

## Research Proposal

### Summary and Introduction

Leaking underground storage tanks (USTs) are the leading documented source of groundwater contamination in the United States, with cleanup costs frequently exceeding \$100,000 per site (Marcus 2021). Despite leak risk being highly predictable based on observable characteristics like tank age and wall construction, 36 states continue to operate public trust funds that charge every facility the same flat premium. This flat-fee structure socializes liability, diluting incentives for safety investment and crowding out private insurers who could price risk more efficiently (Shavell 2007). This creates a classic case of distorted property rights: high-risk facilities are cross-subsidized by low-risk ones, eliminating the price signals necessary to encourage pollution-reducing investment.

This context motivates my central research question: *How does replacing government-administered flat-fee liability insurance with actuarially priced private insurance affect firm investment behavior and environmental pollution rates?* I answer this by exploiting a natural experiment in Texas, where the 1999 closure of the state's Petroleum Storage Tank Remediation Fund forced all facility owners to transition to private insurance (Texas HB 2587 Analysis 1995). This policy shock allows for a clean comparison between Texas facilities, which faced actuarially fair risk-based premiums, and facilities in 18 control states that retained flat-fee public funding. My preliminary results provide the first facility-level causal evidence that market-based insurance pricing reduces pollution externalities. I find that replacing flat fees with risk-based premiums caused facility owners to replace aging, high-risk tanks with safer technology, reducing leak incidents by approximately 30 percent. During the PERC Graduate Fellowship, I will extend this analysis by estimating a dynamic structural model of tank retirement to simulate and

compare the welfare effects of private insurance markets against command-and-control mandates and technology subsidies.

## **Background**

Underground storage tanks sit beneath approximately 500,000 U.S. facilities, primarily in retail gas stations (EPA 2024). While federal law requires financial responsibility for potential cleanups, States are permitted to satisfy this through public trust funds. These funds typically charge a uniform per-gallon fee, severing the link between an individual facility's risk and its financial liability. Economic theory and prior aggregate studies suggest this lack of incentive leads to under-investment in safety and higher leak rates (Yin et al. 2011).

In 1995, Texas passed House Bill 2587, mandating that the state's public fund would stop covering releases discovered after December 1998. This created a sharp, mandatory transition: effective January 1, 1999, all Texas tank owners were required to obtain private insurance. Private insurers immediately entered the market with rate schedules explicitly tied to risk. My reconstruction of actuarial filings from Mid-Continent Casualty shows that a 30-year-old single-walled tank faced premiums approximately 400 percent higher than a new double-walled tank. This transition provides an ideal setting for identifying the causal impact of privatizing environmental liability.

## **Data and Identification Strategy**

I have constructed a comprehensive facility-year panel covering 1990–2021, harmonizing data from the EPA and 14 state administrative databases. The dataset includes 309,640 unique facilities, with a primary analysis sample of 143,647 single-walled facilities existing prior to the 1999 reform.

To isolate the causal effect of the transition to private insurance, I employ a difference-in-differences design comparing Texas facilities (the treated group) to facilities in 18 control states that maintained flat-fee funds (e.g., New Mexico, Oklahoma). The identifying assumption is that, absent the insurance reform, Texas and control states would have followed parallel trends in tank closure and leak outcomes. I validate

this assumption using event-study specifications, which confirm that outcomes in Texas tracked closely with control states in the pre-policy period (1990–1998) before diverging sharply immediately following the 1999 transition. This design allows me to control for macroeconomic shocks and secular trends in technology adoption that affect all states equally.

### **Reduced-Form Evidence**

My reduced-form analysis yields three robust findings that motivate the structural work. First, the transition to risk-based pricing significantly increased the closure rate of high-risk single-walled tanks by 1.8–3.0 percentage points per year. Second, conditional on closure, facilities were significantly more likely to *replace* tanks with safer technology rather than exit the market, demonstrating that insurance pricing drives capital investment rather than firm failure. Third, the policy reduced the probability of a reported leak by approximately 30 percent. While Yin et al. (2011) documented similar aggregate trends in Michigan, my analysis provides the first facility-level causal evidence isolating the mechanism, demonstrating that these environmental gains stem specifically from incentives to upgrade capital rather than just firm exit.

### **Structural Model**

While reduced-form estimates quantify the specific impact of the Texas reform, policymakers need to understand how this market-based approach compares to other regulatory tools. To facilitate these comparisons, I am estimating a dynamic discrete choice model where facility owners decide each period whether to continue operating, upgrade their tanks, or exit the market. The model is parameterized to identify three key behavioral drivers: (1) Premium Sensitivity ( $\gamma_{price}$ ), which measures how owners respond to explicit insurance costs; (2) Risk Internalization ( $\gamma_{risk}$ ), which measures responsiveness to expected liability; and (3) Closure Value  $\kappa$ , which captures the scrap value of exiting. The model code is written and is currently in the estimation phase.

The primary purpose of this structural framework is to simulate counterfactual policy regimes. By recovering the underlying parameters of owner behavior, I can project how the same population of facilities would respond to alternative interventions specifically, command-and-control mandates or technology subsidies and compare the resulting welfare outcomes against the private insurance baseline.

### **Proposed Work at PERC**

The PERC fellowship will be dedicated to advancing this structural framework from estimation to policy application. My primary objective during the residency is to finalize and execute policy-relevant counterfactuals. Specifically, I will simulate the welfare effects of three competing regimes: (1) a California-style command-and-control mandate that bans single-walled tanks at age 30; (2) a Louisiana-style subsidy program that offers grants for tank upgrades; and (3) a universal risk-based insurance regime. Comparing these scenarios will allow me to quantify the efficiency gains of market mechanisms relative to direct regulation and public spending.

In addition to the core simulations, I will conduct robustness checks to verify the stability of my identification strategy and enrich the analysis with facility-specific management measures to test for moral hazard reduction. This involves testing whether private insurance encourages better monitoring and maintenance beyond just capital upgrades. Furthermore, I will explore policy-relevant heterogeneity, such as owner asset size and rural versus urban location. Crucially, I will test whether private markets make firms more responsive to physical risks, such as acidic soil and shallow water tables, compared to state funds. This analysis will verify whether private insurers, driven by profit motives can induce more care behavior along complex environmental risk dimensions than heavy regulated flat-fee programs.

### **Relevance to PERC's Current Initiatives**

This project directly advances PERC's mission to explore market solutions to environmental problems. By contrasting private insurance against government provision, my research empirically demonstrates that private markets can solve government failures by accurately pricing risk. The findings

validate the core economic principle that incentives drive behavior: when liability is socialized, pollution control stagnates; when liability is privatized and priced, owners invest in safety (Shavell 2007). This work is immediately relevant to active policy debates; with California’s state fund sunset in 2025 and other states reconsidering their systems, this research offers timely, actionable evidence for policymakers. My proposed heterogeneity analyses regarding physical risks will further demonstrate the superiority of decentralized market knowledge over centralized bureaucratic pricing in managing complex environmental resources.

## References

- Boomhower, Judson. 2019. “Drilling Like There’s No Tomorrow: Bankruptcy, Insurance, and Environmental Risk.” *American Economic Review* 109 (2): 391–426.
- California State Water Resources Control Board. 2023. “Single-Walled Underground Storage Tanks: Timeline and FAQs.”
- Einav, Liran, Amy Finkelstein, and Neale Mahoney. 2021. “The IO of Selection Markets.” NBER Working Paper 29039.
- Kunreuther, Howard, Patrick Pfaff, and Michelle White. 2010. “The Role of Economic Incentives in Inducing Adoption of Strategies to Reduce Environmental Degradation: Underground Storage Tanks.” *Risk Analysis* 30 (5): 735–749.
- Louisiana Department of Environmental Quality. 2024. “Underground Storage Tank Grant Program Guidelines.”
- Marcus, Michelle. 2021. “Going Beneath the Surface: Petroleum Pollution, Regulation, and Health.” *American Economic Journal: Applied Economics* 13 (1): 72–104.
- Shavell, Steven. 2007. “Liability for Accidents.” In *Handbook of Law and Economics*, edited by A. Mitchell Polinsky and Steven Shavell, 139–182. Elsevier.
- Texas House Research Organization. 1995. “HB 2587 Bill Analysis: Petroleum Storage Tank Remediation Fund.”
- EPA. 2024. “Underground Storage Tank Program Facts.” May 2024.
- Yin, Haitao, Howard Kunreuther, and Matthew W. White. 2011. “Risk-Based Pricing and Risk-Reducing Effort: Does the Private Insurance Market Reduce Environmental Accidents?” *Journal of Law and Economics* 54 (2): 325–363.