Research Project: Turning Up the Heat: How Subsidy Exposure and Heat Pump Adoption in France

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1 Context and Research Question

1.1 The Policy Context

France's heating transition represents a critical test case for environmental policy effectiveness. Unlike the energy sector's "outside transition" (plant closures), the heating sector requires an **"inside transition"** where existing HVAC contractors must adopt new technologies while maintaining their workforce.

1.2 The Core Research Question

Do demand-side subsidies effectively drive supply-side technology adoption, and what market conditions determine this effectiveness?

This question is crucial because policy success depends not just on consumer uptake, but on whether businesses adapt their service offerings in response to policy-induced demand changes.

2 The Natural Experiment

2.1 The Staggered Policy Reform

France's heat pump subsidy program provides ideal identification through its staggered implementation:

January 2018: Subsidies introduced for low-income households replacing oil boilers only.

January 2019: Universal expansion - subsidies extended to:

- All income levels (removing means-testing)

- Gas boiler replacement (expanding fuel types)

2.2 Key Empirical Finding

Preliminary analysis reveals a **striking null result**: despite subsidies being available for oil-heating, low-income households from January 2018, no measurable increase in contractor adoption occurred until January 2019 (see *Figure 2: Effect of Subsidy Exposure on Heat Pump Certification* in the draft paper).

Interpretation: This suggests contractor market entry requires critical mass - broad-based demand rather than targeted eligibility.

3 Identification Strategy

3.1 Geographic Variation in Treatment Intensity

The 2019 expansion creates exploitable variation across local markets based on:

1. **Fuel composition:** Share of households using gas vs. oil heating (2017 census)

2. **Income distribution:** Share of households above median income

3. **Combined exposure:** Markets with high fossil fuel dependency experienced larger demand shocks

3.2 Progressive Empirical Strategy

Stage 1 - Simple Difference-in-Differences:

$$Y_{it} = \alpha_i + \lambda_t + \beta \times \mathbf{1}_{t \geq \text{Jan. 2019}} \times S_{FF,i} + \varepsilon_{it} \tag{1}$$

where $S_{FF,i} = S_{FO,i} + S_{NG,i}$ represents the share of households using fossil fuels in market i, $S_{FO,i}$ that using Fuel Oil, and $S_{NG,i}$ that using natural gas.

Stage 2 - Event Study (Dynamic Effects):

$$Y_{it} = \alpha_i + \lambda_t + \sum_{\tau=-24}^{24} \beta_\tau \times \mathbf{1}(t = \text{Jan. 2019} + \tau) \times S_{FF,i} + \varepsilon_{it} \tag{2}$$

where τ indexes months relative to January 2019.

Stage 3 - Separate Fuel Type Effects:

$$Y_{it} = \alpha_i + \lambda_t + \sum_{\tau=-18}^{30} \beta_{1\tau} \times \mathbf{1}(t = \text{Apr 2018} + \tau) \times S_{FO,i} \tag{3}$$

$$+ \sum_{\tau=-24}^{24} \beta_{2\tau} \times \mathbf{1}(t = \text{Jan 2019} + \tau) \times S_{NG,i} + \varepsilon_{it} \tag{4}$$

where τ indexes months relative to each policy start date.

Stage 4 - Income Eligibility Decomposition (conditional on Stage 3 findings, and if time allows):

If Stage 3 reveals heterogeneous fuel oil effects between April-December 2018 and January 2019 onwards, then:

$$Y_{it} = \alpha_i + \lambda_t + \sum_{\tau=-18}^{8} \beta_{1\tau} \times \mathbf{1}(t = \text{Apr. 2018} + \tau) \times S_{FO,i} \times S_{LowInc,i} \tag{5}$$

$$+ \sum_{\tau=-12}^{24} \beta_{2\tau} \times \mathbf{1}(t = \text{Jan. 2019} + \tau) \times S_{FO,i} \times S_{HighInc,i} \tag{6}$$

$$+ \sum_{\tau=-24}^{24} \beta_{3\tau} \times \mathbf{1}(t = \text{Jan 2019} + \tau) \times S_{NG,i} + \varepsilon_{it} \tag{7}$$

4 Research Objectives

4.1 Primary Objectives

1. **Quantify the supply response:** Measure how contractor adoption responds to policy-induced demand increases

2. **Test critical mass hypothesis:** Determine whether targeted vs. universal eligibility affects market entry differently

3. **Characterize heterogeneous effects:** Identify which market characteristics predict stronger responses

4.2 Methodological Contributions

1. Demonstrate how staggered policy implementation can strengthen identification

2. Show how "null results" can provide substantive insights about market mechanisms

3. Develop framework for evaluating supply-side responses to demand-side policies

5 Data and Implementation

5.1 Data Sources

Register of certified contractors. The register of contractors active on the market for subsidized heat pumps installations covers all certified establishments since 2014 in France. The historic files for the *RGE – Reconnu Garant de l'Environnement* certificates are provided by the French Energy Management Agency *ADEME.*

French 2017 population census. The population census *housing unit* files, provided by the French National Institute for Statistics and Economic Studies *INSEE* includes the main heating source by households (e.g. natural gas, electricity, fuel oil, liquefied natural gas (LNG), wood). It allows to document a quasi-exogenous adoption of the technology at the establishment level between 2018 and 2020.

Base SIRENE. The national comprehensive directory for the identification of French companies and their establishments (*SIRENE* from INSEE) links each estblishment to its 5-digit level industry code. This allows to build the complete universe of heating services businesses in France, gathering 68,542 establishments from January 2017 to February 2020 (Covid lockdown in March 2020).

5.2 Data Extension

The analysis requires extending the observation window to **2020-2023** because:

- Policy effects may have delayed manifestation due to business planning cycles

- COVID-19 period provides additional quasi-experimental variation

- Extended timeline allows measurement of persistence vs. temporary effects

5.3 Robustness and Heterogeneity (if time allows)

- **Market size heterogeneity:** Do larger markets respond faster due to earlier critical mass achievement?

- **Climate zone variation:** Are effects stronger where heat pumps are more cost-effective?