing values and quantify the extent of this

effect. This analysis will provide insight into the broader social costs of data center expansions and will be the first large-scale study to examine how data centers impact local housing economies.

- **Part 3: 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. Do data centers tend to locate in places with green or dirty energy? How does operating 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 greenhouse gas emissions from utilities to determine the impact of data centers on fossil fuel consumption and associated carbon emissions. We will then investigate the causes behind any patterns we discover, including electric utility organization and interconnection queue delays.
- **Part 4: What drives data center location decisions?** Power availability is one of the biggest drivers of data center location decisions. Latency concerns are also very important. We will model the data center location decision, accounting for power, latency, labor and construction costs, zoning barriers, and subsidies offered by state and local governments. Our results will speak to the efficacy of these subsidies and optimal policy given spatial differences in the carbon intensity of data center operation.

Parts 1 and 2 of this project will be joint with Simon Greenhill (Berkeley ARE, 5th year) and Gary Schlauch (Berkeley ARE, 3rd year). Parts 3 and 4 may be joint with other collaborators.

Status: We have several RAs who are helping us complete Part 1.

Challenges: The parts that are most interesting to me about this project (3-4) may involve making significant investments in learning about electricity markets. They also may bring me further into IO, which is not one of my fields. Furthermore, I'm not sure yet whether the question is well-defined or policy-relevant enough to be worth pursuing.

3 Other Ideas

- **Which Companies Abate? Evidence from 10-Ks** *with Toren Fronsdal*
  - **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** *with Toren Fronsdal*
  - **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.

- Follow-on projects on methane: Possible follow-on projects include modeling the pipeline investment problem and investigating causes of cross-firm variation in emissions-intensity.