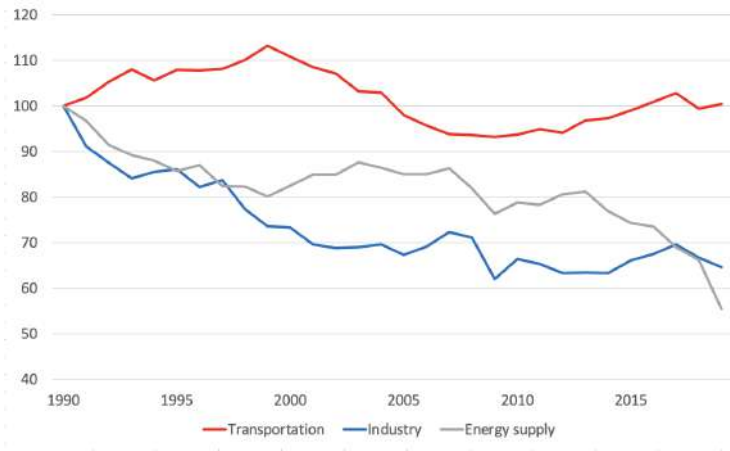


Effectiveness and Heterogeneous Effects of Purchase Grants for EVs

Evidence from Germany

Peter Haan, Adrián Santonja, Aleksandar Zaklan

Emissions of German transportation sector stubbornly high



Source: European Environmental Agency.

Purchase subsidy as part of the climate policy mix

- Purchase subsidies important element in the existing policy mix targeting decarbonization of the transportation sector
- German subsidy implies transfer of ≈ 5 billion euro until 2025 from taxpayers to car manufacturers and buyers of new vehicles

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⚠ Some potential problems:

- Potential for distributional tension and loss in climate policy acceptance
- Incentive to purchase additional vehicles without retiring old ones
- Leakage effects in border regions could lead to losses in (within-country) effectiveness

This paper in a nutshell

Research Questions

- 1 What is the overall effect of the German purchase subsidy program on the German car market?
- 2 Distributional issues: How does the effect differ across geographical and socio-economic dimensions?

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Methods

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Results

- Subsidy causes substantial increase in EV and PHEV registrations
- Heterogeneous effects by...
 - ✓ ...household income level
 - ✓ ...political orientation
 - ✗ ...degree of urbanization
 - ✗ ...potential for leakage effects

Literature and contribution

- Effects of financial incentives for EV adoption using granular data (Muehlegger and Rapson 2018)
 - Additional literature using less granular data (Azarafshar and Vermeulen 2020; Clinton and Steinberg 2019; Jenn, Springel and Gopal 2018; Münzel et al. 2019)

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- Structural analysis, e.g. of the trade-off between financial incentives for EVs and for charging stations (Li et al. 2017; Remmy 2022; Springel 2021)
- Our contributions:
 - Evaluation of causal effects of purchase subsidy in Europe's largest car market using highly granular data
 - Focus on heterogeneous effects allows for examination of distributional impacts

Policy background

- May 2016: German government introduces subsidy program for EVs and PHEVs with listed prices below 60.000 euro
 - 4.000 euro for EVs, 3.000 euro for PHEVs
 - manufacturer share of 50 %
- Subsidy system changed and amounts increased in November 2019 and June 2020

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- Subsidy system changed and amounts increased in November 2019 and June 2020
- Currently:

	<40k	40k - 65k
EV	9.000	7.500
of which manufacturer share	3.000	2.500
PHEV	6.875	5.625
of which manufacturer share	2.250	1.875

Data I

Vehicle registrations

- Data on vehicle registrations (\neq sales) from German Federal Motor Transport Authority (*KBA – Kraftfahrt-Bundesamt*)
 - Monthly registrations at the municipality level for Jan 2015 - Feb 2022 at manufacturer-model level (e.g. number of Renault Zoe registered in February 2022 in Esslingen county)
 - Type of engine (e.g. gasoline, diesel, hybrid, plug-in hybrid, electric)
 - Owner type (private or company)

Data II

Vehicle list prices

- Vehicle list prices from ADAC (*Allgemeiner Deutscher Automobil-Club*) by month and model

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County-level data

- Population density (Destatis)
- Socio-economic data (INKAR)

Data II

Vehicle list prices

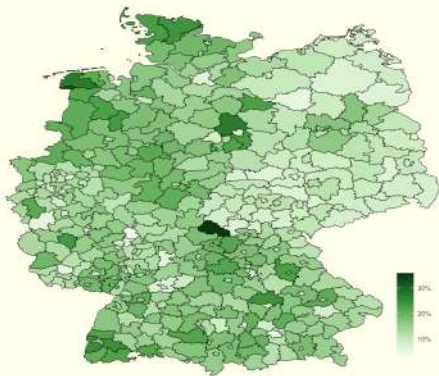
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County-level data

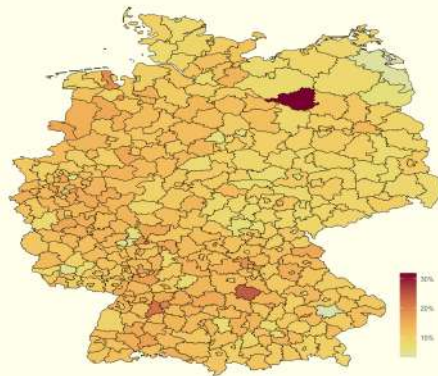
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Final dataset Aggregate to create a balanced panel with 399 counties over 86 months

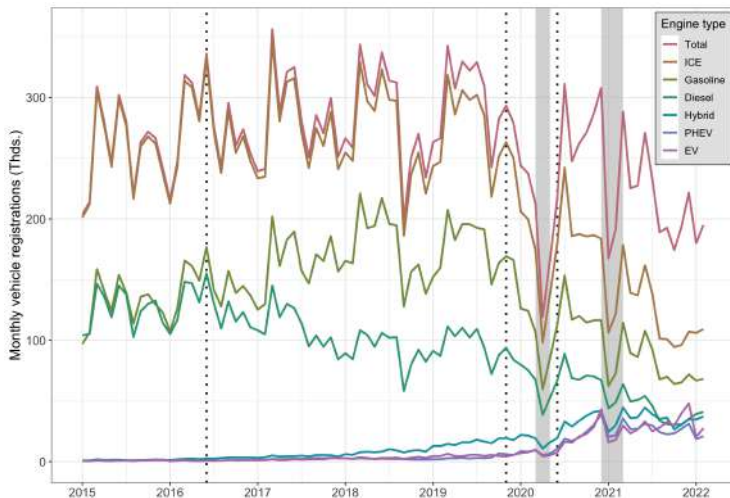
EV market share by district
2021



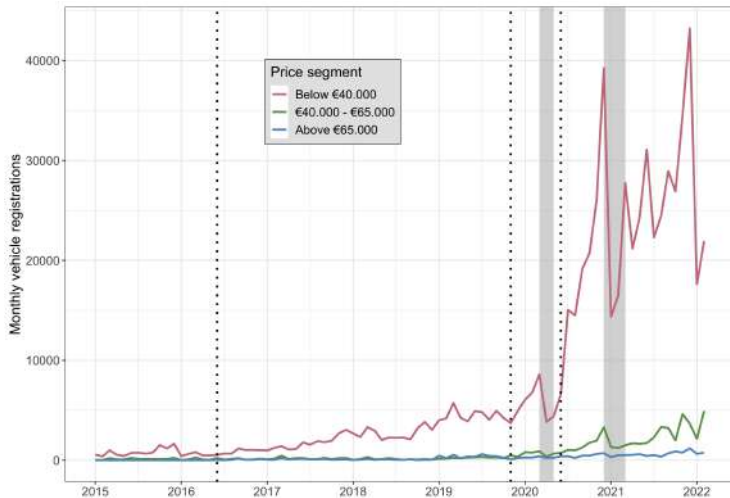
PHEV market share by district
2021



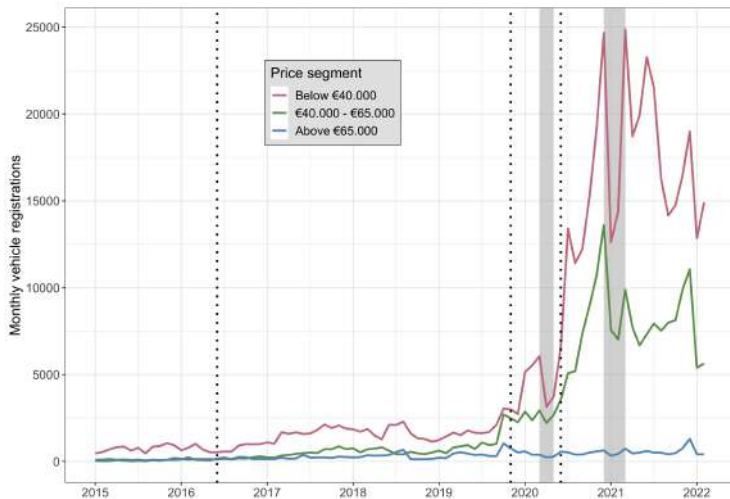
Evolution of German vehicle market



EV segment



PHEV segment



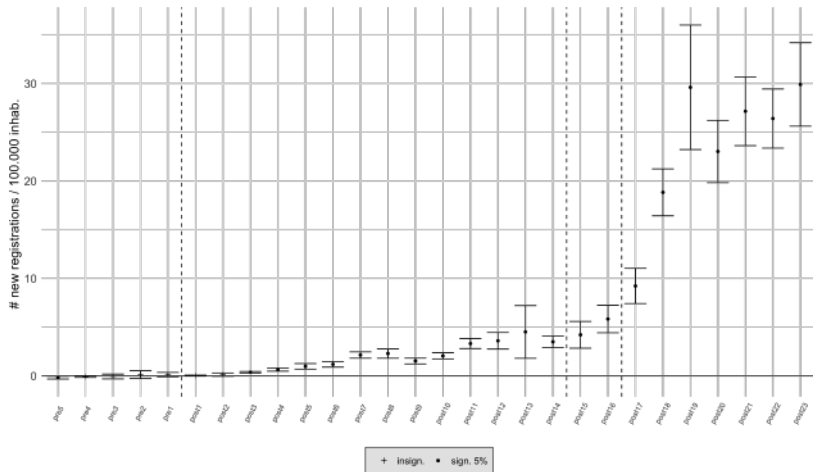
Research Design - Difference-in-Differences

Difference-in-difference approach:

$$y_{kit} = \sum_{j=-m}^q \rho_j D_{kiz, z=0+j} + \alpha_{ki} + \lambda_t + \epsilon_{kit}$$

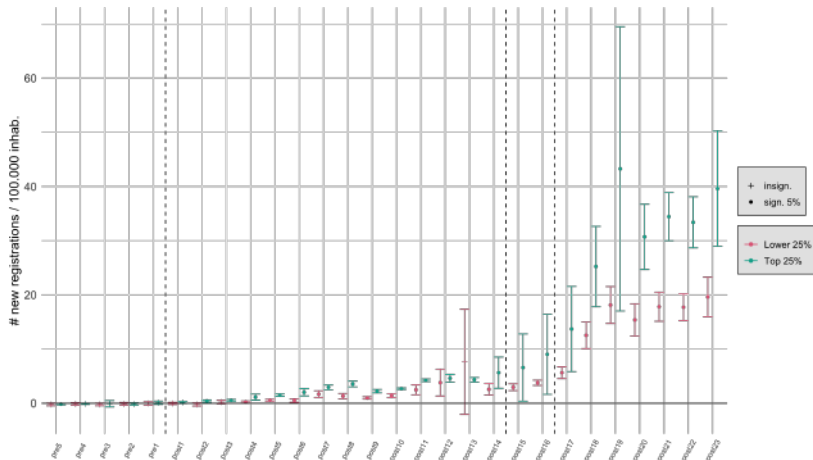
- y_{kit} – Registrations of models in price segment k , county i and month t per 100.000 inhabitants
 - D_{kiz} – Interaction of treatment status and trimester grouping indicator
 - α_{ki} – County \times Price segment FE
 - λ_t – Month-of-sample FE
- **Treatment group** (list price $< \text{€}40.000$) vs **Control group** (list price $> \text{€}65.000$)

Effect of subsidy on EVs



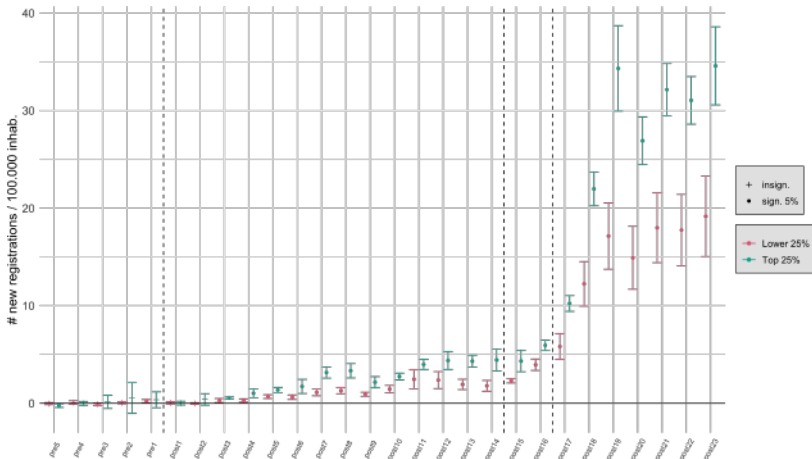
► PHEV results

EVs - Heterogeneous effect I: income



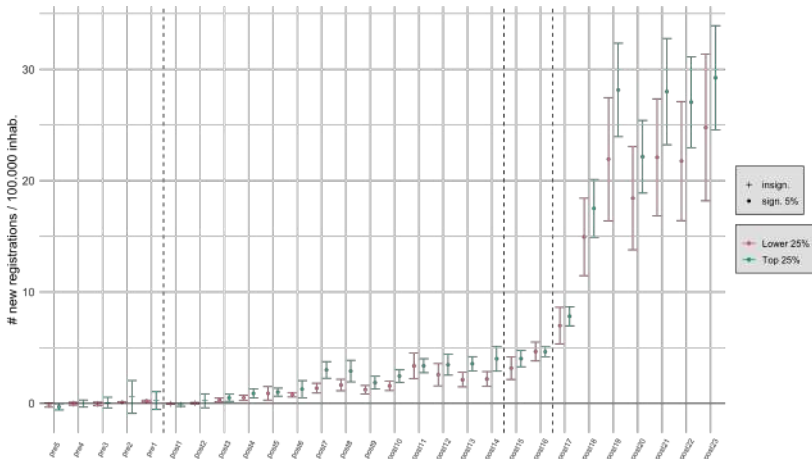
► PHEV results

EVs - Heterogeneous effect II: green party vote share

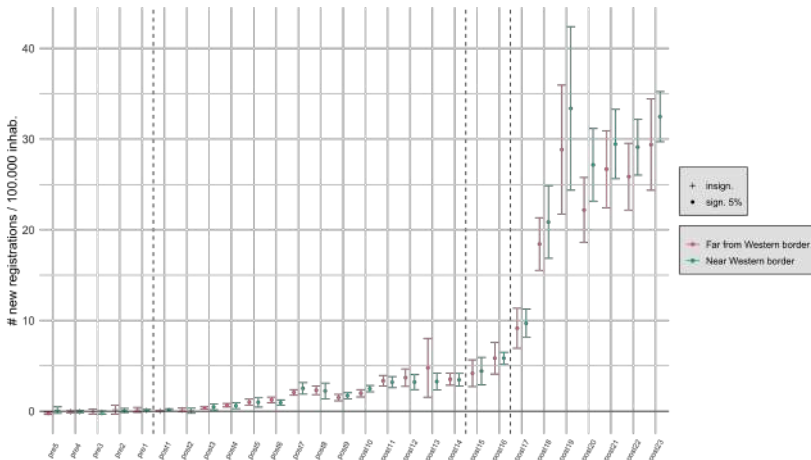


► PHEV results

EVs - Heterogeneous effect III: population density

[► PHEV results](#)

EVs - Heterogeneous effect IV: Western counties



► PHEV results

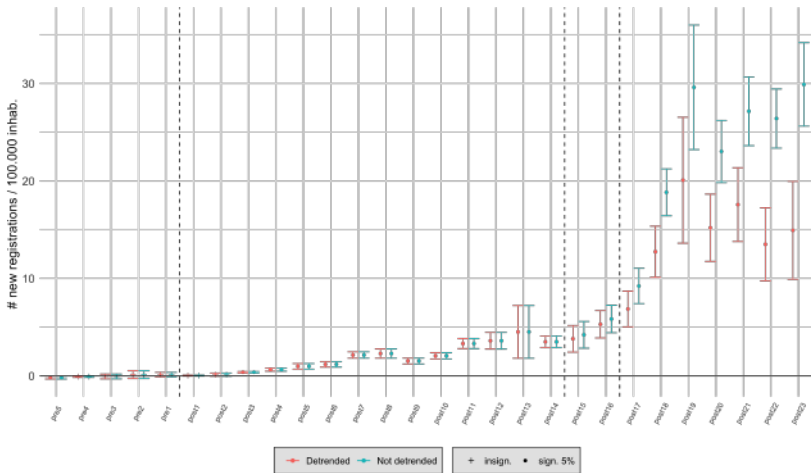
Potential threat to identification

- In 2020, the stringency of European CO_2 emissions standards was increased substantially

Potential threat to identification

- In 2020, the stringency of European CO_2 emissions standards was increased substantially
- In order to account for such concurrent policy at the European level:
 - 1 Calculate the evolution at the national level of EV and PHEV registrations in the Western neighbouring countries (FR, BE, LU, DK, CH, AT)
 - 2 Detrend our outcome variables after 2020 accordingly

Effect of subsidy on EVs



► PHEV results

Conclusions and further steps

Conclusions

- Purchase grant altered the composition of the German vehicle fleet
 - Registrations of EVs (and PHEVs) increased substantially
 - Effect mostly driven by richer counties with a high share of green party voters
 - No evidence of across border leakage

SOON Further steps

- Exploit municipal-level data (11.000 municipalities in Germany)
- Alternative control groups

Thank you for your attention! 🙏

Adrián Santonja

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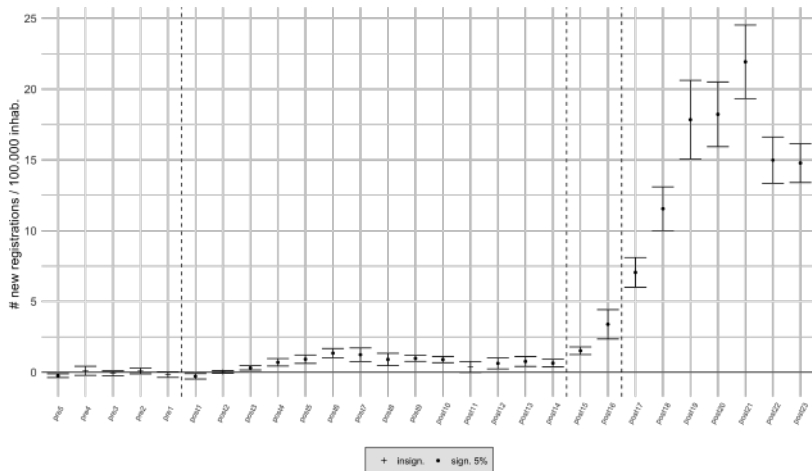
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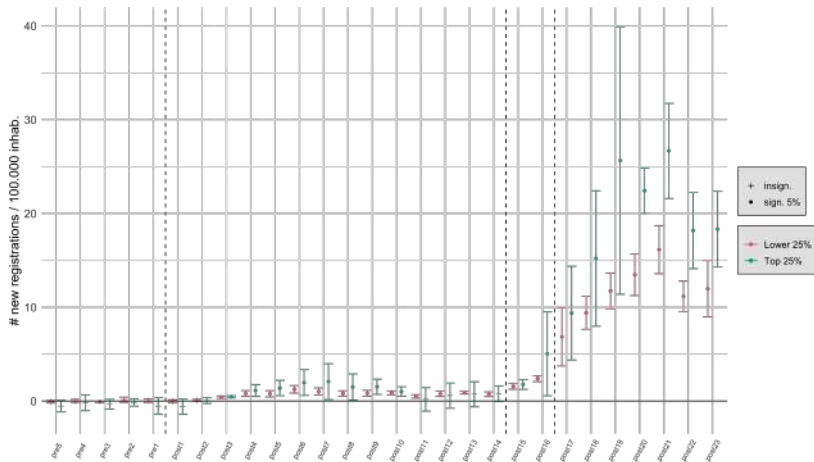
Correlations across subsamples

	HH Income	Population density	Green vote share	Near West border
HH Income	1.0000	-0.0850	0.4304	-0.0212
Population density	-0.0850	1.0000	0.4134	0.0361
Green vote share	0.4304	0.4134	1.0000	0.1327
Near West border	-0.0212	0.0361	0.1327	1.0000

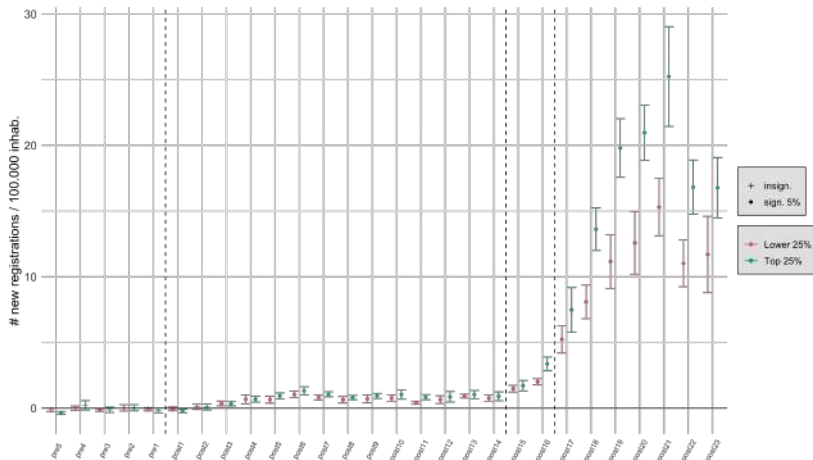
Effect of subsidy on PHEVs

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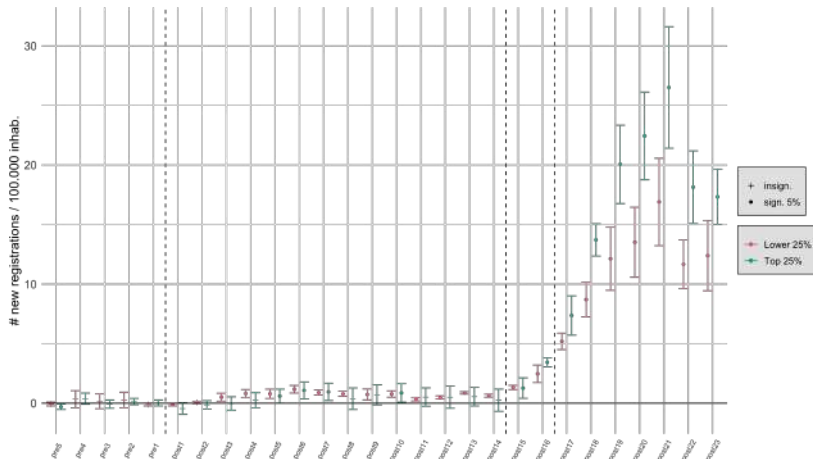
PHEVs - Heterogeneous effect I: income



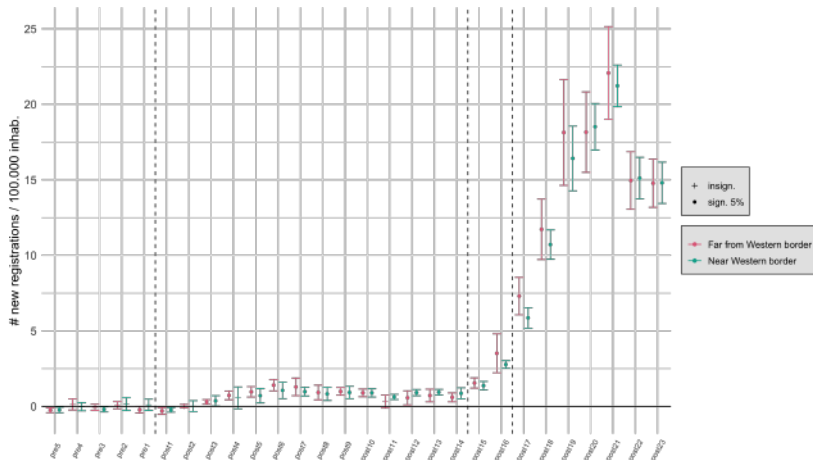
PHEVs - Heterogeneous effect II: green party vote share

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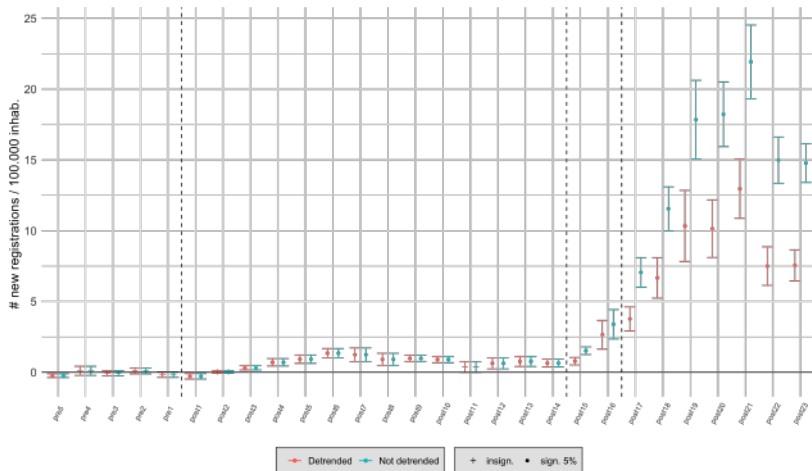
PHEVs - Heterogeneous effect III: population density

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PHEVs - Heterogeneous effect IV: Western counties

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Effect of subsidy on PHEVs

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