

Strategic Substitution : How Do Quantity Mandates Respond To Price Policies ?

The case of French policies for promoting energy efficiency

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» Green transition policies display a wide variety of overlapping instruments

- Whether as a result of multiple market failures and/or political constraints, governments have introduced numerous overlapping policy tools.
- See, for example, the case of energy efficiency : taxes, energy efficiency obligations, subsidies, standards, financial support, labelling & information campaigns
- The literature is still conflicted as to the effects of policy interactions :
 - The interaction between the ETS (cap-and-trade) and other policies has provoked much debate, see e.g. Perino, Ritz, van Benthem (2025)'s theoretical review. E.g. : in presence of a fixed supply of GHG allowances, mandating a shutdown of coal power plants may have 0 effects on emissions.
 - Stechemesser et al. (2019)'s ex post review of policy combinations finds that well-designed mixes are more effective.

» Leveraging a natural experiment : how do price subsidies interact with quantity mandates ?

We leverage a natural experiment to assess the interactions between quantity policies and an increase in subsidies for abatement :

- An increase in **public grants for home energy efficiency improvements**, in spring 2022.
- This took place in the context of a pre-existing scheme which sets **home energy savings targets for energy providers**.
- Using an event-study approach, we study the effects of this increase on private investment, improvement prices, and the number of improvements carried out.

» Evidence on public & private investment complementarity in general is limited

- **Macro-level studies** : many macro papers study government *spending* multipliers (0.5-1, with some evidence for state-dependency), though to our knowledge only a few papers (Eden, Kray (2016) ; Abiad, Furceri, Topalova (2016)) examine public *investment* shocks.
- **Public investment shocks** : exploit **natural experiments in public investment to show crowding-in (especially R&D)** ; effects are linked to credit frictions, i.e. SME investment is crowded-in while large firms are unresponsive or reduce investment.

» Preview of the results : extra public support may be offset by higher prices & lower private funding

- We find :
 - **Small increase in the number of improvements carried out ;**
 - **Approx 1/3 of the increase in grants offset by lower contributions from energy providers ;**
 - A majority of the increase in grants passed on to improvement prices.
 - No significant effect on households' out-of-pocket renovation expenses.

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» Certificats d'Economies d'Energie : savings mandate financed by energy bills

- The state sets 4-year targets for energy providers, in terms of energy savings.
 - Targets are met by certificates of household energy savings.
 - Households allow firms to accumulate these certificates by signing a form, certifying that the energy supplier played an « active and incentivising » role in carrying out energy efficiency renovations.



- In practice, energy providers (or third parties) will seek out households which may be enticed into carrying out improvements, and thus delivering certificates.

>> MaPrimeRenov' : grants for house improvements targeted towards low-income households

- MPR allows households to apply for grants for improvements to their house's energy efficiency.
 - Grants vary depending on the household's size and position relative to income quartiles

Plafonds de ressources hors Île-de-France				
Nombre de personnes composant le ménage (foyer fiscal)	Revenu fiscal de référence (RFR) Mon RFR est indiqué sur mon avis d'imposition			
	MaPrimeRenov' Bleu <small>Mais chez moi, mieux pour la planète</small>	MaPrimeRenov' Jaune <small>Mais chez moi, mieux pour la planète</small>	MaPrimeRenov' Violet <small>Mais chez moi, mieux pour la planète</small>	MaPrimeRenov' Rose <small>Mais chez moi, mieux pour la planète</small>
1	jusqu'à 15 262 €	jusqu'à 19 565 €	jusqu'à 29 148 €	> 29 148 €
2	jusqu'à 22 320 €	jusqu'à 28 614 €	jusqu'à 42 848 €	> 42 848 €
3	jusqu'à 26 844 €	jusqu'à 34 411 €	jusqu'à 51 592 €	> 51 592 €
4	jusqu'à 31 359 €	jusqu'à 40 201 €	jusqu'à 60 336 €	> 60 336 €
5	jusqu'à 35 894 €	jusqu'à 46 015 €	jusqu'à 69 081 €	> 69 081 €
Par personne supplémentaire	+ 4 526 €	+ 5 797 €	+ 8 744 €	+ 8 744 €

- From 2020 to March 2025 : 13.9 billion euros of grants.
 - 2.1 billion in 2021, 3.1 in 2022.
- MPR may be combined with other aids, up to a maximum of 90% of the price of the improvement.

» MPR & CEE designs create opportunities for strategic behaviour

- MPR subsidies are defined by administrative decrees, unlike CEE support which only has a floor, but is otherwise left to the energy providers' discretion.
 - Thus, MPR's design opens the door to **strategic behaviours from energy providers**, i.e., calibrating their CEE support to households according to the amount already covered by the State through MPR.

» The CASD MPR dataset

- The MPR dataset was compiled by the Transition Ministry's statistical service, based on the internal processing system for MPR applications.
- It provides useful application-level information and link it back to records of individual improvements
 - **each observation is thus an individual energy efficiency improvement.**
- **We aggregate the individual improvements in the MPR data into a panel dataset** at the *Zone d'Emploi* level (285 total ZEs in metropolitan France) and at monthly frequency.

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>> Identification : an increase in MPR following the invasion of Ukraine

We leverage an administrative decision, **announced mid-March 2022**, to increase the MPR subsidies for **some** types of improvements, effective on April 15 2022.

 Barbara Pompili 
@barbarapompili

 Show translation
Nous augmentons #MaPrimeRenov de 1000€ pour le remplacement de chaudières à énergies fossiles par des solutions comme des pompes à chaleur.

L'aide totale pourra aller jusqu'à 9000€.
Un moyen efficace de réduire nos factures et notre dépendance aux fossiles.
#PlanRésilience



 Jean Castex and 3 others
5:41 PM · Mar 16, 2022
 109  181  314  5 

- The MPR increase was part of the French Government's Resilience strategy in the wake of the Russian invasion and subsequent energy shock.
 - The stated aim was to decrease French dependence on fossil fuels.

» Estimating the effects of the MPR increase through an event study

- We examine the effects of the increase in MPR grants through an event-study framework.
 - Using an **estimator robust to heterogeneity in treatment effects (Callaway and Sant'Anna 2021)**, we study the effects of the MPR change 5 months before/after it was effective.

As our treatment variable is binary (= 1 if the improvement type is concerned by the MPR increase and the date is 15/04/2022 or after), the estimation is similar to, but more robust than, the canonical DiD TWFE regression :

$$Y_{i,t} = \alpha_i + \lambda_t + \sum_{k=-5;}^5 \gamma_k * D_{i,t-k} + \beta * X_{i,t}$$

- At this stage, **we are limited in terms of specification choice by the amount of variables available in the CASD dataset**. We control for :
 - Median fiscal revenue ;
 - Share of MPR applicants that are homeowners.

» Sample & treated/control group selection

- We focus on the lowest income category : i.e. those most likely to be « activated » by the subsidies.
- We focus on discrete improvements rather than insulation works, as the former make for more intuitive comparison groups.
- The treated group could include, in theory, all types of improvements which were concerned by the MPR increase of April 2022.
 - Thus far : we focus on heat pumps as our treated group, which are the improvement type which 1) benefited from the MPR increase 2) has the highest number of observations.
- The control group includes improvements which were not concerned by the MPR increase.
 - **We further exclude high performance gas boilers due to the trend in gas prices and explicit policy of reducing their usage.**

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» Substantial increases in the number of improvements are visible irrespective of MPR increases

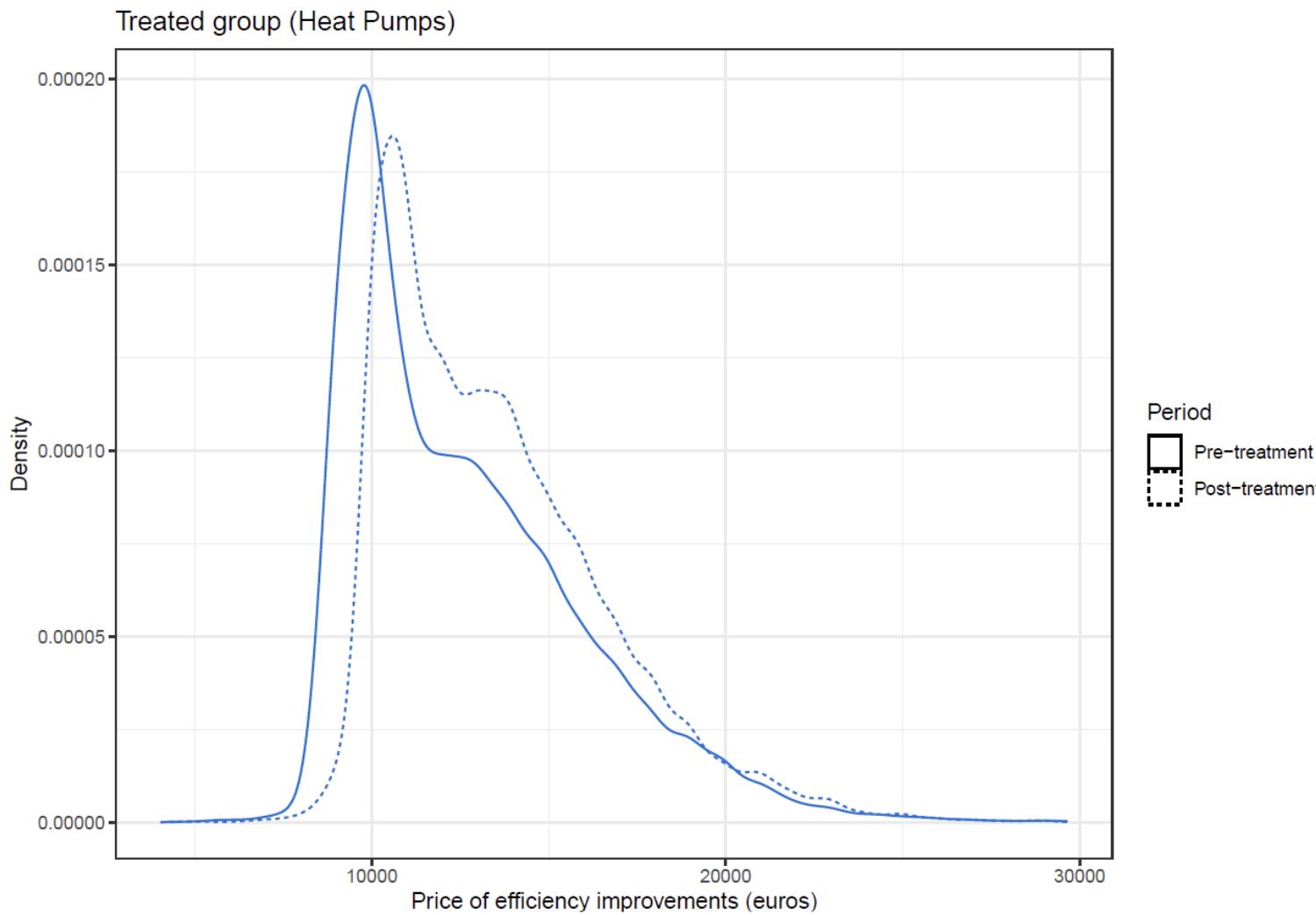
Nombre de gestes répertoriés dans la base MPR

Période de 5 mois avant l'augmentation du forfait MPR (15/04/2022)

Geste	Pré-intervention	Post-intervention
Groupe de Contrôle		
Chauffe-eau solaire	9764	12407
Chaudière à granulés	3979	6058
Chauffe-eau thermodynamique	3245	5983
Chaudière à gaz THPE	2573	2796
Ventilation double flux	4444	8331
Groupe Traité		
PAC air/eau	13222	24027

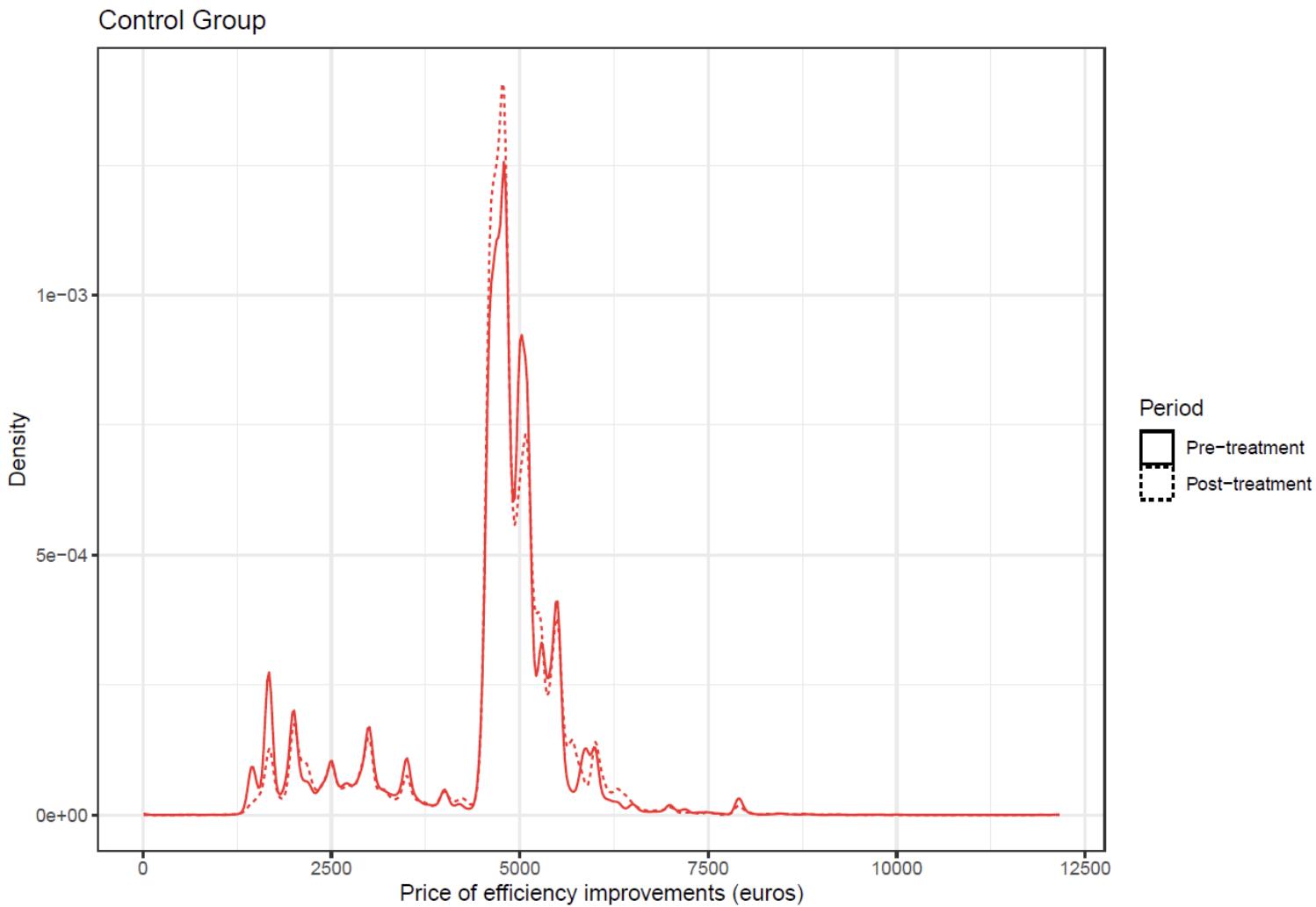
» Pre/post distributions suggest the MPR increase was passed on to prices

Treated group :



» Pre/post distributions suggest the MPR increase was passed on to prices (2)

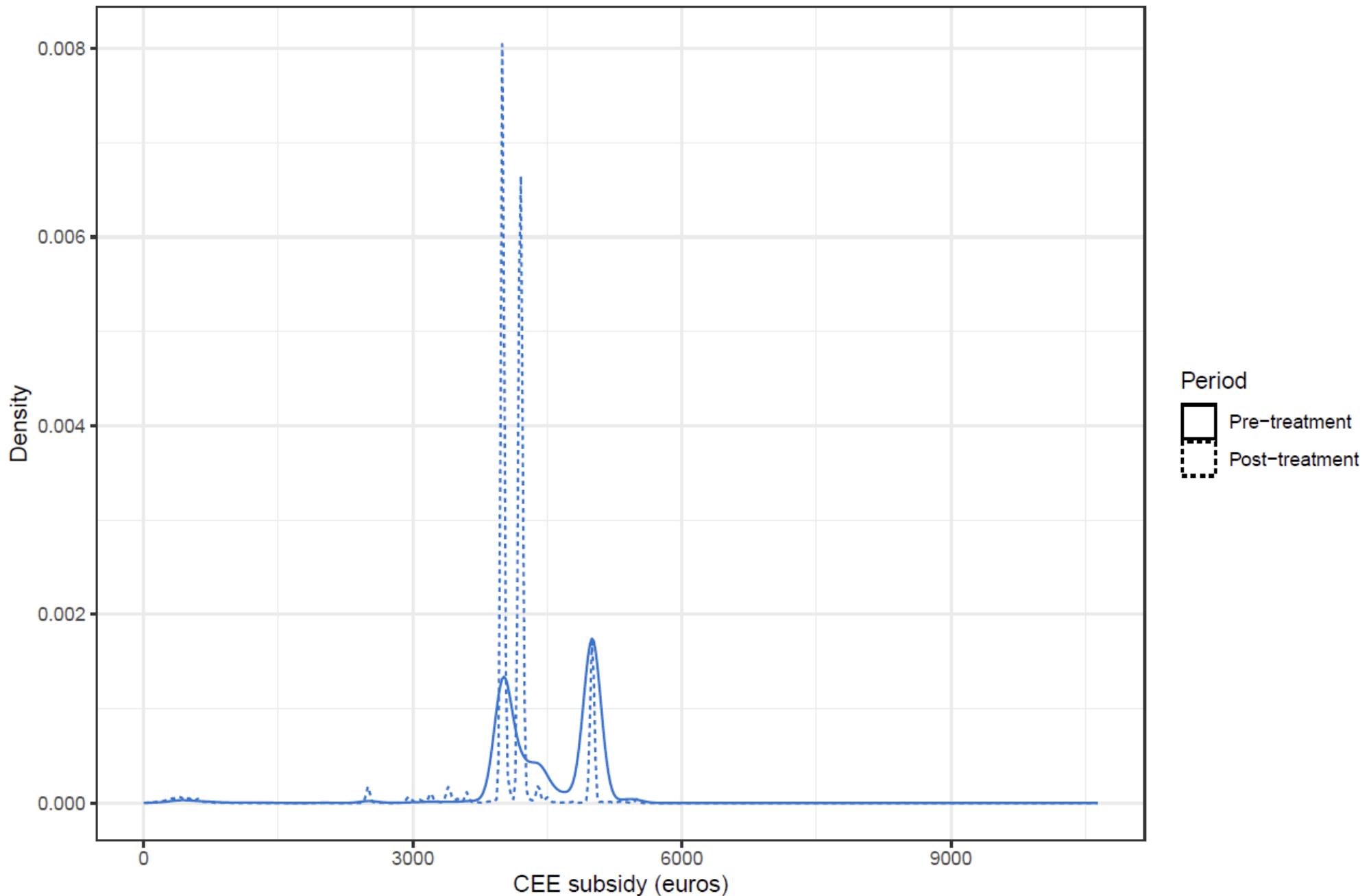
Control group :



» Pre/post distributions of CEE are ambiguous

Treated group :

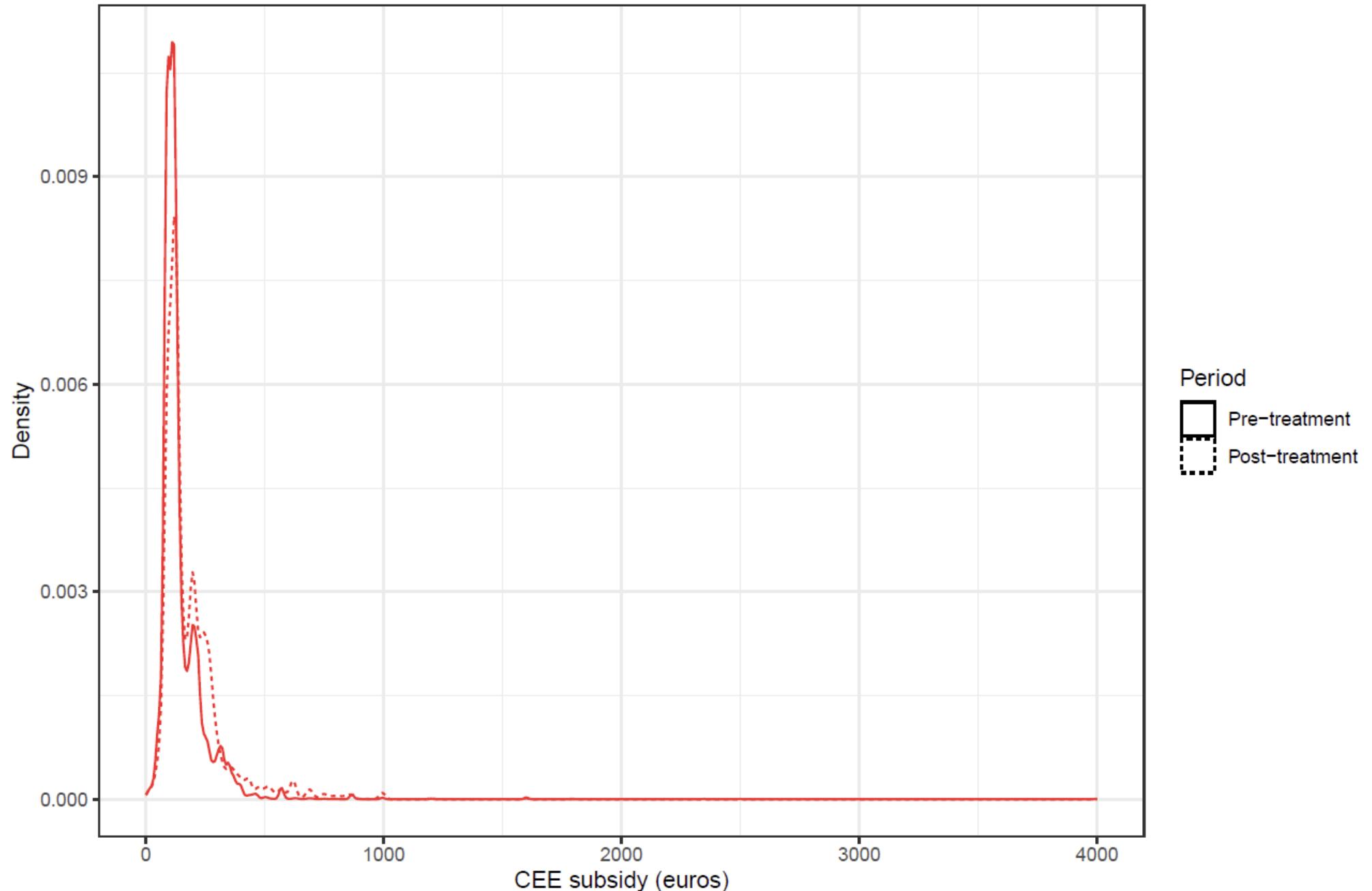
Treated group (Heat Pumps)



» Pre/post distributions of CEE are ambiguous (2)

Control group :

Control Group



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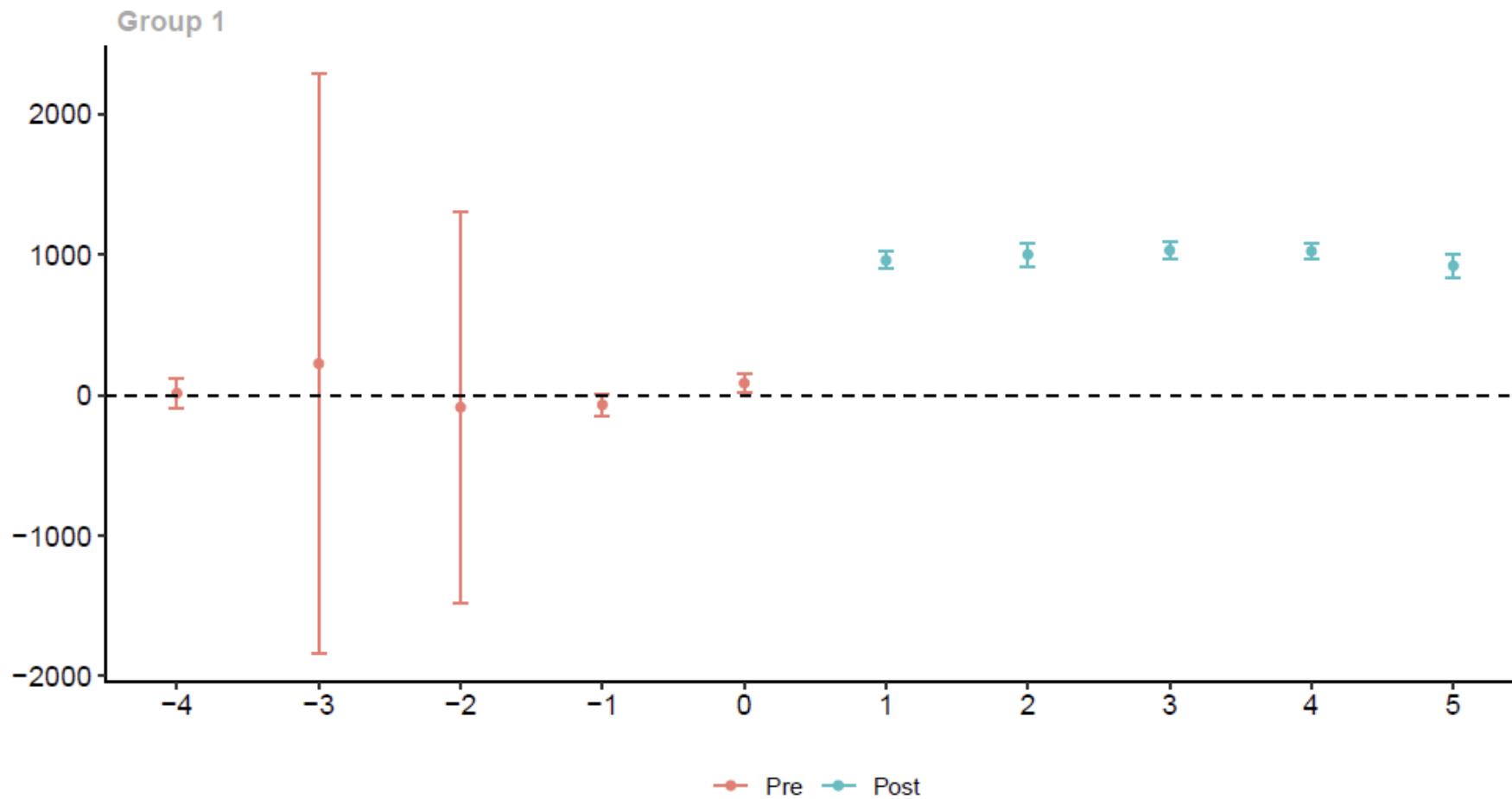
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» Households experienced the expected MPR increase

Pompe à chaleur air/eau, ménages très modestes

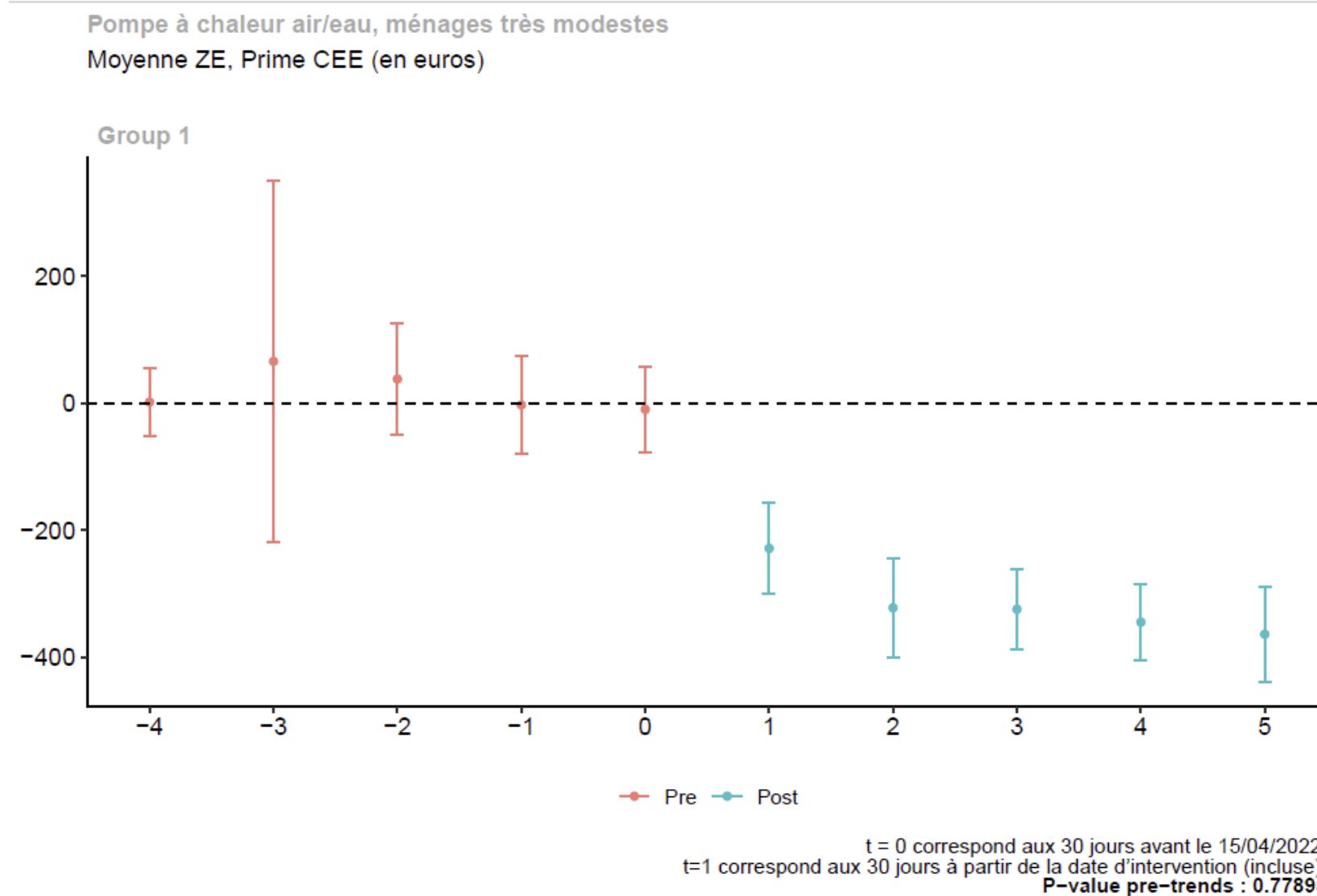
Moyenne ZE, Prime MPR (en euros)

Groupe de contrôle : autres gestes (excl. isolation)

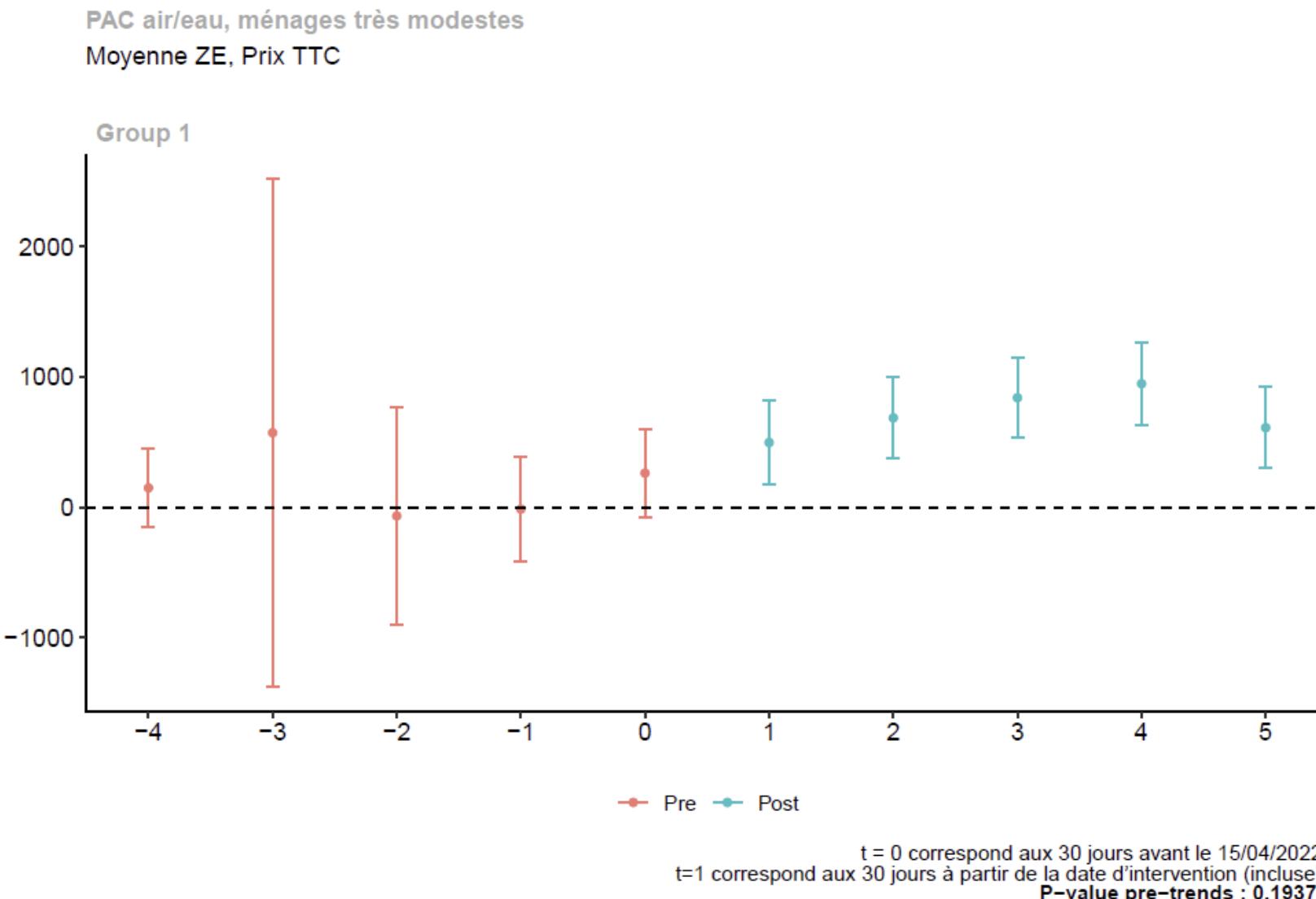


$t = 0$ correspond aux 30 jours avant le 15/04/2022.
 $t=1$ correspond aux 30 jours à partir de la date d'intervention (inclus).
P-value pre-trends : 0.06869

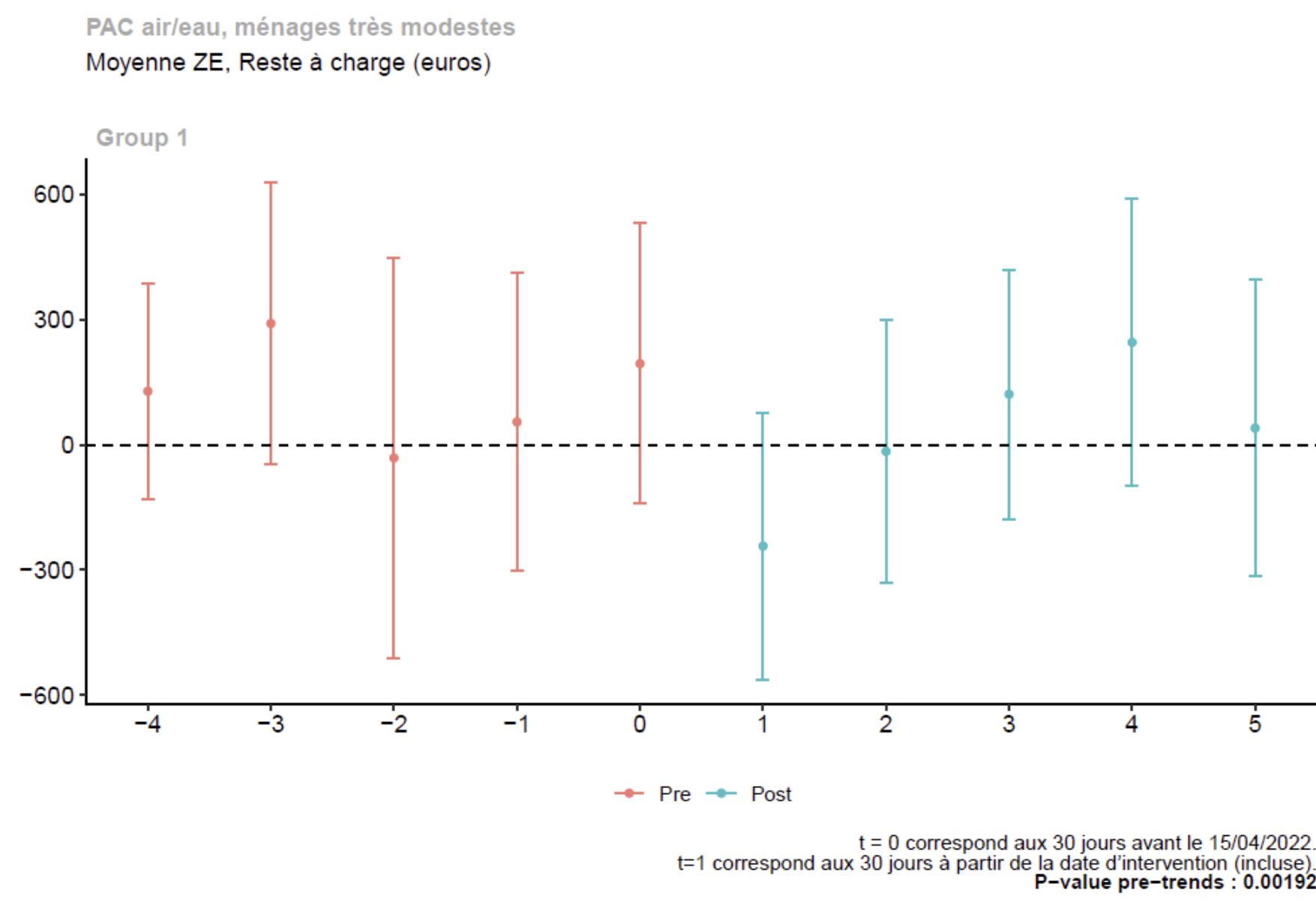
» However, approx. 1/3 is captured by energy providers via lower CEE funding



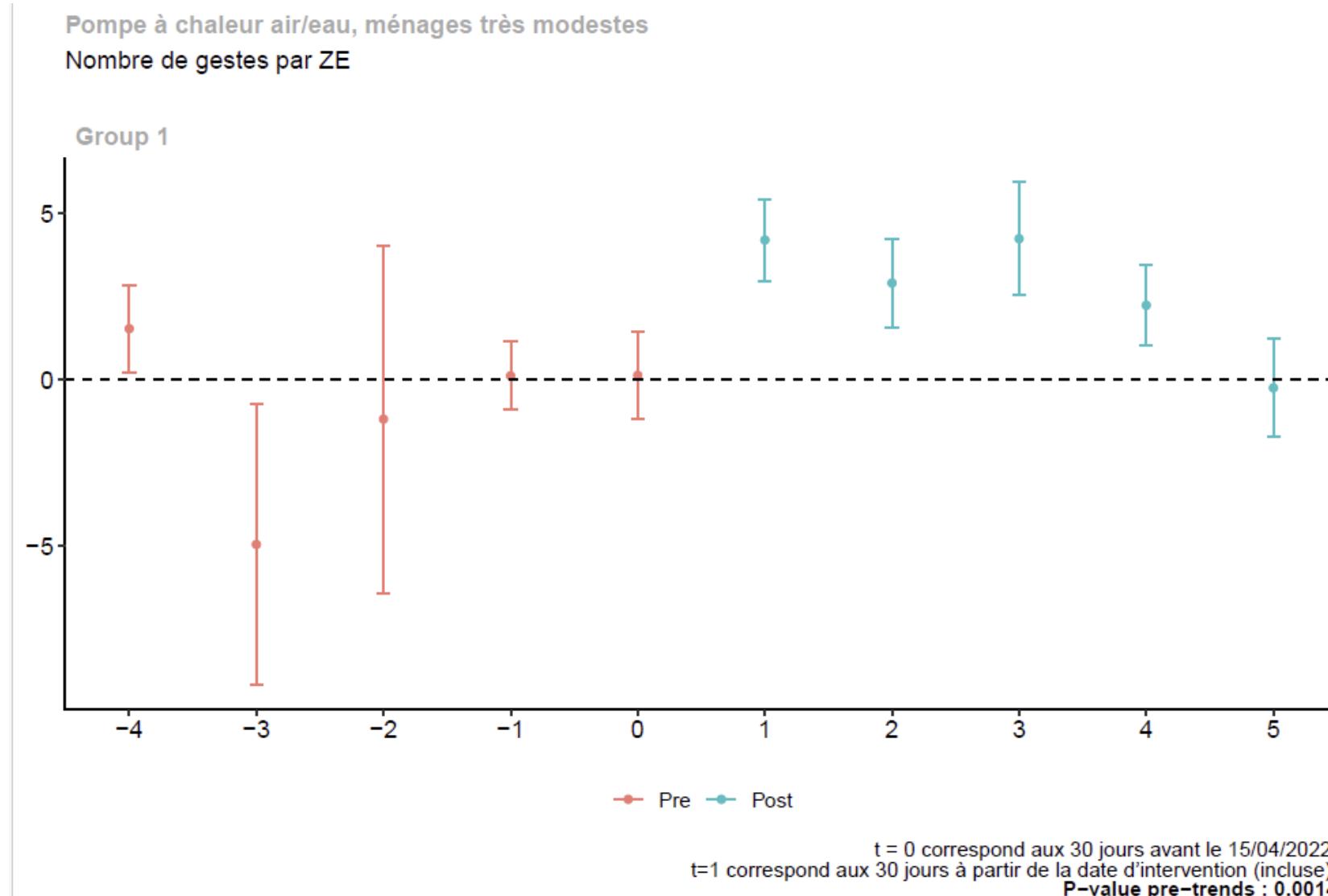
» A large share of the increase in grants (~2/3) is passed onto prices



» Out-of-pocket expenses for households remained stable



» The extra MPR grants did lead to a small increase in the number of improvements



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>> Conclusion

- A combination of private and public financing is the default strategy for governments to meet pressing investment needs.
- Furthermore, in the context of green transition efforts, there are overlaps of policy instruments.
 - E.g.: quantity & price instruments.
 - The evidence on the effects of these interacting policies is limited thus far.
- Our contribution is to leverage a natural experiment to provide some evidence on how quantity/price policies interact.
 - In the case of MPR and CEE, our results suggest that the increase in subsidies partly displaced private funding resulting from the quantity mandate.

» Extensions

As this work is still preliminary, there are many avenues for further research :

- Performing the same estimates for other household income levels and/or improvement types
- Examining the price effect : is it an increase in profit margins ? (of heat pump installers ? or makers ?)
- Modelising the strategic interactions that lead to the crowding-out effect.

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» Overview of the energy efficiency improvement programmes

France has implemented several programmes to support energy efficiency improvements, of which MPR and CEE are just a few :

	Nature	Description
MaPrimeRénov'	Subvention (forfait gradué selon revenus)	Prime forfaitaire selon le type de travaux/niveau de revenus. Introduit en 2020, en remplacement du CITE (crédit d'impôt, en % du prix de l'installation).
CEE	Consommateur-payeur	Obligations des fournisseurs d'énergie de contribuer à des cibles de gains d'efficience énergétique (en kW/h cumac) en soutenant financièrement les ménages. En théorie, le coût du soutien aux ménages est répercuté sur les factures.
EPTZ	Subvention ?	Prêts à taux zero pour la rénovation énergétique.
TVA à taux réduit	Subvention	TVA réduite (5,5%) sur certains produits

>> MPR changes in April 2022

Travaux	2021 (€)	2022 (€)	2023 (€)
Bonus sortie de passoire	1500	1500	1500
Bonus Bâtiment Basse Consommation (BBC)	1500	1500	1500
Audit énergétique	500	500	500
Chaudières à granulés	10000	11000	10000
Pompes à chaleur géothermiques ou solarothermiques	10000	11000	10000
Chauffage solaire	8000	11000	10000
Chaudières à bûches	8000	9000	8000
Pompes à chaleur air/eau	4000	5000	4000
Chauffe-eau solaire	4000	4000	4000
Poêles à granulés	3000	3000	2500

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» MPR and CEE are cumulative, but only up to a point

- The sum of MPR and CEE may not exceed a share of the total cost of the improvement (from 60% to 90%).
- Depending on the generosity of MPR and CEE, this may « mechanically » introduce substitution effects between MPR and CEE.

>> Summary statistics

Moyennes, période pre-traitement

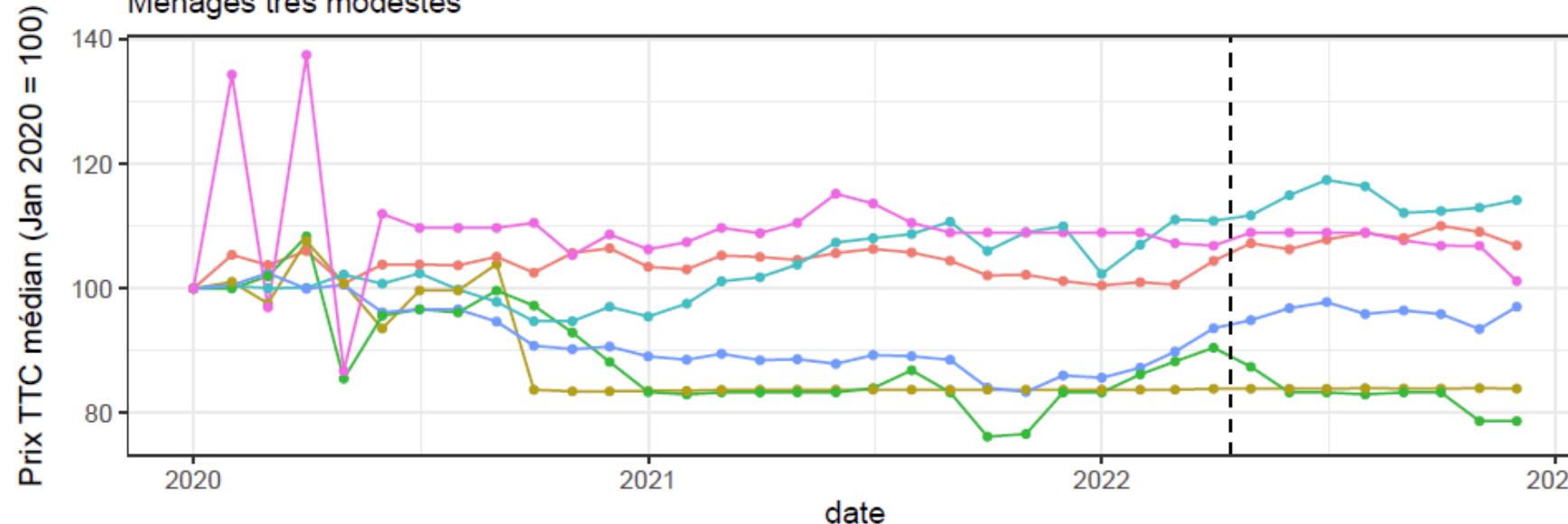
<u>period_pre</u>	CEE	MPR	Prix TTC	Reste à charge	Ecart au seuil d'écrètement	RFR
Contrôle						
Pre-intervention	858	4279	6821	1685	-1002	17617
Post-intervention	797	4451	7053	1804	-1099	17463
Traité						
Pre-intervention	4446	3979	12652	4227	-2962	17149
Post-intervention	4081	4962	13580	4538	-3180	17236

» Trends : price & number of works

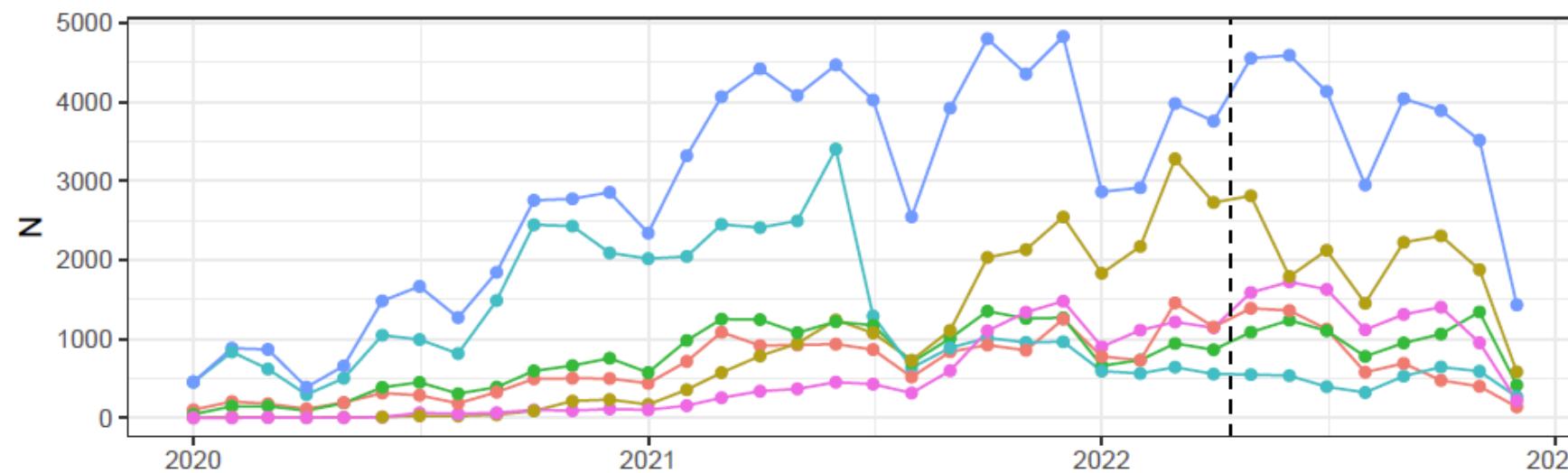
[Ventil2 = VMC double flux ; cag = Chaudière à granulés ; cet = Chauffe-eau thermodynamique ; ces = Chauffe-eau solaire]

Evolution des prix, par type de geste

Ménages très modestes



15/12/2021 au 15/09/2022.
t = 0 correspond aux 30 jours après le 15/04/2022.



» Grants were increased for some, but not all, eligible home improvements

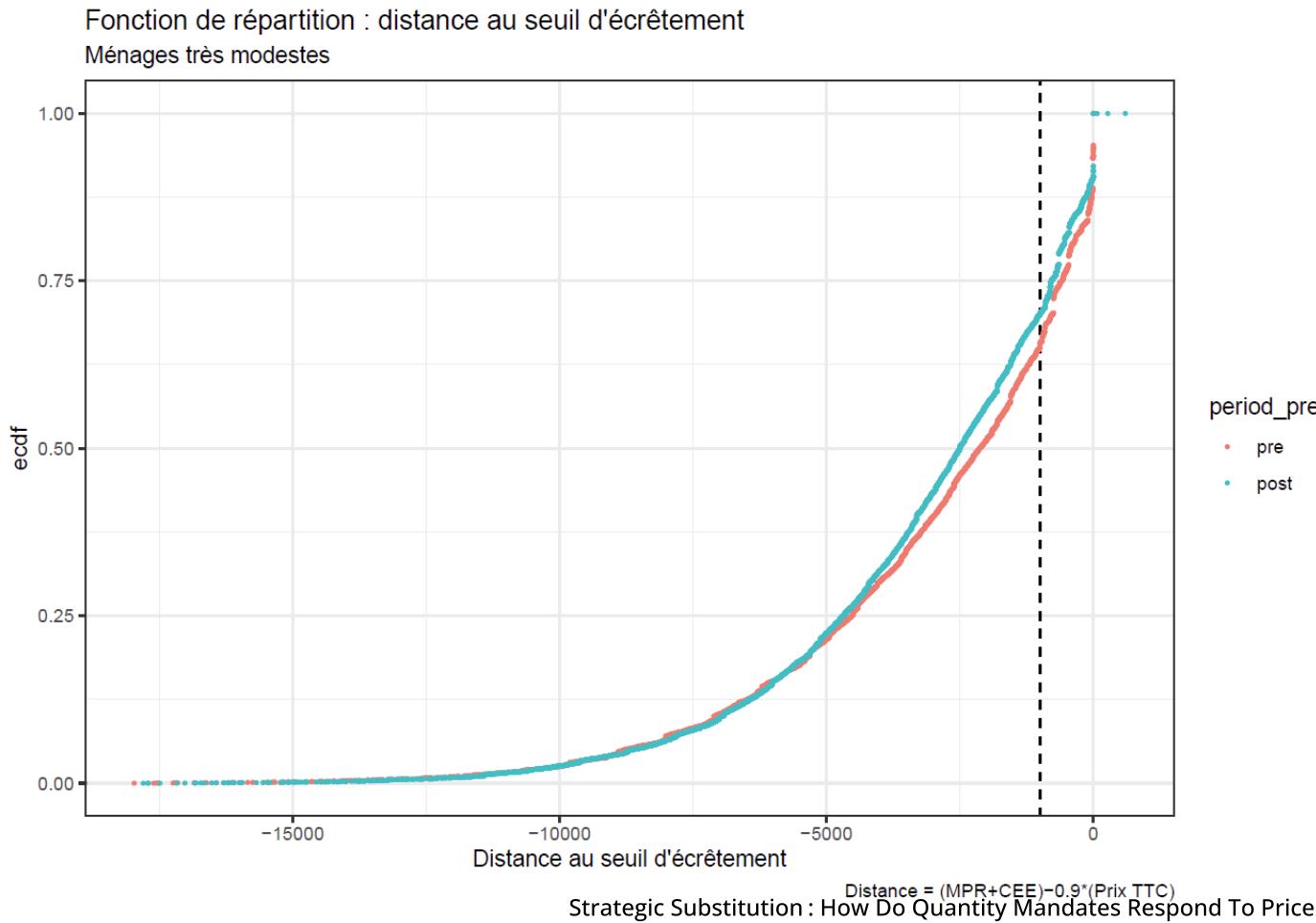
- This non-exhaustive table shows the temporary increase in grants for some of the key improvement types.

Travaux	2021 (€)	2022 (€)	2023 (€)
Chaudières à granulés	10000	11000	10000
Pompes à chaleur air/eau	4000	5000	4000
Chauffe-eau solaire	4000	4000	4000
VMC Double flux	3000	3000	2000

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>> Distribution des seuils d'écrêtement

- Rappel : la somme des primes MPR + CEE ne peut pas dépasser 90% du prix TTC.
 - Sur la période pré-intervention, parmi les travaux où le cumul des aides impliquant un reste à charge <1000 euros, l'écart entre le seuil d'écrètement et le cumul des aides était de 349 euros en moyenne.**



» Fonction de répartition des CEE

