Decarbonizing Commercial Real Estate: Evidence from a Regression Discontinuity Design

Olivier Denagiscarde* Rachel Paya†

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Abstract

We examine how commercial real estate stakeholders respond to decarbonization mandates. A French policy requires commercial buildings above 1,000 square meters to achieve energy savings by 2030. Exploiting this sharp threshold, we link building characteristics, renovation permits, and energy consumption, and estimate annually repeated regression discontinuity designs. Following the policy implementation, we find a significant increase in renovation activity among regulated buildings and a significant decrease in energy consumption, even in non-renovated buildings. The effects are concentrated in the post-2022 period, coinciding with the introduction of mandatory energy consumption reporting and the energy crisis. This suggests that, even in the absence of strong enforcement, climate objectives can amplify firms' responsiveness to financial incentives to decarbonize.

JEL classification: *G*38, *Q*48, *Q*54, *R*33

Key Words: Climate Change, Transition Risk, commercial Real Estate, Energy Retrofit

*Université Paris 1 Panthéon-Sorbonne, CNRS, Centre d'Economie de la Sorbonne, 106-112 bd de l'Hôpital, FR-75647. E-mail: olivier.denagiscarde@etu.univ-paris1.fr

†ESSEC Business School and CY Cergy Paris University. E-mail: rachel.paya@essec.edu

1 Introduction

In 2015, in a defining speech for the field of climate finance, Mark Carney, then Governor of the Bank of England, warned financial actors about the tragedy of the horizon in addressing climate change. This tragedy, he explained, stems from the mismatch between the time horizon of climate change risks, which could take decades to materialize, and the much shorter horizons of financial and political actors, which rarely exceed a few years (Carney, 2015). This discrepancy hinders the early transition to a low-carbon economy needed to mitigate climate change and therefore reduces the probability to keep global warming under 2°C compared to pre-industrial level (IPCC, 2023). This raises the question of whether long-term climate policies can break the tragedy of the horizon and influence economic actors' short-term behavior.

In this paper, we take advantage of a decree implemented in France in 2019 setting mandatory long-term energy efficiency targets for existing commercial buildings to study early-stage responses from commercial real estate market actors to the policy. Representing nearly 40% of global greenhouse gas emissions (UNEP, 2023), real estate constitutes a key sector for achieving climate change mitigation goals. Furthermore, the sector is closely tied to financial stability so risks associated with its adjustment to a low-carbon economy could have broad repercussions throughout the entire financial system. It is therefore critical to analyze how real estate market actors respond to the introduction of long-term climate objectives.

To this end, we construct a novel dataset by matching French administrative land registry data at the land unit-level with address-level energy consumption data and the French building permits registry. Land unit-level data are available only since 2018, making a credible difference-in-difference analysis difficult. We circumvent this issue by exploiting the 1,000 m^2 surface cutoff determining whether buildings are subject to the energy efficiency obligations in a regression discontinuity design (RDD) to analyze both short-term energy usage changes and anticipatory measures in the form of planned renovations. We find that energy consumption decreased more in buildings just above the cutoff, and thus subject to the energy-efficiency obligations, compared to buildings just below the cutoff over the period 2018–2023.[1]

On average, the decrease in energy consumption of treated buildings was 9 percentage points

1. We use 2018–2023 to compare the latest available post-policy consumption (2023) with a strictly pre-decree baseline (2018), i.e., before the October 2019 decree and subsequent implementation.

greater than that of control buildings. Too early to be attributed to renovation works, the magnitude matches estimates of energy savings from small behavioral changes such as turning off the lights and lowering the heating by a few degrees (He et al., 2021). Using building-permit data, we also show that treated buildings are 50% more likely than control buildings to undergo renovations over the post-decree implementation period.

In order to pinpoint the timing of the reaction, we repeat our RDD analysis every year for both outcomes. We find that the increase in the probability of renovation for buildings subject to the energy efficiency obligations is mostly concentrated in 2023, following the enforcement of the mandatory reporting of energy consumption and the energy crisis of 2022. For energy consumption, the discontinuity in the change relative to 2018 becomes negative in 2022 and statistically significant only in 2023. These results suggest that both the salience of the policy and the external financial incentives are key determinants of the timing of the reaction of market actors. This has implications for the design of policies aiming to accelerate the transition to a low-carbon economy.

Effects vary meaningfully by ownership type. Publicly-owned regulated buildings show the largest significant decrease in energy consumption, with a positive but insignificant effect on renovations; combined with their already high baseline renovation rate, this is consistent with reputational incentives to meet government climate objectives. Real estate companies drive the aggregate renovation effect but show no significant reduction in energy use, plausibly because they face fewer financial constraints but, as non-occupiers, have limited control over consumption. Other private owners display the opposite pattern, reducing energy use significantly while renovating less. We find no effect for individual owners, consistent with information frictions and tighter financial constraints. Finally, we detect no significant response in transaction behavior, suggesting the targets have not (yet) been capitalized into asset values.

Related literature Our paper contributes to the literature on climate risks for the real estate sector. Previous studies have predominantly addressed the impacts of physical climate risks, such as floods (Fairweather et al., 2024), hurricanes (Ortega and Taşpınar, 2018; Addoum et al., 2024) or sea level rise (Bernstein et al., 2019; Tyndall, 2023) on real estate markets. Climate transition risk, on the other hand, has garnered increasing attention from practitioners, as evidenced by the numerous institutional and private reports on the topic in recent years (OECD, 2025; OECD,

2024; UNEP, 2023; Boland et al., 2022). However, the academic literature on climate transition risks in the real estate sector remains limited. Ferentinos et al. (2023) evaluate the consequences on sales prices in the UK housing market of a ban on renting properties with very low energy-efficiency ratings. Xiao (2024) analyzes how real asset owners price the risk of having a tenant firm exposed to climate transition, which can be seen as the indirect exposure to transition risk. With the exception of this last study, existing literature on both physical and transition risks has mainly studied residential real estate. We contribute to the literature by analyzing the response of commercial real estate to the materialization of climate transition risks in the form of legally binding long-term climate objectives.

We also relate to the literature on green real estate. A significant body of work in this literature provides evidence on the capitalization of energy efficiency into both residential and commercial real estate prices (Aydin et al., 2020; Walls et al., 2017; Fuerst et al., 2015; Taruttis and Weber, 2022; Eichholtz et al., 2010; Eichholtz et al., 2013; Holtermans and Kok, 2019). Beyond sales prices, the studies on commercial real estate have also looked at the impact of energy efficiency on rental rates and effective rents (Eichholtz et al., 2010; Eichholtz et al., 2013; Holtermans and Kok, 2019), on neighboring buildings' financial outcomes (Chegut et al., 2014) as well as on credit default risk and terms of loans with a building serving as collateral (An and Pivo, 2020). We add to this literature in two significant ways. First, all of the previously cited works rely on energy efficiency certificates or labels to determine whether a building is "green" or not. This is problematic as the information provided by the labels often cannot be verified, the underlying energy consumption data being unobserved, and obtaining a green label is likely strongly linked to other building characteristics and owners' decisions, making the measure highly endogenous. In this paper, when looking at transactions and prices, we instead define green buildings as those subject to energy efficiency obligations, providing a cleaner, exogenous, and more transparent classification. Furthermore, we observe energy consumption and renovation permits at the building level and are therefore able to confirm that regulated buildings have decreased their energy consumption more and have made more renovations than comparable unregulated buildings. Second, our RDD setting exploiting the exogenous cutoff of the policy allows us to estimate a credible causal effect of this heightened incentive for energy efficiency, in contrast with previous studies that mostly rely on matching strategies prone to endogeneity concerns.

Finally our results also provide evidence on the importance of salience for timely climate mitigation. Salience refers to the quality of being the "most noticeable or important".[2] A salient fact will therefore attract more attention than other facts because it is different, unusual or more visible for instance. Previous studies document the link between salient weather events such as local temperature shocks and an increase in concern over climate change (Egan and Mullin, 2012; Zaval et al., 2014; Choi et al., 2020). This heightened concern has been shown to have real effects on economic decisions. Indeed, Smith (2022) finds that firms making an M&A deal and experiencing abnormally high temperatures at their headquarters location in the 6 months prior acquired targets with lower carbon emissions compared to acquiring firms that didn't experience a temperature shock. On the salience of climate regulation, Ramadorai and Zeni (2024)'s results indicate that climate transition shocks such as the Paris Agreement also lead firms to update their beliefs about future climate regulation and to adapt their planned and actual abatement activities as a consequence. Our paper complements these works by showing that salient climate regulation paired with salient energy prices can spur green investments (proxied by renovation activity in this context).

The remainder of the paper is organized as follows: section 2 details the regulatory and economic context, section 3 describes our data sources and the construction of our dataset, section 4 exposes our empirical strategy and provides descriptive statistics of our estimation samples, then we present our results in section 5, discuss them in section 6 and conclude in section 7.

2 Context

2.1 Institutional context

The *Décret Tertiaire*, published on July 23, 2019, introduces binding energy-reduction targets for the commercial real estate sector in France. This includes all service-sector buildings (*immobilier tertiaire* in french), that is, buildings that are not dwellings, industrial, or agricultural premises. The decree is part of a broader legislative framework that includes the *Loi ELAN* (2018), the European Energy Performance of Buildings Directive, and France's commitments under the 2015

2. Definition from the Oxford English Dictionary.

Paris Agreement.

The regulation requires progressive reductions in final energy consumption of 40% by 2030, 50% by 2040, and 60% by 2050, compared with a past reference level. These demanding objectives were announced as early as 2019, creating a strong signal for market participants about the forthcoming tightening of energy-efficiency requirements. In practice, the regulation distinguishes between a relative and an absolute compliance path. The first measures reductions against each building's own historical consumption, while the second, introduced later to avoid disadvantaging already efficient buildings, defines fixed performance thresholds according to building category, activity, and location. The detailed absolute benchmarks are being progressively developed and communicated by the administration, and regulated entities are allowed to comply with whichever target, relative or absolute, is less demanding for their situation. In both cases, reported consumption is adjusted for climatic variations to ensure comparability across years and regions.

Scope of Application and Exemptions. The decree applies to all buildings used for service-sector activities where the floor area dedicated to such uses is at least 1,000 square meters. This includes both single buildings and groups of buildings located on the same site and considered as a single land unit whose cumulative floor area dedicated to service-sector activities meets or exceeds this threshold.[3] The obligation applies jointly to owners and tenants, each responsible for their respective scope of control: owners for common areas and major renovation works, and tenants for energy management and improvements within their private premises. Prefects are responsible for local enforcement and can require non-compliant actors to submit corrective action plans. Exemptions or modulations of reduction targets may be granted in specific circumstances, including protection of architectural heritage, disproportionate cost relative to expected energy savings, technical or safety constraints, or regulatory incompatibility, upon submission of a detailed justification file for administrative review.

Implementation and Monitoring. The decree entered into force on October 1, 2019. The mandatory reporting obligation, which marks the start of the monitoring phase, came into effect

3. Service-sector activities include offices, public services, education, healthcare, justice, retail, hospitality, cultural and sports facilities, tourism and leisure buildings, warehouses, data centers, laundries, printing and reprography services, transportation hubs (airports, train and bus stations, ports), and similar uses.

in September 2022, coinciding with the launch of the OPERAT platform.[4] This digital platform is the technical cornerstone of the regulation: it enables stakeholders to declare their reference energy-consumption level, chosen between 2010 and 2019, and to report their annual consumption data thereafter. OPERAT automatically corrects reported values for climatic variations, classifies buildings by activity category and climate zone, and generates a compliance certificate summarizing the progress made toward the required reduction targets.

Reporting is primarily based on self-declaration by owners and tenants, who are expected to identify whether they fall under the regulation and to submit data accordingly. To support compliance, ADEME and local authorities periodically contact entities identified as likely to be subject to the decree, reminding them to report or update their data when omissions occur. This process reflects the gradual operationalization of the monitoring system and the government's current emphasis on awareness and data reliability before the first enforcement phase.

Enforcement. Although the reporting obligation has been mandatory since 2022, the authorities have so far adopted a tolerant approach, emphasizing awareness and data reliability over sanctions. No fines have been imposed yet, and enforcement remains gradual while the technical framework is being consolidated. Prefects are empowered to issue formal notices requiring submission of an action plan within three months in case of non-compliance. Persistent non-compliance may result in administrative fines of up to €1,500 for individuals and €7,500 for legal entities, along with public disclosure of non-compliant stakeholders ("name and shame"). Sanctions for failure to meet reduction targets are expected to apply from 2030 onward, when the first milestone target will become binding.

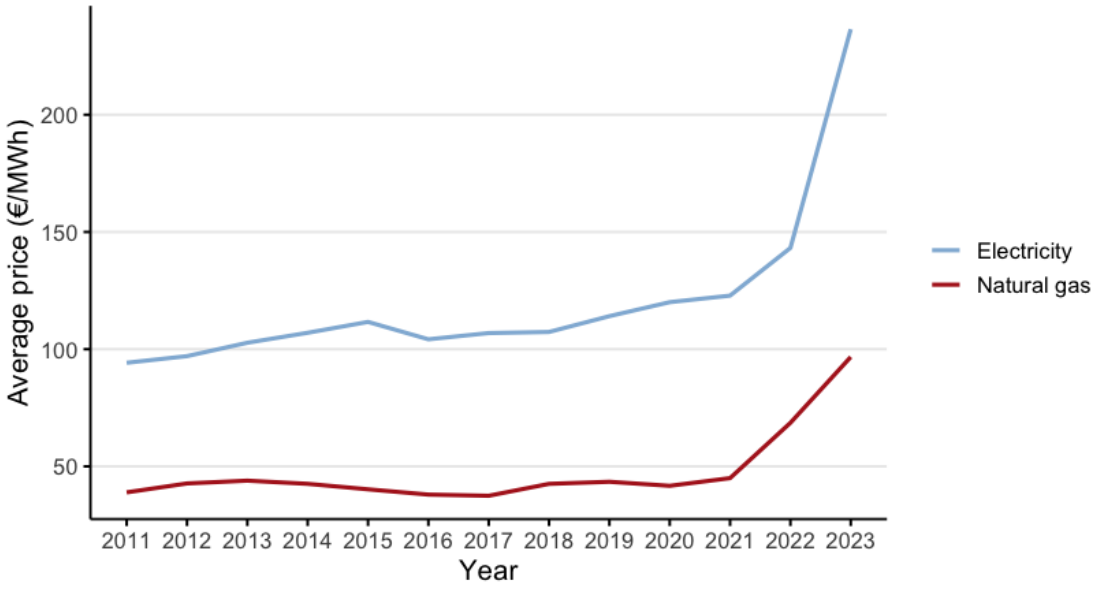
2.2 Energy Crisis in France

From the end of 2021 to the beginning of 2023, France, among other countries, experienced an important increase in energy prices. This energy crisis resulted from the lower availability of French nuclear plants due to unplanned maintenance and the sharp decrease in European gas imports from Russia following its invasion of Ukraine. These combined events led to historically

4. OPERAT: *Observatoire de la Performance Énergétique, de la Rénovation et des Actions du Tertiaire*. ADEME: *Agence de la Transition Écologique*, the French Agency for Ecological Transition. OPERAT is managed by ADEME and serves as the national system for reporting and monitoring energy performance data under the decree.

high wholesale energy prices in 2022, especially for electricity and gas, which were partly passed on to end users despite the support measures implemented by the government (SDES, 2024). In particular, the service sector, for which electricity and gas represent over three-quarters of total energy consumption, experienced a 93% increase in the average electricity price and a 115% increase in the average gas price between 2021 and 2023, as shown on figure 1.

Figure 1: Evolution of average energy prices in the French service sector



Notes: This figure displays the annual evolution of the average electricity and gas prices paid by service-sector businesses in France from 2011 to 2023. The average prices are calculated by dividing the total energy expenses of the service sector by its total energy consumption, for each energy type. The price of natural gas is expressed in euro per MWh GCV.
Source: *Séries longues du bilan énergétique provisoire de la France 2024* (SDES)

3 Data

3.1 Data Sources

For our main analysis, we leverage several sources of administrative data from France. These allow us to track commercial building energy consumption, characteristics, and renovation authorizations over time.

Local Energy Consumption. The main parameter targeted by the newly introduced policy is building energy consumption. To analyze its impact on this metric, we use the local energy consumption database provided by the *SDES*.[5] This dataset contains address-level annual electricity and gas consumption (measured in MWh) from 2018 to 2023. It is provided by transmission system operators and distribution system operators with more than 50,000 customers (RTE, Enedis).[6] This address-based data covers consumption and delivery points for business buildings by major sector of activity, and for residential buildings with at least 10 dwellings. We filter it to retain only service-sector activities, in line with the decree's scope. Address labels in this dataset vary in quality; some are incomplete or erroneous (e.g., missing street numbers or names, wrong labels). We perform a basic text analysis to harmonize and clean them. As several distinct observations may be recorded for a single address in a given year, we aggregate the data at the address level. To further improve data quality and generate corresponding geographic coordinates, we use the French government's geocoding tool and retain only observations with a satisfactory matching score, which eliminates clearly erroneous labels and substantially reduces the risk of mismatches.[7]

Renovation Authorizations. As renovation may be an important channel to reduce energy consumption, we also track the renovation authorizations recorded in *Sitadel* database, also maintained by the *SDES*. *Sitadel* is the official registry of construction authorizations in France, covering all operations from 2013 to 2024 for residential and non-residential use. It is supplied by information collected by local councils concerning urban planning acts. It mainly includes parcel-level information on building permits, but also on declarations of works, demolition permits, and subdivision permits. For our analysis, we focus on renovation works on existing buildings, recorded as permits, and restrict the sample to operations on commercial buildings (offices, retail, hotels, and public sector).

5. Statistical Department for Data and Studies under the French Ministry for Ecological Transition.
6. The market share of these providers represents about 50% of the entire market.
7. In our main analysis, this threshold is set at 0.5 to ensure a high-quality match, which results in a drop of about 20% of observations.

Transactions and Prices. To analyze market responses, we use the *DV3F* database provided by Cerema and made available by the DGALN under the Ministry for Ecological Transition.[8] This administrative dataset records all property transactions in France from 2012 to 2023, including information on transaction price, floor area, location, and building characteristics. For the purpose of this study, we focus on sales involving buildings with non-zero non-residential floor area, regardless of their exact use (e.g. offices, retail, hotels, or public facilities). We exclude transactions with a reported floor area below 10 square meters and remove the top and bottom 1 percent of observations based on price per square meter to address extreme outliers. These filters ensure that the analysis focuses on economically meaningful and properly recorded market transactions.

Land Registry. To complete our analysis, we rely on the *Fichiers Fonciers*, an exhaustive administrative dataset that compiles annual parcel-level information on land use, building characteristics, and ownership in France, provided by *Cerema*.[9] It is derived from tax administration records maintained by the *DGFiP*.[10] The dataset allows us to track annually the evolution and characteristics of the real estate stock, including geolocation, construction year, floor area, number of floors, ownership type, and features such as parking. To align with the *Décret tertiaire*, we use the TUP database (*Table Unifiée du Parcellaire*) from 2018 to 2024, which aggregates adjacent cadastral parcels into consistent and stable land units by resolving geometric inconsistencies and grouping parcels that share ownership or built structures.

The analysis is conducted at the TUP level because this is the unit explicitly considered by the policy for compliance and reporting. A single land unit may contain several parcels or buildings, which can collectively exceed the 1,000 square meters threshold that defines whether the policy applies. Using parcels or buildings as the unit of observation would therefore risk underestimating the number of regulated sites, since some would appear below the threshold individually even though they are subject to the regulation as part of a larger land unit. We thus focus on land units containing at least 10 square meters of built area used for service-sector activities, covering over two million units across the full panel.

8. DGALN stands for *Direction Générale de l'Aménagement, du Logement et de la Nature*, the French government directorate responsible for planning, housing, and land policy.
9. Center for Studies and Expertise on Risks, the Environment, Mobility, and Urban Planning.
10. French General Directorate of Public Finances.

3.2 Spatial and Parcel Matching

One key step and contribution of our analysis consists in matching, for the first time, address-level energy consumption data with building characteristics. To do so, we perform a spatial join that assigns, by year, each consumption observation to the nearest land unit from the *Fichiers Fonciers*. Our computation is based on the Haversine distance, which is appropriate for handling the very large number of land unit observations. Crucially, this step allows us to link the energy consumption of service-sector activities with key building characteristics such as floor area and construction year.

Another critical aspect of the paper is the matching of renovation authorizations with the same land unit information. To perform this match, we first recover parcel IDs in *Sitadel* based on cadastral references and municipality codes. A maximum of three different parcels is recorded for each construction project. We assign a renovation authorization to a land unit in a given year if at least one parcel associated with the project is part of the land unit. This approach allows us to perfectly match two-thirds of the renovation projects with land units. Since parcel IDs are not correctly recorded for the remaining projects, we apply the same spatial join approach as previously used for the energy consumption data. In the end, this allows us to construct a binary variable indicating whether a renovation has been authorized for each land unit in a given year (equal to 1 in that case, and 0 otherwise).

We apply a similar procedure to match transaction data from the *DV3F* database with the land units constructed from the *Fichiers Fonciers*. Using the cadastral references available in both datasets, we assign transactions to land units on a yearly basis. We restrict the match to transactions involving buildings with positive non-residential floor area. This matching process allows us, for each land unit and year, to determine whether a transaction occurred (binary indicator equal to 1), and to recover the associated transaction price and building characteristics, including surface, location, and type of use.

3.3 Treatment Definition

We define a land unit as treated if its total non-residential floor area equals or exceeds 1,000 square meters, consistently with the eligibility threshold set by the *Décret Tertiaire*.[11] In our baseline approach, treatment assignment is based on floor area measured in 2018, the first year available in our data. This treatment status is held constant across years for all post-2018 analyses.[12]

Our study ensures that the exemptions defined by the decree are taken into account. We therefore construct a list of exempted land units, which we remove from our sample. First, we use data provided by the French Ministry of Culture to identify approximately 43,000 buildings protected as Historic Monuments. Second, we leverage OpenStreetMap data to detect all places of worship, as well as buildings used for defense, civil protection, or national security activities (primarily military zones, police stations, and gendarmeries). We apply the same spatial join procedure as before to assign to each of these geocoded observations the nearest land unit. Finally, we remove all land units that meet at least one of these three exemption criteria.

3.4 Sample

To ensure comparability over time, we focus on a balanced panel composed of the same land units observed in each year of the study period. In addition, we restrict the sample to land units whose non-residential floor area is consistently above or below the 1,000 square meter threshold in all years of observation. This restriction eliminates cases where treatment status may change over time due to extensions, new constructions, or administrative corrections in surface measurements. It ensures that treatment assignment is not sensitive to marginal year-to-year variations and reinforces the interpretation of our estimates as reflecting discontinuous exposure to the regulation.[13]

To study energy consumption dynamics, we restrict the econometric sample by trimming the top and bottom 5% of the distribution of annual consumption changes between 2018 and 2023. This approach removes extreme fluctuations likely driven by exceptional circumstances in

11. In line with the regulatory definition, indoor and outdoor parking areas are excluded from the calculation of non-residential floor area used to define treatment status.

12. This approach is consistent with the decree, which specifies that regulatory obligations remain applicable to a building once it has crossed the 1,000 square meter threshold.

13. These restrictions remove around 30% of observed land units.

a building's lifecycle, such as prolonged vacancy or construction work, which could introduce noise into the estimation. The thresholds appear reasonable: the lower bound corresponds to a 76% drop in consumption (i.e., the building consumes only 24% of its 2018 level), while the upper bound reflects a 127% increase (i.e., more than double the initial consumption), indicating substantial deviations from typical usage patterns.

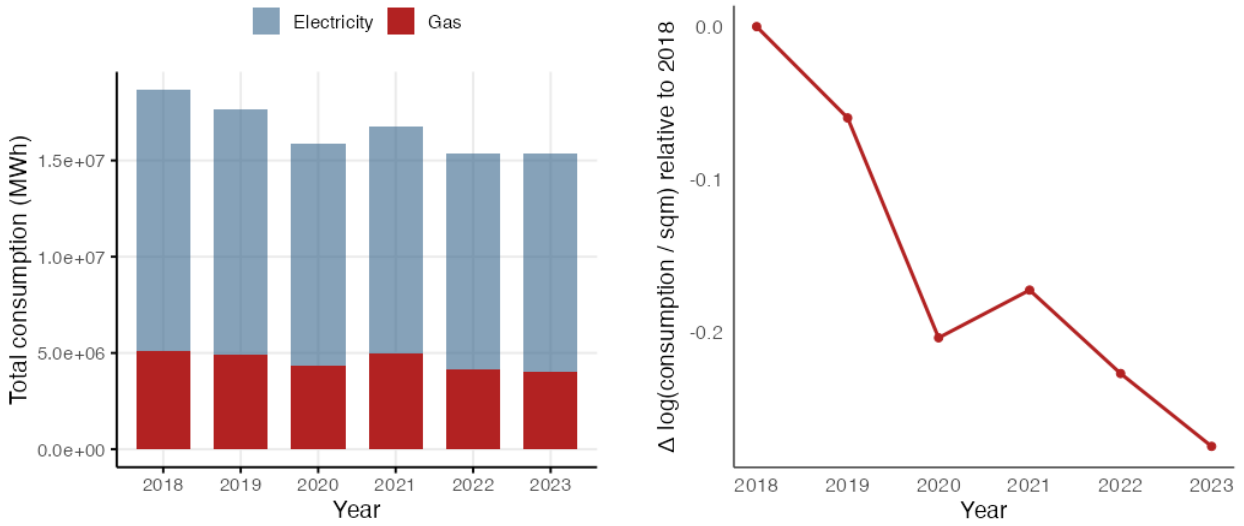
When analyzing renovation activity, we exclude land units composed entirely of new buildings less than or equal to two years old, in order to focus on structures that are plausibly subject to renovation decisions during the observation period.[14]

Figure 2 illustrates aggregate trends in energy consumption among commercial buildings in our balanced sample between 2018 and 2023. Panel (a) shows that total energy consumption, defined as the combined electricity and gas use, has steadily declined over the period, reaching approximately 15 million MWh in 2023. This downward trend applies to both electricity and gas in similar proportions. Panel (b) complements this picture by showing changes in average consumption per square meter, a proxy for energy efficiency. Between 2018 and 2023, average energy use per square meter declined by 27 percent, suggesting substantial efficiency gains. While these patterns may signal progress toward the reduction targets set by the *Décret Tertiaire*, they should be interpreted with caution. The figures are not corrected for weather conditions, and recent winters have been particularly mild.[15] In addition, consumption per square meter is sensitive to occupancy and activity levels: the sharp contraction in economic activity at the height of the pandemic in 2020, and the subsequent expansion of work-from-home, may have reduced actual office use and thereby lowered energy demand independent of technical efficiency improvements. Finally, part of the observed reduction may reflect behavioral adjustments to the rise in energy prices after 2022, rather than structural improvements to comply with the policy.

14. This restriction remove an additional 15% of land unit observations, essentially due to missing observations for the building age variable.

15. The French Agency for Ecological Transition (ADEME) has observed a similar reduction in the data collected through the OPERAT platform, and is currently working on producing a climate-adjusted version of energy consumption figures.

Figure 2: Energy Consumption Trend



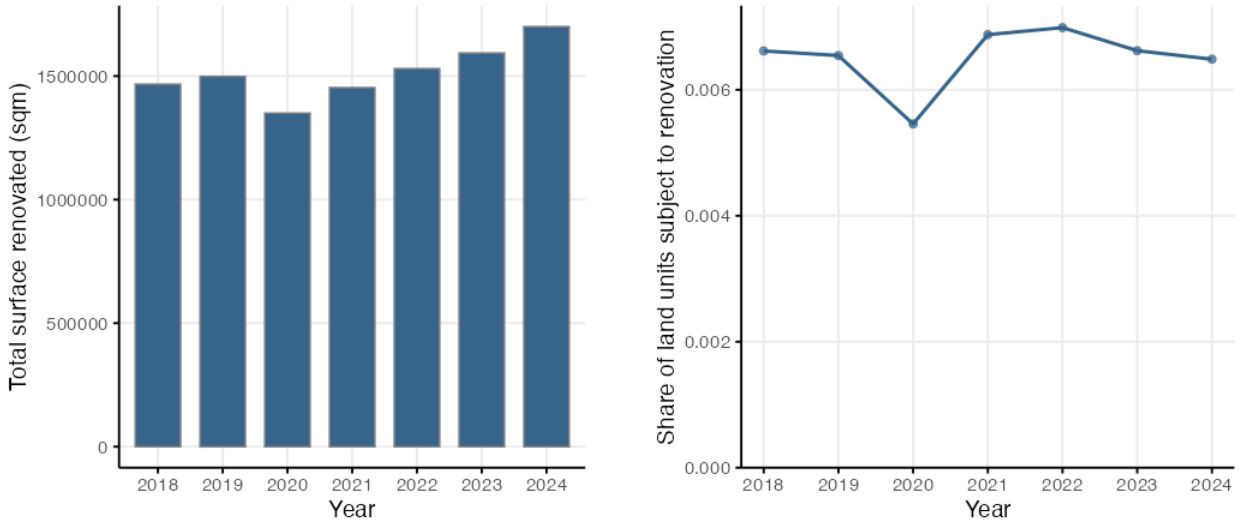
(a) Total Consumption

(b) Average Consumption Change

Notes: This figure displays the annual evolution of energy consumption in France from 2018 to 2023. Panel (a) shows total consumption, measured as the sum of electricity and gas consumption across all land units in the balanced sample. Panel (b) reports the average change in consumption per square meter relative to 2018, providing an indication of energy efficiency improvements over time.

Figure 3 displays aggregate trends in the renovation of commercial buildings in France between 2018 and 2024. Panel (a) shows that the total annual floor area permitted for renovation has steadily increased since 2021, exceeding 1.6 million square meters in 2024. This follows a temporary drop in 2020, likely driven by the Covid-19 crisis. Panel (b) shows that the share of land units undergoing renovation each year has remained relatively stable and low, around 0.6% throughout the period. This low annual renovation rate highlights the magnitude of the challenge: at this pace, it would take many years to renew the commercial building stock at scale.

Figure 3: Renovation of Commercial Buildings in France



(a) Renovated Floor Area

(b) Share of Renovated Land Units

Notes: This figure displays the annual evolution of renovation activity in France from 2018 to 2024. Panel (a) plots the total floor area permitted for renovation each year, while panel (b) shows the share of land units with at least one renovation permit.

4 Empirical Strategy

4.1 Identification Strategy

To estimate the causal effect of the *Décret Tertiaire*, we exploit the sharp discontinuity in regulatory exposure created by the 1,000 square meter floor area threshold. Buildings with a non-residential floor area equal to or above this cutoff are subject to mandatory reporting and energy reduction obligations, while those just below are exempt. This regulatory design lends itself to a sharp regression discontinuity design (RDD), in which treatment assignment changes abruptly when a continuous running variable crosses a known threshold.

The econometric implementation is formalized in the equation below:

$$Y_i = \alpha + \tau \cdot \mathbb{1}[\text{Area}_i \geq 1000] + f(\text{Area}_i) + \varepsilon_i \tag{1}$$

where Y_i denotes the outcome of interest for the land unit i, $\mathbb{1}[\text{Area}_i \geq 1000]$ is a binary indicator for regulatory exposure, and $f(\text{Area}_i)$ is a smooth function of non-residential floor area. The

coefficient τ captures the local average treatment effect of the regulation at the threshold.

We implement the robust bias-corrected sharp regression discontinuity estimator developed by Calonico et al. (2014), which corrects for the bias introduced by local polynomial estimation near the threshold and delivers valid inference in finite samples. This correction is especially relevant when estimation relies on relatively few observations near the threshold, as is common in sharp designs. In our baseline specification, we use a second-order local polynomial regression fitted separately on each side of the cutoff.

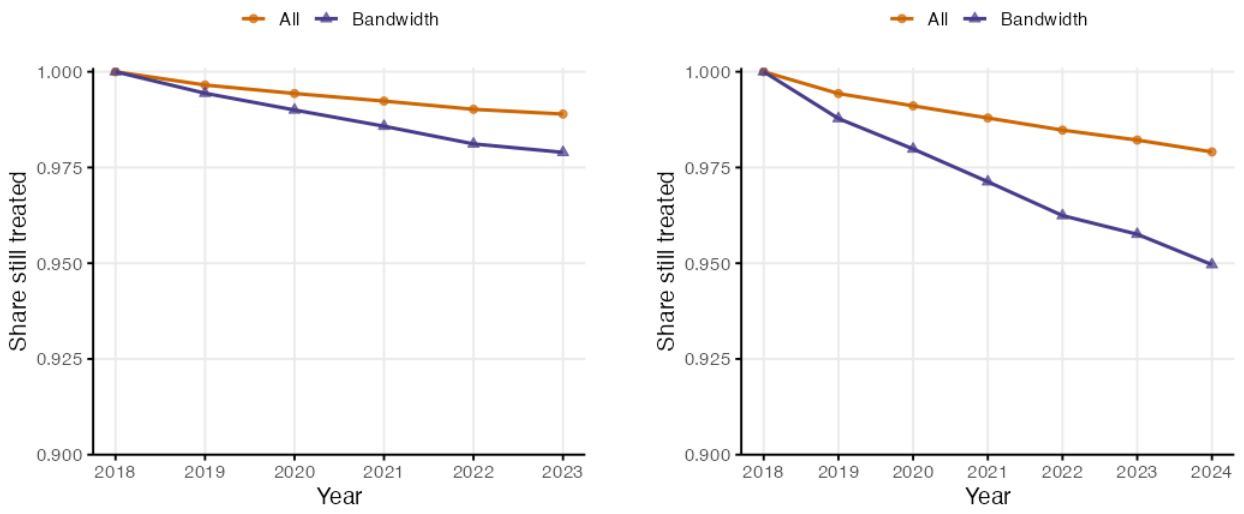
4.2 Identification Assumptions

Identification relies on the assumption that, in a sufficiently small neighborhood around the cutoff, potential outcomes vary smoothly with building size in the absence of treatment. Within this local window, treated and control units are assumed to be comparable in all unobserved respects, so that any discontinuous change in outcomes at the threshold can be causally attributed to the regulation. A key condition for identification is that the running variable, non-residential floor area, is not subject to precise manipulation by agents. Under these assumptions, the regression discontinuity design identifies the local average treatment effect (LATE) of the decree for buildings near the eligibility threshold.

Figure 4 examines whether the policy induces bunching behavior, specifically strategic manipulation of reported building size to remain below the regulatory exposure threshold. The plots display the share of land units that were treated in 2018 (that is, with commercial floor area above 1,000 square meters) and remained treated in subsequent years, both for the full sample and for the subsample within the optimal bandwidth. In all outcome panels, treatment stability is very high: over 95 percent of initially treated units remain treated through 2024, even in the narrow neighborhood of the threshold. This provides strong evidence against bunching, as it suggests that building size declarations were not systematically altered to avoid regulation. Appendix figure A1 further supports this conclusion by showing that control stability, meaning the share of units remaining below the threshold, is also high but consistently lower than treatment stability. Notably, the number of units crossing the threshold from below to above exceeds the reverse, allowing us to rule out strategic efforts to avoid regulatory exposure. Nonetheless, units whose treatment status changes over time are not negligible. This is unsurprising given the

nature of real estate assets, whose physical characteristics such as floor area may evolve. These observations reinforce our decision to restrict the core analysis to land units with stable treatment status throughout the study period.

Figure 4: Treatment Stability Over Time



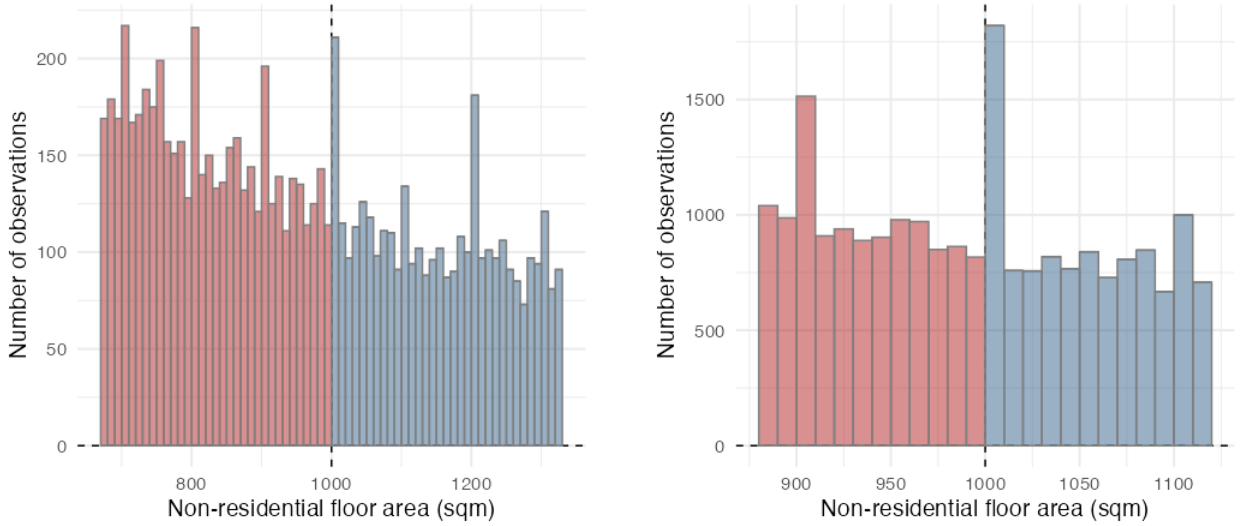
(a) Consumption **(b)** Renovation

Notes: This figure shows the share of observations that were treated in 2018, meaning with commercial floor area above 1,000 square meters, and remained above this threshold in the following years. It is presented by year for each outcome panel (consumption, renovation), separately for the full sample and for the estimation sample within the corresponding optimal bandwidth.

Figure 5 displays the distribution of the running variable, the commercial floor area in square meters, within the selected bandwidths around the threshold of 1,000 square meters. We can see in both panels that the running variable displays regular density peaks at round values (for example 900, 1,000, and 1,100 square meters). While this heaping reflects the common reporting practice in real estate of rounding floor areas to the nearest 10 or 100 square meters in records and permits rather than strategic manipulation, it could still invalidate our analysis if observations at the heaps are significantly different from the non-heaped observations (Barreca et al., 2016). By checking the continuity of covariates at the threshold, we uncover a significant drop in the employment density of the municipality in which the buildings are located, as shown in appendix figure A8 panel (b). To address this problem, we follow Barreca et al. (2011) as recommended in

the econometric literature on RDD (Dong, 2015) and implement a "donut RDD", which consists in discarding the observations near the threshold. We therefore remove observations for which the floor area is exactly equal to 1,000 sqm from our estimation sample. The new distribution of the running variable is shown in figure 6, now displaying continuity at the cutoff. We also verify the continuity of the covariates in this new sample in appendix figure A8 panels (c) and (d) and find that it holds, lending further credibility to our design. For comparison and transparency, we report the results of the conventional RDD in the robustness section.

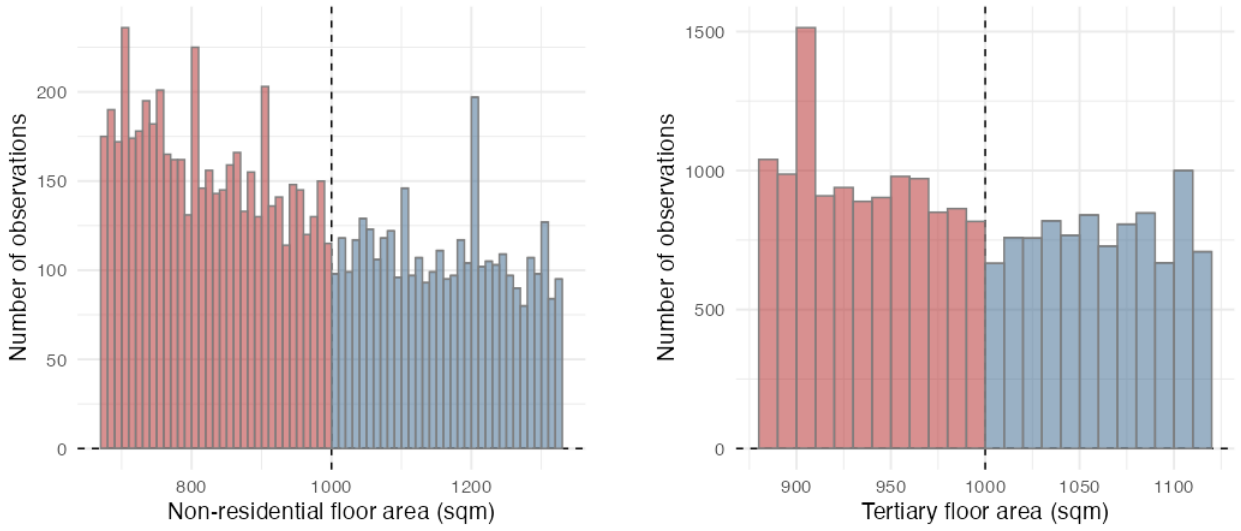
Figure 5: Running Variable Distribution Around the Cutoff



(a) Consumption **(b)** Renovation

Notes: This figure presents histograms of the running variable, non-residential floor area in square meters, within the optimal bandwidth around the 1,000 square meter treatment cutoff. Each panel corresponds to one outcome (consumption, renovation). The histograms use 10 square meter bins and are centered at the cutoff to assess the density and continuity of the running variable around the threshold.

Figure 6: Running Variable Distribution Around the Cutoff (without 1,000 sqm observations)



(a) Consumption **(b)** Renovation

Notes: This figure presents histograms of the running variable, non-residential floor area in square meters, within the optimal bandwidth around the 1,000 square meter treatment cutoff with observations exactly equal to 1,000 square meter excluded. Each panel corresponds to one outcome (consumption, renovation). The histograms use 10 square meter bins and are centered at the cutoff to assess the density and continuity of the running variable around the threshold.

4.3 Outcomes of Interest

We examine several outcomes to capture distinct layers of response to the policy. In the real estate sector, the introduction of a long-term energy regulation can lead to two main forms of adjustment. The first involves modifying energy use and operational behavior, for example by reducing heating or cooling levels, improving maintenance, or coordinating energy consumption among users. These measures are relatively inexpensive and can be implemented quickly, but their effect on overall energy use is limited because they do not change the building's physical characteristics. The second involves investment in renovation to improve energy efficiency, for instance through better insulation, replacement of windows, or modernization of heating and cooling systems. Renovation requires substantial upfront expenditure and can temporarily disrupt activity, yet it delivers much larger and longer-lasting improvements in performance. We measure energy consumption behavior as the log change in consumption between 2018 and 2023, defined as $Y = \log(\text{Consumption}_{2023}/\text{Consumption}_{2018})$. For renovation activity, we construct a

binary indicator equal to one if a renovation permit is filed after the policy implementation date (October 1, 2019) and up to 2024, and zero otherwise.

The policy could also affect owners' incentives to sell and investors' willingness to acquire buildings subject to the targets, depending on the extent of the efforts required to meet those targets. To assess these market effects, we consider two outcomes observed over the 2019–2023 period: a binary indicator for the occurrence of a transaction, and the logarithm of transaction price for observed sales, $Y = \log(\text{Price})$.

4.4 RDD Samples

For each outcome panel, the econometric analysis is restricted to observations within a data-driven bandwidth around the 1,000 square meter threshold, chosen after removing the observations with a floor area exactly equal to 1,000 square meters from the sample. Bandwidths are selected using the mean squared error (MSE)-optimal procedure developed by Calonico et al. (2020), which minimizes the expected squared difference between the estimated and true treatment effects. This method jointly selects estimation and bias-correction bandwidths to balance bias and variance in local polynomial regressions. We therefore use one optimal bandwidth per outcome panel throughout the analysis. Table 1 reports summary statistics for the year 2018, the first year of observation and baseline prior to policy implementation. The two panels correspond to our main outcomes of interest: Panel A focuses on energy consumption, while Panel B examines renovation activity. Each panel is restricted to the corresponding optimal bandwidth around the 1,000 square meter threshold. As expected, electricity accounts for the vast majority of reported energy consumption, particularly near the threshold.

Table 1: Descriptive Statistics Within the Optimal Bandwidth

Variable	Unit	Mean	Q1	Median	Q3	SD
Panel A: Energy Consumption *Optimal Bandwidth = 331, N = 8879*						
Non-residential floor area	sqm	959.20	792.00	935.00	1120.00	191.15
Energy consumption	MWh/sqm	0.27	0.06	0.11	0.22	0.82
Electricity share	/total consumption	0.94	1.00	1.00	1.00	0.20
ΔConsumption	log(2023/2018), MWh/sqm	-0.21	-0.37	-0.18	-0.02	0.36
Building age	years	60.14	15.00	34.00	98.00	61.35
Employment density	jobs/sqkm	2327.60	161.83	499.28	1426.80	4779.16
Panel B: Renovation *Optimal Bandwidth = 117, N = 20396*						
Non-residential floor area	sqm	992.29	930.00	987.00	1052.00	69.01
Renovation permit	0/1	0.007	0.000	0.000	0.000	0.083
Building age	years	50.52	12.00	28.00	60.25	60.90
Employment density	jobs/sqkm	955.37	25.12	114.15	490.68	3057.47

Notes: This table presents descriptive statistics for the samples used in the regression discontinuity analyses of energy consumption (Panel A) and renovation (Panel B). Each panel is restricted to observations within the corresponding MSE-optimal bandwidth around the 1,000 square meter threshold defined by the *Décret Tertiaire*.

Table 2 compares mean characteristics between treated and control units within the respective bandwidths. Statistics appear broadly similar across groups, supporting the assumption that buildings just below and above the threshold are sufficiently comparable to identify the causal impact of the policy.[16]

16. Employment density is significantly higher in the consumption sample compared to the renovation sample. This is expected, as the consumption panel only includes buildings for which energy use is reported by major electricity and gas providers, which tend to cover denser urban areas.

Table 2: Group Means by Treatment Status Within the Optimal Bandwidth

Variable	Unit	Control	Treated	T-test
Panel A: Energy Consumption				
Optimal Bandwidth = 331; Treated: 3595; Control: 5284				
Non-residential floor area	sqm	822.17	1160.59	***
Energy consumption	MWh/sqm	0.30	0.23	***
Electricity share	/total consumption	0.95	0.94	
ΔConsumption	log(2023/2018), MWh/sqm	-0.20	-0.22	***
Building age	years	63.31	55.36	***
Employment density	jobs/sqkm	2383.95	2281.50	
Panel B: Renovation				
Optimal Bandwidth = 117; Treated: 9186; Control: 11210				
Non-residential floor area	sqm	937.62	1058.99	***
Renovation permit	0/1	0.006	0.008	*
Building age	years	51.82	48.93	***
Employment density	jobs/sqkm	949.53	962.49	

Notes: This table reports the mean values of key variables by treatment status within the optimal bandwidth around the 1,000 square meter threshold, for both the energy consumption and renovation samples. Variables are measured in 2018, the reference year prior to policy implementation. *Treated* refers to units with commercial floor area greater than 1,000 square meters. *Control* refers to units below that threshold.

5 Results

5.1 Main Findings

In this section, we present and discuss the main findings of the empirical strategy previously detailed.

Regulatory Exposure Lowers Energy Consumption. Table 3 presents the results of the regression discontinuity design estimating the impact of the *Décret Tertiaire* on land-unit-level energy consumption change between 2018 and 2023. The estimates show that regulatory exposure leads to an average reduction of 8 percentage points in energy consumption, confirming that commercial real estate occupiers are responsive to the long-term reduction target set by the policy. This effect remains stable and statistically significant across all specifications. Columns (2) to (5) progressively introduce a range of controls. Column (2) adds occupier's sector fixed effects, which are important given the heterogeneous effects of the Covid-19 pandemic across industries.

Column (3) includes French department fixed effects to account for spatial variation in temperature and climate, which may affect annual energy use. Column (4) controls for the logarithm of employment density at the municipality level, to capture the influence of urban structure on energy dynamics. Finally, column (5) includes all controls simultaneously. The consistency of the results across specifications strengthens the conclusion that the policy had a meaningful effect on energy use reductions among regulated buildings.

Table 3: Policy Effect on Energy Consumption Change

	ΔConsumption/sqm				
	(1)	(2)	(3)	(4)	(5)
Treatment effect	-0.094***	-0.093***	-0.095***	-0.093***	-0.093***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)
Sector FE		✓			✓
Department FE			✓		✓
log(density)				✓	✓
Bandwidth	331	331	331	331	331
Control group mean	-0.189	-0.189	-0.189	-0.189	-0.189
N	8879	8879	8879	8879	8879

Notes: $^{**}p < 0.01$. This table reports robust regression discontinuity estimates from model (1), where the dependent variable is the change in annual energy consumption (electricity and gas), measured as $\log(\text{Consumption/sqm}_{2023}/\text{Consumption/sqm}_{2018})$. The year 2018 serves as the reference year, prior to the implementation of the *Décret Tertiaire*, while 2023 is the latest available consumption data . All estimations are conducted at the land unit level. Treatment refers to the 1,000 square meter threshold defined by the *Décret Tertiaire*. Estimates are based on the robust bias-corrected procedure a second-order polynomial in the running variable. Standard errors are reported in parentheses.

Table 4 presents yearly estimates of the policy's effect on energy consumption, measured as annual changes relative to 2018 at the land unit level. As expected, there is no statistically significant effect in the early years following the introduction of the decree, including 2019 and 2020. This pattern is consistent with the gradual rollout of the policy and the limited salience of its obligations during this initial phase. The reporting requirement under the *Décret Tertiaire* only became mandatory at the end of 2022, which likely contributed to the lack of immediate behavioral response. From 2022 onward, following the energy crisis linked to Russia's invasion of Ukraine, the estimated effects begin to grow in magnitude, and by 2023 the treatment effect reaches statistical significance. These results provide evidence that regulatory exposure leads

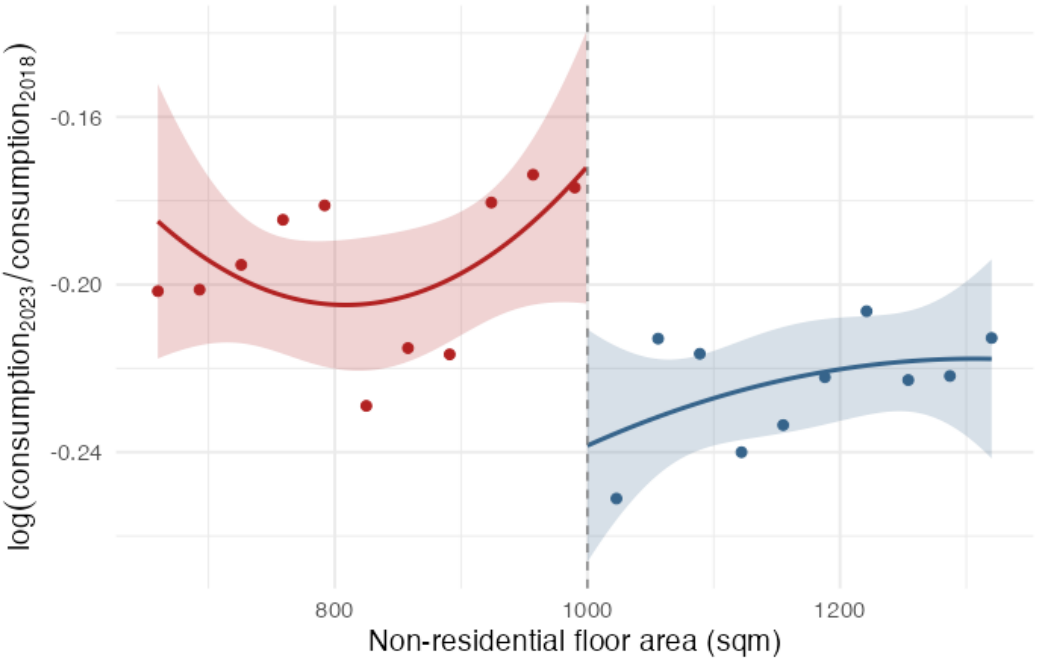
to observable adjustments in energy consumption behavior among commercial real estate occupiers, but only when it becomes sufficiently salient and when financial incentives are aligned with the policy obligations.

Table 4: Policy Effect on Energy Consumption Change by Year

	ΔConsumption/sqm				
	(1)	(2)	(3)	(4)	(5)
	2019	2020	2021	2022	2023
Treatment effect	-0.007	0.014	0.010	-0.037	-0.094***
	(0.009)	(0.019)	(0.023)	(0.024)	(0.028)
Bandwidth	331	331	331	331	331
Control group mean	-0.027	-0.177	-0.116	-0.139	-0.189
N	8968	8897	8919	8904	8879

Notes: $^{**}p < 0.01$. This table reports robust regression discontinuity estimates from model (1), where the dependent variable is the change in annual energy consumption (electricity and gas), measured as $\log(\text{Consumption}_t/\text{Consumption}_{2018})$ for each year t between 2019 and 2023. The year 2018 serves as the reference year, prior to the implementation of the *Décret Tertiaire*. All estimations are conducted at the land unit level. Treatment refers to the 1,000 square meter threshold defined by the *Décret Tertiaire*. Estimates use the robust bias corrected procedure with a polynomial of order two in the running variable; standard errors are in parentheses. N differs slightly across years because, for each year, we trim the top and bottom 5 percent of consumption changes before restricting the sample to the optimal bandwidth around the cutoff. For comparability, the bandwidth is set to 331 square meters (selected on the 2023 data) and then applied uniformly to all years.

Figure 7: Discontinuity in Energy Consumption Change at the Policy Cutoff



Notes: This figure presents the graphical sharp regression discontinuity design estimate of the effect of the *Décret Tertiaire* on energy consumption change in 2023 relative to 2018, based on model (1). The outcome variable is $\log(\text{Consumption/sqm}_{2023}/\text{Consumption/sqm}_{2018})$. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter cutoff defining regulatory exposure. Dots represent binned means: red for units below the cutoff (control), blue for those above (treated). Fitted lines are local polynomial regressions of second order, estimated separately on each side of the threshold. Shaded areas represent 95% confidence intervals.

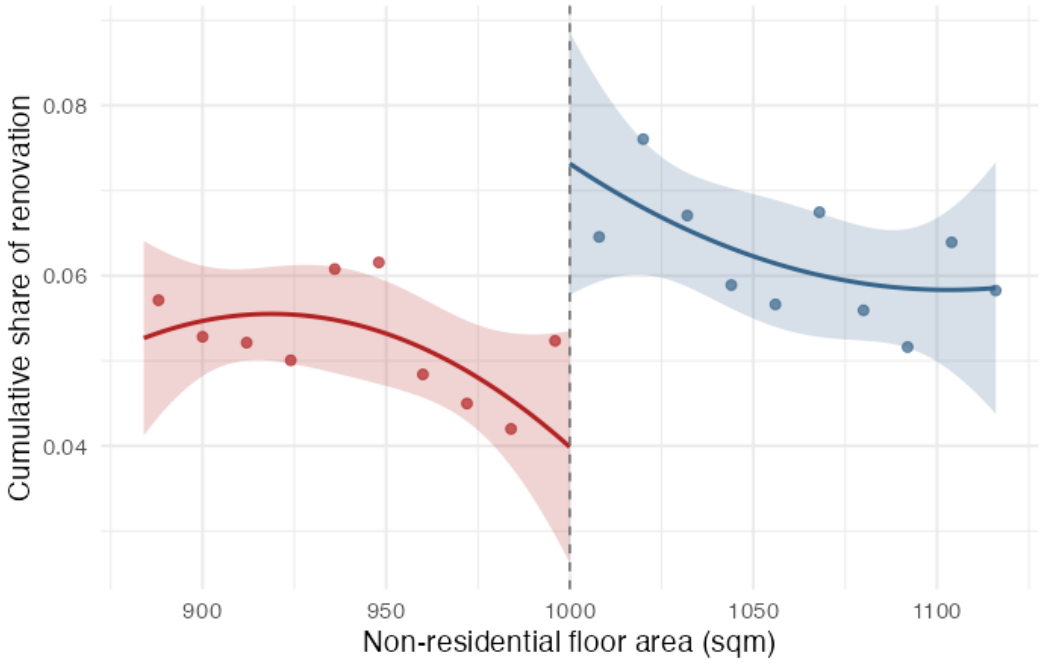
Regulation Exposure Spurs Building Renovations in Salient Periods. Table 5 provides evidence of a substantial impact of the *Décret Tertiaire* on the likelihood of undertaking renovation work. On average, regulatory exposure increases the probability of at least one renovation between October 1, 2019 and December 31, 2024 by 3 percentage points at the 1,000 square meter cutoff. This is a sizable effect relative to the average renovation rate in the sample, which is just 5.5 percent. Columns (2) through (4) introduce controls for two key factors that may influence renovation decisions: the logarithm of building age and the logarithm of local employment density. Building age is a strong predictor of renovation needs, as older buildings are more likely to require structural upgrades or energy retrofits. Employment density captures local economic activity and urban intensity, which may influence both the demand for high-performing buildings and the capacity of owners to finance improvements. The estimated treatment effect remains highly significant and stable across specifications, confirming the robustness of the results. These findings suggest that the long-term reduction targets imposed by the decree create an incentive to initiate renovation projects requiring permits, in order to improve the structural energy performance of buildings. Figure 8 provides a visual confirmation of the discontinuity in cumulative renovation likelihood observed in Table 5, showing a clear upward shift at the 1,000 square meter threshold.

Table 5: Policy Effect on Renovation Likelihood

	Renovation Permit (0/1)			
	(1)	(2)	(3)	(4)
Treatment effect	0.034**	0.034**	0.034**	0.034**
	(0.012)	(0.012)	(0.012)	(0.012)
log(age)		✓		✓
log(density)			✓	✓
Bandwidth	117	117	117	117
Control Group Mean	0.052	0.052	0.052	0.052
N	20396	20396	20396	20396

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table presents estimates from model (1), where the dependent variable is a binary indicator equal to 1 if a land unit underwent at least one renovation between the implementation of the decree on October 1, 2019 and December 31, 2024., and 0 otherwise. The treatment variable captures whether the commercial floor area of the land unit equals or exceeds 1,000 square meters in 2018, as defined by the *Décret Tertiaire*. Columns (2) to (4) progressively control for the logarithm of building age and the logarithm of municipality-level employment density. All regressions use a robust bias-corrected local polynomial of second order with the MSE-optimal bandwidth. Standard errors are in parentheses.

Figure 8: Discontinuity in Renovation Likelihood at the Policy Cutoff

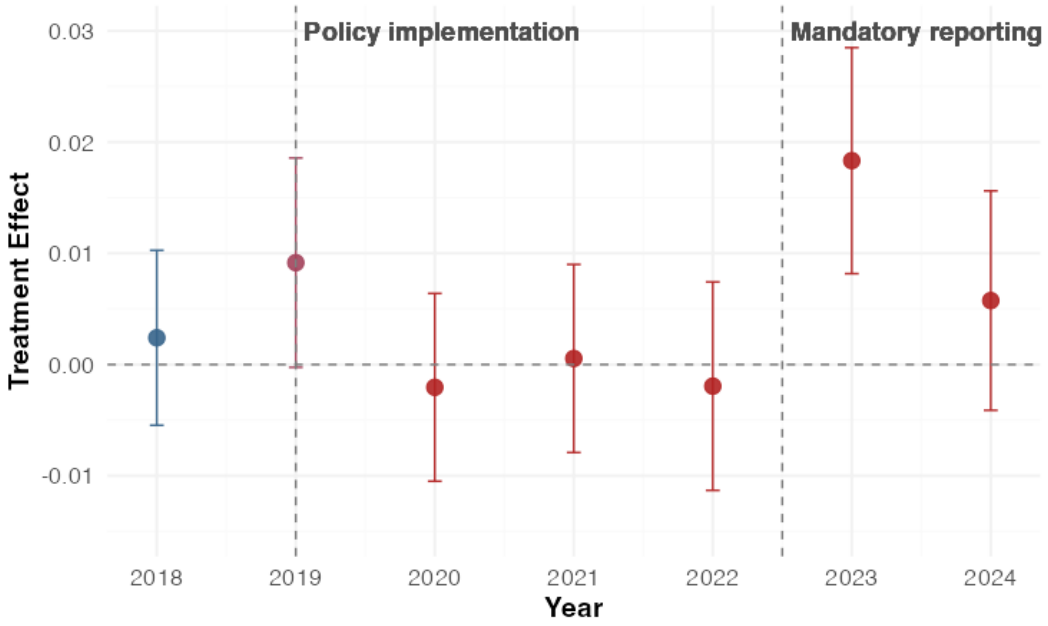


Notes: This figure presents the graphical estimate of the effect of the *Décret Tertiaire* on the cumulative likelihood of renovation by 2024, based on model (1). The outcome variable is a binary indicator equal to 1 if a renovation permit was issued for the land unit at any point between the implementation of the decree on October 1, 2019 and December 31, 2024. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter cutoff defining regulatory exposure. Dots represent binned means: red for units below the cutoff (control), blue for those above (treated). Fitted lines are second-order local polynomial regressions estimated separately on each side of the threshold. Shaded areas represent 95% confidence intervals.

Figure 9 illustrates how the discontinuity in the probability of renovation evolves over time, in line with the successive stages of enforcement of the *Décret Tertiaire*. In this specification, the dependent variable is a binary indicator equal to one if a land unit received at least one renovation permit within the corresponding year, and zero otherwise. This year-by-year setup differs from the cumulative specification used elsewhere, allowing us to isolate the timing of responses more precisely. As expected, no discontinuity is observed in 2018, prior to the policy's introduction. In 2019, we observe a small but statistically significant jump only after the implementation date of October 1, confirming that the effect is not driven by anticipatory behavior. The estimated effect remains muted in the following years, before strengthening markedly from 2023 onward, coinciding with the start of mandatory energy consumption reporting as well as the energy crisis. This temporal pattern underscores how the combination of regulatory and financial incentives

influence investment decisions. Full results and significance levels are reported in Appendix Table A1, which decomposes the year 2019 into pre- and post-implementation periods and shows that the significant jump is driven by the post-implementation period.

Figure 9: Short-Term Response in Renovation Activity to Regulatory Enforcement



Note: This figure presents estimates from model (1), run separately by year. The dependent variable is a binary indicator equal to one if a land unit received at least one renovation permit within the corresponding year, and zero otherwise. The treatment variable equals one if the commercial floor area of the land unit is at least 1,000 square meters in 2018. Each point represents the estimated treatment effect for a given year between 2018 and 2024, with vertical lines showing 95% confidence intervals. All regressions use a robust bias-corrected local polynomial of second order with the optimal bandwidth.

5.2 Additional Results

Role of Renovation Activity. To assess the extent to which the policy's effect on energy consumption change is driven by renovation activity, since the decree affects both consumption and renovation permits, we re-estimate the RDD after excluding land units that received at least one renovation permit since October 2019. Table 6 reports these results. This alternative specification removes about 5% of observations around the cutoff relative to the baseline. The estimated treatment effect remains negative and statistically significant across all specifications, although it

is about 10 to 15% smaller than in the baseline. This pattern indicates that renovations explain a small part of the estimated consumption response, with the remaining effect consistent with changes in usage and operating practices. Finally, recall that we trim the top and bottom 5% of annual consumption changes prior to bandwidth selection in every year, which already removes abnormal drops or spikes linked to temporary activity disruptions.

Table 6: Policy Effect on Energy Consumption Change

Excluding Land Units Subject to Renovation Permit

	ΔConsumption/sqm				
	(1)	(2)	(3)	(4)	(5)
Treatment effect	-0.081**	-0.079**	-0.081**	-0.080**	-0.079**
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Sector FE		✓			✓
Department FE			✓		✓
log(density)				✓	✓
Bandwidth	331	331	331	331	331
Control group mean	-0.197	-0.197	-0.197	-0.197	-0.197
N	8444	8444	8444	8444	8444

Notes: $^{**}p < 0.01$. This table reports robust regression-discontinuity estimates from model (1), where the dependent variable is the change in annual energy consumption (electricity and gas), measured as $\log(\text{Consumption/sqm}_{2023}/\text{Consumption/sqm}_{2018})$. The year 2018 serves as the reference year, prior to the implementation of the *Décret Tertiaire*, and 2023 is the latest year with available consumption data. All estimations are conducted at the land-unit level. Treatment refers to the 1,000 square meter threshold defined by the *Décret Tertiaire*. Estimates use the robust bias-corrected procedure with a second-order polynomial in the running variable; standard errors are reported in parentheses. For all specifications, we exclude land units that have at least one renovation permit issued since the decree's implementation in October 2019.

Heterogeneity by Ownership Type. We classify owners into four categories based on the *Fichiers Fonciers* ownership typology (`catpro2`), as detailed in Appendix Table A2. This grouping reflects broad economic functions and likely ownership situations rather than legal distinctions. Public owners include the State, local governments, and public institutions such as universities and hospitals. Real estate companies correspond to professional real estate investors and developers, including institutional investors, property companies, and semi-public developers, that typically own and manage buildings for rental or investment purposes. Other private owners encompass non-real-estate firms and organizations, such as those in industry, commerce, tourism,

or the non-profit sector, which are more likely to occupy the premises they own. Finally, individual owners refer to natural persons, usually small-scale investors or self-employed professionals.

Table 7 presents the heterogeneity in policy effects on the change in energy consumption between 2018 and 2023 across these ownership categories. The largest and most precisely estimated reductions are observed for public and non-real-estate private owners, while the effects for real estate professionals and individual owners are not statistically significant. The stronger response among public entities may reflect both better access to information about the regulation and stronger institutional incentives to comply, as these actors are directly involved in its implementation and reporting framework. For non-real-estate private owners, the result may be linked to a higher prevalence of owner-occupiers, whose incentives to reduce energy consumption are directly aligned with operating costs and compliance outcomes. By contrast, real estate companies, who typically lease their assets, may have limited control over tenants' energy use and therefore weaker capacity to respond to the regulation through behavioral adjustments. For individual owners, the absence of a significant effect may relate both to the small number of regulated sites in this category and to more limited awareness of the policy.

Regarding renovation activity, Table 8 shows a distinct pattern. The estimated effect is statistically significant only for real estate companies, who are more likely to undertake renovations when exposed to the policy. This result may reflect their larger financial capacity, stronger incentives to preserve or enhance asset value, and the fact that physical renovation is the main channel through which they can influence energy performance. Public and non-real-estate private owners display positive but non-significant coefficients, while the control group renovation rate is higher for public owners than for other categories. No effect is observed for individual owners, whose coefficient is slightly negative and imprecisely estimated, which may reflect the financial constraints and limited administrative capacity typically faced by smaller players.

Table 7: Policy Effect on Energy Consumption Change by Owner Type

	ΔConsumption/sqm			
	Individual	Public	Real Estate Companies	Other Private
Treatment effect	-0.064	-0.148*	-0.058	-0.104*
	(0.105)	(0.071)	(0.041)	(0.041)
Bandwidth	331	331	331	331
Control group mean	-0.209	-0.175	-0.201	-0.192
N	741	1072	4575	3401

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$. This table reports robust regression discontinuity estimates from model (1), where the dependent variable is the change in annual energy consumption (electricity and gas), measured as $\log(\text{Consumption/sqm}_{2023}/\text{Consumption/sqm}_{2018})$. The year 2018 serves as the baseline, prior to the implementation of the *Décret Tertiaire*. Each column presents results for a different owner type, based on the dominant ownership category of the land unit. Treatment refers to whether the commercial floor area of the land unit equals or exceeds 1,000 square meters in 2018. Estimates are based on a robust bias-corrected procedure using the MSE-optimal bandwidth and a second-order local polynomial. Standard errors are reported in parentheses.

Table 8: Policy Effect on Renovation Likelihood by Owner Type

	Renovation (0/1)			
	Individual	Public	Real Estate Companies	Other Private
Treatment effect	-0.010	0.031	0.051**	0.023
	(0.027)	(0.038)	(0.017)	(0.019)
Bandwidth	117	117	117	117
Control Group Mean	0.034	0.069	0.053	0.050
N	2750	2566	9724	6987

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table presents estimates from model (1), where the dependent variable is a binary indicator equal to 1 if a land unit received at least one renovation permit between the implementation of the decree on October 1, 2019 and December 31, 2024. The treatment variable captures whether the commercial floor area of the land unit equals or exceeds 1,000 square meters in 2018, as defined by the *Décret Tertiaire*. Each column reports results for a different owner type, based on the ownership category associated with the land unit. All regressions use a robust bias-corrected local polynomial of second order with the MSE-optimal bandwidth. Standard errors are reported in parentheses.

No Spillovers on Market Transactions and Prices. We now examine whether the policy had spillover effects on commercial real estate markets by testing its impact on the likelihood of property transactions. Table 9 presents regression discontinuity estimates where the outcome is a binary indicator equal to one if a land unit experienced at least one transaction between October 2019 and December 2024. The treatment is still defined by crossing the 1,000 square meter thresh-

old in non-residential floor area. The baseline estimate in Column (1) suggests a small, negative effect of the policy on transaction likelihood. However, once we control for the logarithm of local employment density in Column (2), the estimate becomes smaller and statistically insignificant. This control variable captures baseline economic activity, market depth, and the presence of potential buyers and sellers, all of which are important determinants of transaction activity. Across all specifications, including alternative choices of polynomial order and bandwidth, we find no evidence that the policy significantly affected transaction behavior at the threshold. This suggests limited spillover effects on investment decisions in the commercial property market.[17]

Table 9: Policy Effect on Transaction Likelihood

	Transaction (0/1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment effect	0.000	0.000	0.003	-0.004	-0.005	0.002
	(0.013)	(0.013)	(0.009)	(0.017)	(0.015)	(0.012)
log(density)		✓	✓	✓	✓	✓
polynomial order	2	2	1	3	2	2
bandwidth scale	×1	×1	×1	×1	×0.75	×1.25
Bandwidth	144	144	144	144	108	180
N	44485	44485	44485	44485	33761	56085

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table presents estimates from regression discontinuity models described in Equation (1), where the dependent variable is a binary indicator equal to 1 if a land unit was involved in at least one transaction between October 1, 2019 and December 31, 2023, and 0 otherwise. The treatment variable indicates whether the commercial floor area of the land unit was greater than or equal to 1,000 square meters in 2018, as defined by the *Décret Tertiaire*. Column (1) includes no covariates. Column (2) adds a control for the logarithm of municipality-level employment density. Columns (3)–(6) test alternative specifications using different polynomial orders or bandwidth scaling. All regressions use a robust bias-corrected local polynomial estimator with a triangular kernel. Bandwidths are selected using the MSE-optimal procedure. Standard errors are reported in parentheses.

Table 10 further supports the absence of significant spillover effects by examining the policy's impact on transaction prices. The outcome variable is the logarithm of transaction price for land units sold between October 2019 and December 2023. All specifications include controls for transacted floor area and local employment density, as well as year fixed effects to account for common shocks and changes in market conditions over time. We find no statistically significant

17. Appendix Figure A4 provides a visual confirmation of the absence of discontinuity in transaction likelihood once we control for employment density. Appendix Figure A5 decomposes the effect year by year and shows that a statistically significant negative discontinuity only appears in 2021.

discontinuity in price at the 1,000 square meter threshold. These results reinforce the conclusion that the policy did not affect market valuations of commercial real estate across the threshold in the short term. Appendix Figure A6 confirms this null result visually, showing no apparent discontinuity in transaction prices at the regulatory threshold. Moreover, Appendix Figure A7 illustrates that this pattern holds consistently across all years from 2018 to 2023, with no visible jump in any individual year.

Table 10: Policy Effect on Transaction Price

	log(price)				
	(1)	(2)	(3)	(4)	(5)
Treatment effect	0.037	-0.004	0.088	0.069	0.009
	(0.062)	(0.046)	(0.079)	(0.072)	(0.055)
log(sqm)	✓	✓	✓	✓	✓
log(density)	✓	✓	✓	✓	✓
year FE	✓	✓	✓	✓	✓
polynomial order	2	1	3	2	2
bandwidth scale	×1	×1	×1	×0.75	×1.25
Bandwidth	215	215	215	161	268
N	11192	11192	11192	8078	14107

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table reports estimates from regression discontinuity models described in Equation (1), where the outcome variable is the logarithm of the transaction price for land units that were transacted between October 1, 2019 and December 31, 2024. The treatment indicator equals one if the commercial floor area of the land unit exceeded 1,000 square meters in 2018. All specifications include controls for the logarithm of transacted floor area and the logarithm of employment density in the municipality, as well as year fixed effects. The outcome variable and the running variable are both residualized on year fixed effects to account for time-varying differences in building characteristics and market conditions. Columns (2) to (5) explore the robustness of the results by varying the polynomial order and the scale of the bandwidth used in the local polynomial estimation. All models use a triangular kernel and a robust bias-corrected estimator. Bandwidths are selected using the MSE-optimal procedure. Standard errors are reported in parentheses.

5.3 Robustness Checks

Bandwidth and Polynomial Sensitivity. Appendix Table A4 presents sensitivity analyses confirming that our baseline estimates are robust to alternative specifications. Specifically, we vary the order of the local polynomial and the size of the bias-correction bandwidth. In all cases, the estimated treatment effects remain statistically significant and consistent in sign and magnitude,

supporting the validity of our main findings.

Placebo Cutoff Tests. To further assess the validity of our identification strategy, we conduct placebo tests using alternative thresholds of 500, 750, 1250 and 1500 square meters. As reported in Appendix Table A5, the estimated effects at these placebo cutoffs are close to zero and statistically insignificant for both energy consumption and renovation outcomes. This reinforces the interpretation that the observed discontinuities in our main specification are driven by the policy threshold at 1,000 square meters, rather than by spurious correlations or underlying trends in the data.

Robustness to Extreme Variations in Energy Use. Appendix Table A3 presents results from a robustness check where we trim only the bottom and top 2.5 percent of the distribution of annual energy consumption changes, compared to the 5 percent trimming applied in the baseline specification. This less conservative approach retains a wider range of observations, including extreme consumption changes that may reflect atypical events such as major renovations, prolonged vacancy, or metering issues. While this broader sample introduces more variability, the results remain robust. In 2023, the estimated change in energy consumption between 2018 and 2023 is still 9 percentage points lower for treated units relative to comparable controls. The lower bound of the outcome variable in this extended sample corresponds to a situation where treated units consumed only about 12.2 percent as much energy as comparable controls, while the upper bound implies that treated units consumed up to 4.15 times more. These extreme values illustrate the broader variation allowed under lighter trimming, but the main conclusion remains unchanged: the policy is associated with a meaningful reduction in energy use among treated buildings.

Extending the Definition of Renovation Activity. The analysis also holds when extending the definition of renovation to include light renovations, identified through formal declarations of work. Appendix Table A6 presents the results using this broader outcome variable. The estimated treatment effect increases slightly, showing that crossing the 1,000 square meter threshold led to a statistically significant increase of 3.3 percentage points in the probability of obtaining any form of renovation authorization. This further validates the main findings by confirming

that the policy triggered a broader response, not limited to major permits.

This result is not surprising, as renovation permits represent about 75% of all renovation authorizations within the optimal bandwidth around the threshold during the study period. While French building law does not require a permit for renovations that do not involve a change of use, the data suggest that for relatively large commercial buildings, a permit is often filed regardless. This likely reflects the scale and visibility of the works involved, such as retrofitting the façade or structural improvements, which are more substantial and may trigger administrative review, safety oversight, or coordination with local planning rules. It may also reflect a precautionary approach by owners or contractors seeking legal certainty and traceability.

Conventional RDD To assess the impact of excluding the land units with a floor area of exactly 1000 sqm from the sample, we also conduct our analysis on the full sample. The results for our main outcomes, energy consumption change and renovation probability, are reported in appendix tables A8 and A9 respectively. The estimated coefficients are -8.3 percentage points in energy consumption and +3 percentage points in renovation probability for treated land units, both significant at least at the 1% significance level, which is very close to our baseline results, both in terms of magnitude and significance. As such, the effects do not seem to be driven by the documented drop in employment density at the cutoff in the conventional RDD, and removing the observations exactly at the cutoff do not change the results significantly.

6 Discussion

6.1 Conceptual Framework

By establishing future regulatory constraints and making them visible and measurable, long-term climate policies aim to raise the expected cost of inaction today. Their effectiveness depends on policy design, through clear and binding targets, monitoring, and potential sanctions, and on credibility, which is a necessary condition for agents to internalize these future costs. When the policy is perceived as credible and ultimately binding, the anticipated penalties or loss of asset value are incorporated into current expectations. This modifies the intertemporal trade-off between acting now and postponing adjustment: the option value of waiting declines, and earlier

action becomes economically rational. In contrast, if credibility or enforcement capacity is weak, the short-term benefits of inaction dominate, and adaptation is likely to be delayed.

The timing and form of adjustment are likely to differ across buildings and actors. The initial energy performance determines the effort needed to meet targets: inefficient buildings are more likely to require renovation, while efficient ones can probably comply through improved management and user behavior. Financial capacity may also shape responses, as large investors or public entities can fund upgrades more easily than small owners or tenants facing tight budget constraints. The division of roles between owners and occupiers further limits flexibility: tenants can influence daily energy use but rarely decide on renovation, whereas owners can invest in efficiency improvements but depend on occupiers' cooperation to reduce consumption. Reputation and visibility may also play a role, since large or public actors could face higher reputational costs in case of non-compliance.

6.2 Environmental Impact

While the objective of the *Décret Tertiaire* is energy savings rather than decarbonization, a decrease in energy consumption necessarily translates into a decrease in CO_2 emissions if the energy consumed does not entirely come from renewable sources. This is the case for the French service sector, in which half of the energy consumed is electricity, and a quarter is natural gas (SDES, 2024). To give an order of magnitude of the effect of the policy on CO_2 emissions, we perform a "back of the envelope" calculation, extrapolating our results to the entire treated population, that is all buildings with over 1,000 sqm of floor area used for service-sector activities. This represents 996 million square meters, accounting for 83% of the total 1.2 billion square meters of commercial real estate in France (ADEME, 2024). We found that treated buildings decreased their energy consumption by 9.4 percentage points more than control buildings between 2018 and 2023. Given that the average energy consumption in the treated group in 2018 was 0.23 MWh per square meter, this represents an additional 21.6 kWh per square meter saved over the period thanks to the policy. Multiplying this effect by the 996 million square meters subject to the decree results in 21,513.6 GWh of energy saved. Assuming that electricity and gas consumption declined in similar proportions, we estimate that, based on the 2018 energy mix of the treated group, 94% of the total energy savings stem from reduced electricity use and 6% from reduced

gas use. To convert these energy savings into reductions in CO_2 emissions, we use emission factors from the database *Base Empreinte* produced by the French agency for the energy transition (ADEME): the emission factor for natural gas is 0.169 kg of CO_2 equivalent per kWh GCV[18] and that of electricity is 0.058 kg of CO_2 equivalent per kWh[19]. Therefore, we find that the policy led to a reduction of 1.39 million tons of CO_2 equivalent over the period, or approximately 278,000 tons per year. To put this in perspective, achieving the European climate target of a 55% reduction in greenhouse gas emissions by 2030 would require commercial real estate to cut emissions by about 4 million tons of CO_2 equivalent per year (SDES, 2023). The impact of the *Décret Tertiaire* thus corresponds to roughly 7% of the required annual reduction. Now, this estimation should be interpreted with caution, as it rests on important assumptions. First, while RD designs yield highly credible causal estimates, the downside is their low external validity. For this exercise, we extrapolate the estimated effect of the policy at the cutoff to all treated buildings, thus making the very strong assumption that buildings very far from the cutoff are similar to those close to the cutoff and have reacted in the same way to the policy. Second, due to the unavailability of data for other energy sources, our analysis focuses only on electricity and gas consumption. While they represent the largest share of total energy consumption, we still do not know how the policy affected the consumption of other energies. However, aggregate numbers show that the consumption of other fossil fuels in the service sector has also declined over the period (SDES, 2025), providing some reassurance that our estimate is a lower bound.

7 Conclusion

We examine how real estate market actors respond to the regulatory realization of climate transition risk by leveraging the exogenous threshold of a French policy mandating energy efficiency improvements in commercial buildings by 2030. We find that buildings subject to the policy decrease their energy consumption by 9 percentage points more than unregulated buildings, which corresponds to estimates of energy savings from moderate changes in energy use found in the literature. This effect is driven by publicly-owned buildings, where the reputational incentives to comply with government policy are likely to be the strongest. Additionally, regulated buildings

18. GCV stands for gross calorific value and measures the maximum heat produced by combustion of the fuel.
19. We take the 2023 emission factor for electricity as the effect on electricity consumption only becomes statistically significant that year. It is calculated by ADEME based on the energy mix used to produce electricity in France.

show a 3 percentage point higher likelihood of undergoing renovations following the policy implementation compared to unregulated buildings. This response is particularly pronounced after the start of mandatory energy consumption reporting and the sharp increase in energy prices in 2022, highlighting the role of policy salience and aligned financial incentives in accelerating the energy transition. The effect is driven by real estate companies and other private owners, suggesting that financial constraints may be an important determinant of the response to climate regulation. Finally, we find no significant impact of the policy on transaction volumes or prices around the 1,000-square-meter cutoff, indicating that investment activity in the commercial real estate market has so far remained unaffected by this regulatory threshold.

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APPENDIX

TABLES

Table A1: Policy Effect on Renovation Likelihood by Year

	Renovation Permit (0/1)								
	2018	2019 $<$ Oct.1	2019 $\geq$ Oct.1	2019 (full)	2020	2021	2022	2023	2024
p = 1									
Treatment effect	0.005	0.005.	0.005**	0.007*	0.001	-0.002	-0.002	0.014***	0.008*
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
p = 2									
Treatment effect	0.002	0.009.	0.004.	0.009.	-0.002	0.001	-0.002	0.018***	0.006
	(0.004)	(0.005)	(0.002)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Bandwidth	117	117	117	117	117	117	117	117	117
N	20396	20396	20396	20396	20396	20396	20396	20396	20396

Notes: This table reports sharp regression discontinuity estimates of the effect of the 1,000 square meters policy threshold on the likelihood of obtaining a renovation permit, estimated separately by year. The dependent variable equals one if a land unit received at least one renovation permit in the corresponding year. The treatment variable equals one if the land unit's service-sector floor area in 2018 is at least 1,000 square meters. Results are reported for local polynomial fits of order $p = 1$ and $p = 2$, using robust bias-corrected estimates with the optimal MSE-minimizing bandwidth. Standard errors are reported in parentheses.

Table A2: Ownership Categories Used in the Analysis

Group	Codes	Description
Public	P1–P6, F2, E1–E3, S1–S2, R0–R7	State, regions, departments, intermunicipal structures, municipalities, other local authorities; public land institutions; universities and schools; health and social structures; network infrastructure owners (roads, rail, telecoms, etc.).
Real estate companies	F1, F4–F7, G1	Social housing institutions, semi-public developers, land developers, promoters, institutional investors, real estate companies.
Other Private	A1–A5, Z1–Z4, L1–L4, M0–M2, G2	Agricultural, environmental or forestry structures, consular chambers, industry, commerce, extractive activities, tourism, religion, culture, sports, other legal entities, divided property lots.
Individual	X1	Natural person (individual).
Unknown	99	No identified owner.
Unclassified	–	All other codes not included above.

Note: Ownership categories are derived from the French *Fichiers Fonciers* classification (`catpro2`). Grouping is based on economic function and legal status of the property owner.

Table A3: Policy Effect on Energy Consumption Change - Extended Sample

	ΔConsumption/sqm				
	(1)	(2)	(3)	(4)	(5)
	2019	2020	2021	2022	2023
Treatment effect	-0.009	-0.034	-0.028	-0.045	-0.091*
	(0.013)	(0.025)	(0.029)	(0.033)	(0.036)
Bandwidth	331	331	331	331	331
Control group mean	-0.024	-0.177	-0.119	-0.143	-0.197
N	9413	9381	9394	9385	9381

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$. This table reports robust regression discontinuity estimates from model (1), where the dependent variable is the change in annual energy consumption (electricity and gas), measured as $\log(\text{Consumption}_t/\text{Consumption}_{2018})$ for each year t between 2019 and 2023. The year 2018 serves as the reference year, prior to the implementation of the *Décret Tertiaire*. All estimations are conducted at the land unit level. Treatment refers to the 1,000 square meter threshold. Estimates are based on the robust bias-corrected procedure a second-order polynomial in the running variable. Standard errors are reported in parentheses. This specification uses an extended sample in which the top and bottom 2.5 percent of the energy consumption change distribution are trimmed to remove extreme outliers, in contrast to the 5 percent trimming used in the baseline analysis.

Table A4: Sensitivity Analysis

	p=1	p=3	b×0.75	b×1.25
	ΔConsumption/sqm			
Treatment effect	-0.062**	-0.100**	-0.099**	-0.074**
	(0.021)	(0.036)	(0.033)	(0.025)
Bandwidth	331	331	248	414
N	8879	8879	6494	11510
	Renovation Permit (0/1)			
Treatment effect	0.031***	0.027.	0.031*	0.035***
	(0.008)	(0.015)	(0.014)	(0.010)
Bandwidth	117	117	88	146
N	20396	20396	14637	25614

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table reports sensitivity checks for the main regression discontinuity estimates of energy consumption change (top panel) and renovation activity (bottom panel). Columns vary the polynomial order of the local fit (from $p = 2$ in the baseline to $p = 1$ and $p = 3$), or adjust the bias-correction bandwidth b by $\times 0.75$ and $\times 1.25$ around its baseline value. Estimates are obtained using robust bias-corrected inference based on local polynomial regressions, with treatment defined by the 1,000 square meter cutoff.

Table A5: Placebo Tests with Alternative Cutoffs and Polynomial Orders

	c = 500	c = 750	c = 1250	c = 1500
	ΔConsumption/sqm			
p = 1				
Treatment effect	-0.009	0.001	-0.023	-0.026
	(0.015)	(0.018)	(0.023)	(0.029)
p = 2				
Treatment effect	-0.002	-0.001	-0.059.	-0.014
	(0.020)	(0.023)	(0.032)	(0.040)
Bandwidth	331	331	331	331
N	19892	12389	6663	5239
	Renovation Permit (0/1)			
p = 1				
Treatment effect	0.002	-0.004	0.012	-0.008
	(0.003)	(0.005)	(0.009)	(0.010)
p = 2				
Treatment effect	0.004	-0.005	0.013	-0.015
	(0.004)	(0.007)	(0.013)	(0.014)
Bandwidth	117	117	117	117
N	78612	35986	15056	11059

Notes: This table reports placebo estimates from a sharp regression discontinuity design (RDD) using alternative cutoffs of 500, 750, 1250, and 1500 square meters. For each outcome, the reported coefficients correspond to the estimated discontinuity at the specified cutoff. The first outcome is the log change in energy consumption per square meter between 2023 and 2018, and the second is a binary indicator for the presence of a renovation permit. For each specification, results are presented for local polynomial fits of order one ($p = 1$) and two ($p = 2$). Robust standard errors are reported in parentheses. Bandwidths correspond to optimal values selected under the MSE-minimizing criterion.

Table A6: Policy Effect on Renovation Likelihood (Including Light Renovation)

	Renovation Authorization (0/1)			
	(1)	(2)	(3)	(4)
Treatment effect	0.040**	0.040**	0.040**	0.040**
	(0.013)	(0.013)	(0.013)	(0.013)
log(age)		✓		✓
log(density)			✓	✓
Bandwidth	117	117	117	117
Control Group Mean	0.070	0.070	0.070	0.070
N	20396	20396	20396	20396

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table presents estimates from model (1), where the dependent variable is a binary indicator equal to 1 if a land unit was subject to at least one renovation permit or declaration of work between the implementation of the decree on October 1, 2019 and December 31, 2024., and 0 otherwise. The treatment variable captures whether the commercial floor area of the land unit equals or exceeds 1,000 square meters in 2018, as defined by the *Décret Tertiaire*. Columns (2) to (4) progressively control for the logarithm of building age and the logarithm of municipality-level employment density. All regressions use a robust bias-corrected local polynomial of second order with the MSE-optimal bandwidth. Standard errors are in parentheses.

Table A7: Estimates by Climatic Zone

	(1) Cold (H1)	(2) Temperate (H2)	(3)) Warm (H3)
	ΔConsumption/sqm		
Treatment effect	-0.088**	-0.083	-0.162*
	(0.033)	(0.067)	(0.075)
Bandwidth	331	331	331
N	6117	1938	824
	Renovation Permit (0/1)		
Treatment effect	0.035*	0.033	0.036
	(0.015)	(0.023)	(0.030)
Bandwidth	117	117	117
N	11644	6378	2374

Table A8: Conventional RDD Estimates for Energy Consumption Change

	ΔConsumption				
	(1)	(2)	(3)	(4)	(5)
Treatment effect	-0.083**	-0.079**	-0.080**	-0.082**	-0.076**
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Sector FE		✓			✓
Department FE			✓		✓
log(density)				✓	✓
Bandwidth	337	337	337	337	337
Control group mean	-0.196	-0.196	-0.196	-0.196	-0.196
N	9143	9143	9143	9143	9143

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table presents estimates from the conventional RDD, which keeps heaped observations at the cutoff in the estimation sample. The dependent variable is the log change in energy consumption between 2018 and 2023. Columns (2) to (5) progressively control for sector fixed effects, department fixed effects, and the logarithm of municipality-level employment density. All regressions use a robust bias-corrected local polynomial of second order with the MSE-optimal bandwidth. Standard errors are in parentheses.

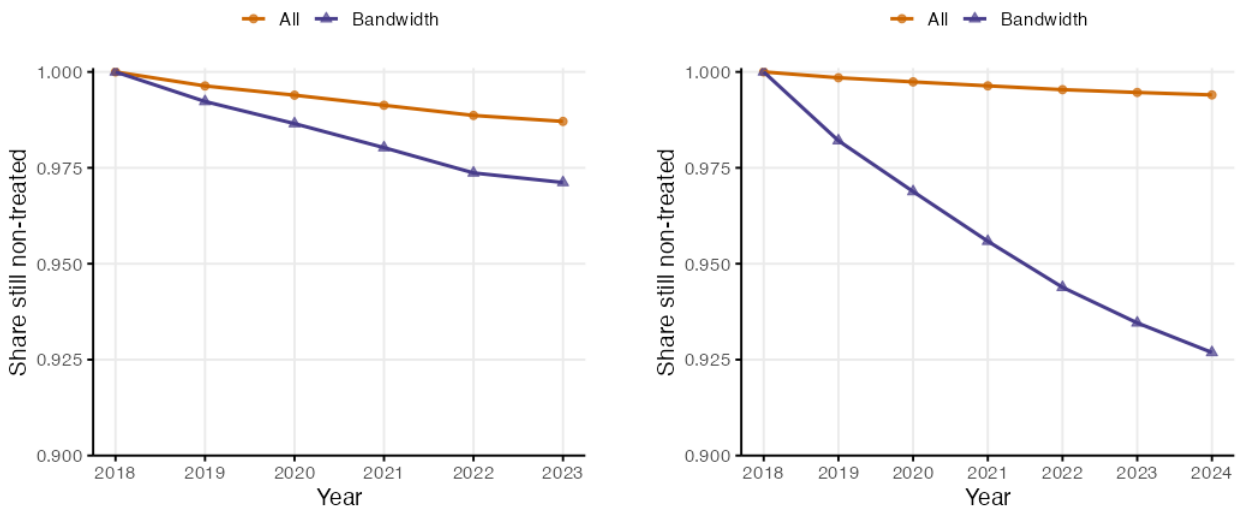
Table A9: Conventional RDD Estimates for Renovation Likelihood

	Renovation Permit (0/1)			
	(1)	(2)	(3)	(4)
Treatment effect	0.030***	0.030***	0.029***	0.029***
	(0.009)	(0.009)	(0.009)	(0.009)
log(age)		✓		✓
log(density)			✓	✓
Bandwidth	144	144	144	144
Control group mean	0.053	0.053	0.053	0.053
N	26585	26585	26585	26585

Notes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. This table presents estimates from the conventional RDD, which keeps heaped observations at the cutoff in the estimation sample. The dependent variable is a binary indicator equal to 1 if a land unit underwent at least one renovation between the implementation of the decree on October 1, 2019 and December 31, 2024, and 0 otherwise. Columns (2) to (4) progressively control for the logarithm of building age and the logarithm of municipality-level employment density. All regressions use a robust bias-corrected local polynomial of second order with the MSE-optimal bandwidth. Standard errors are in parentheses.

FIGURES

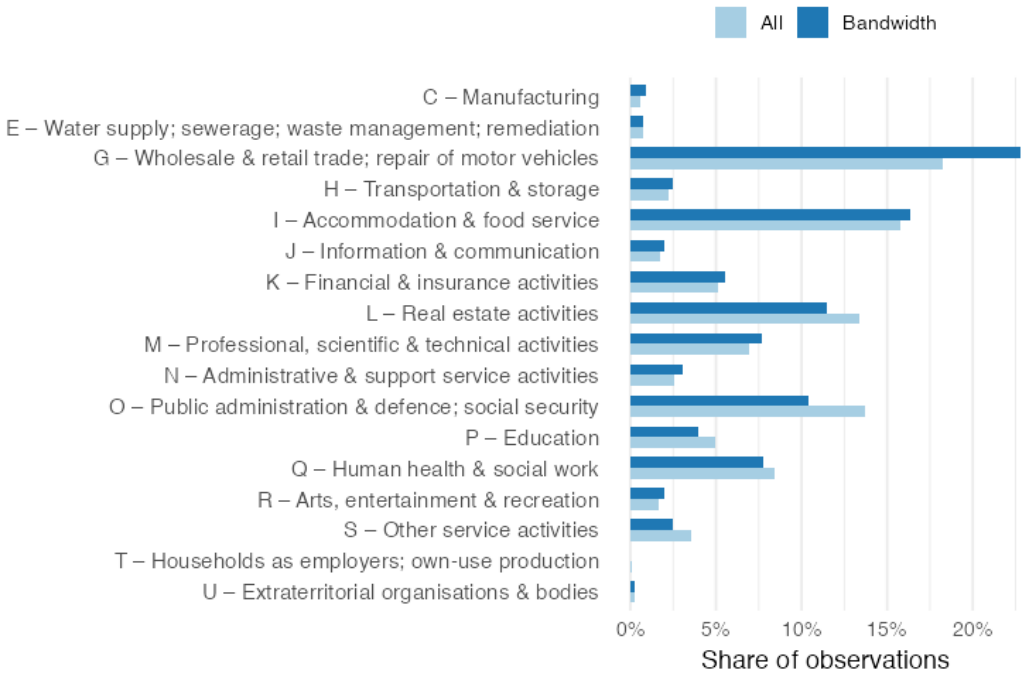
Figure A1: Control Stability Over Time



(a) Consumption **(b)** Renovation

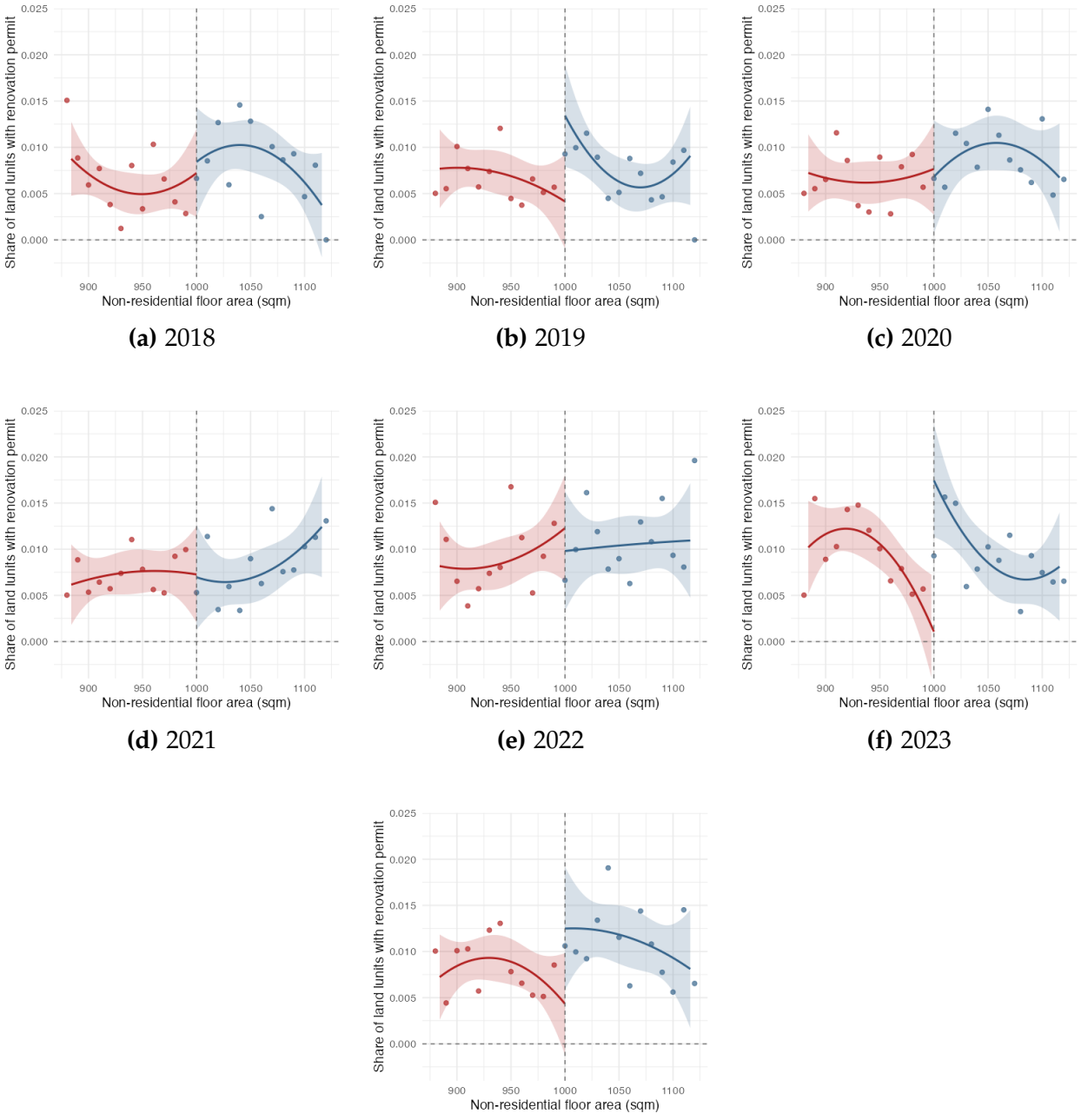
Notes: This figure shows the share of observations that were not treated in 2018, meaning with commercial floor area below 1,000 square meters, and remained non-treated in the following years. It is presented by year for each outcome panel (consumption, renovation), separately for the full sample (orange) and for the estimation sample within the corresponding optimal bandwidth (purple).

Figure A2: Sectoral Composition of the Energy Consumption Sample



Notes: This figure shows the sectoral composition of the energy consumption sample. It reports the share of observations by industry for both the entire sample (after trimming the top and bottom 5% of changes in energy consumption between 2018 and 2023) and the subsample within the optimal bandwidth (331 square meters) around the 1,000 square meter cutoff used for the regression discontinuity analysis. The classification follows NACE industry codes, reflecting the dominant economic activity of each land unit rather than its building type (e.g., office, retail). As a result, some industrial sectors appear even though the analysis focuses on service-sector buildings.

Figure A3: Discontinuity in Renovation Likelihood at the Policy Cutoff by Year



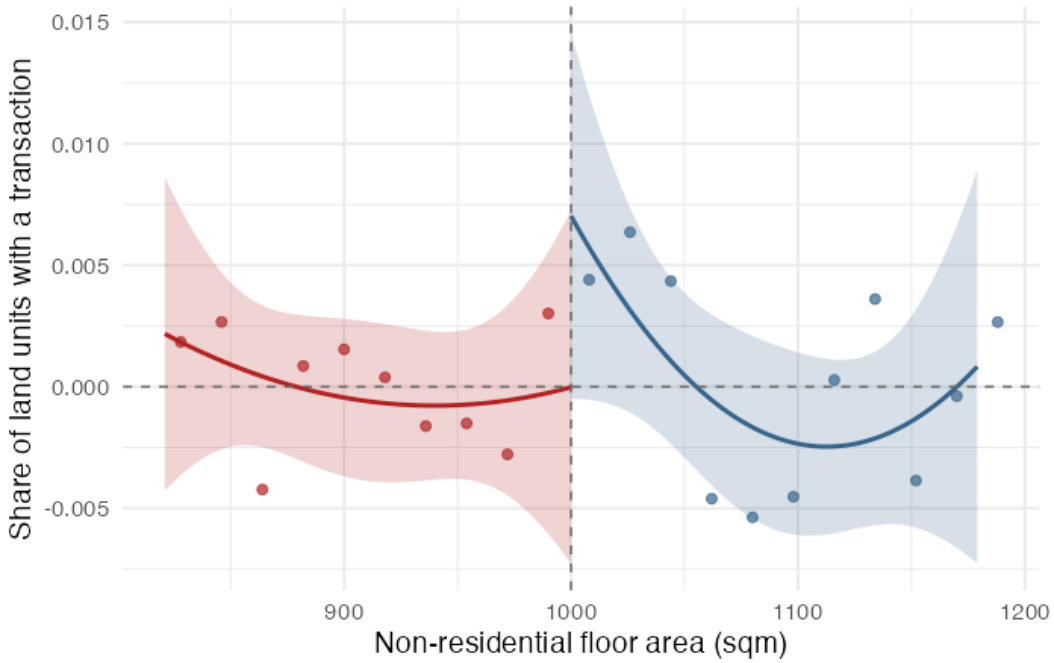
(a) 2018 **(b)** 2019 **(c)** 2020

(d) 2021 **(e)** 2022 **(f)** 2023

(g) 2024

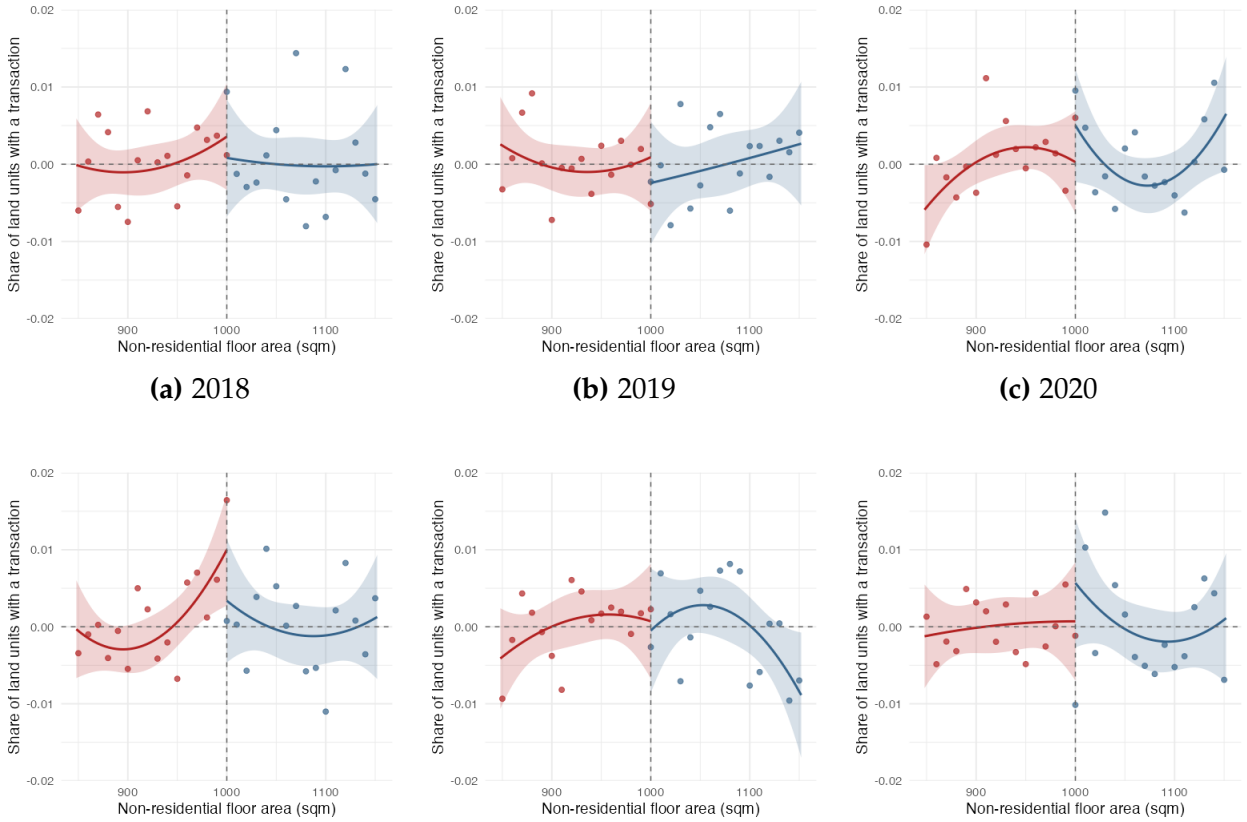
Notes: This figure presents the graphical sharp regression discontinuity design (RDD) estimates of the effect of the *Décret Tertiaire* on the likelihood of renovation permit, based on model (1). Each subfigure corresponds to a different year from 2018 to 2024. The outcome variable is a binary indicator equal to 1 if at least one renovation permit is recorded for a land unit in a given year, and 0 otherwise. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter cutoff defining regulatory exposure. Dots represent binned means: red for units below the cutoff (control), blue for those above (treated). Fitted lines are local polynomial regressions of second order, estimated separately on each side of the threshold. Shaded areas represent 95% confidence intervals.

Figure A4: Discontinuity in Transaction Likelihood at the Policy Cutoff



Notes: This figure presents the graphical estimate of the effect of the *Décret Tertiaire* on the cumulative likelihood of renovation by 2024, based on model (1). The outcome variable is a binary indicator equal to 1 if a transaction occured for the land unit at any point between the implementation of the decree on October 1, 2019 and December 31, 2023. The logarithm of local employment density is included as a covariate. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter cutoff defining regulatory exposure. Dots represent binned means: red for units below the cutoff (control), blue for those above (treated). Fitted lines are second-order local polynomial regressions estimated separately on each side of the threshold. Shaded areas represent 95% confidence intervals.

Figure A5: Discontinuity in Transaction Likelihood at the Policy Cutoff by Year

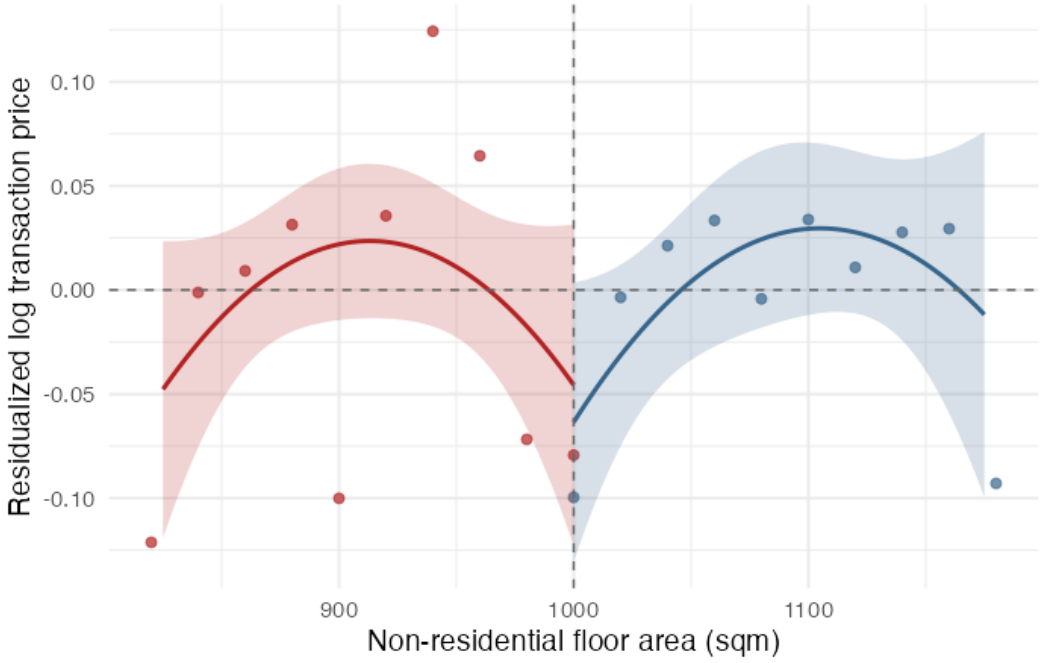


(a) 2018 **(b)** 2019 **(c)** 2020

(d) 2021 **(e)** 2022 **(f)** 2023

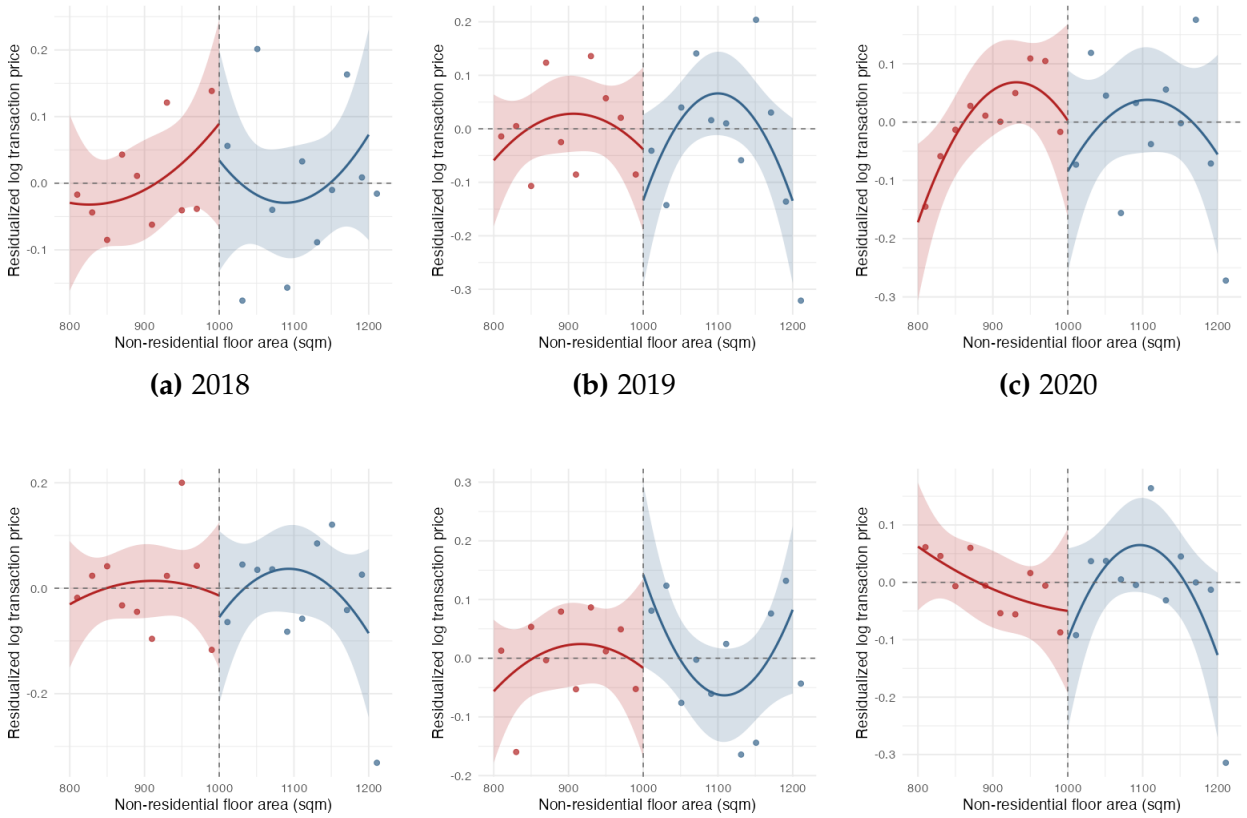
Notes: This figure presents the graphical sharp regression discontinuity design estimates of the effect of the *Décret Tertiaire* on the likelihood of transaction, based on model (1). Each subfigure corresponds to a different year from 2018 to 2024. The outcome variable is a binary indicator equal to 1 if at least one transaction is recorded for a land unit in a given year, and 0 otherwise. The logarithm of local employment density is included as a covariate in estimations. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter cutoff defining regulatory exposure. Dots represent binned means: red for units below the cutoff (control), blue for those above (treated). Fitted lines are local polynomial regressions of second order, estimated separately on each side of the threshold. Shaded areas represent 95% confidence intervals.

Figure A6: Discontinuity in Transaction Price at the Policy Cutoff



Notes: This figure presents the graphical estimate of the effect of the *Décret Tertiaire* on transaction price, based on model (1). The outcome variable is the logarithm of transaction price for land units that changed hands between the implementation of the decree on October 1, 2019 and December 31, 2024. The model controls for the logarithm of transacted floor area, the logarithm of local employment density, and year fixed effects. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter threshold defining regulatory exposure. Dots represent binned means of the residualized outcome: red for units below the cutoff (control group), blue for those above (treated group). Fitted lines are second-order local polynomial regressions estimated separately on each side of the threshold. Shaded areas indicate 95% confidence intervals.

Figure A7: Discontinuity in Transaction Price at the Policy Cutoff by Year

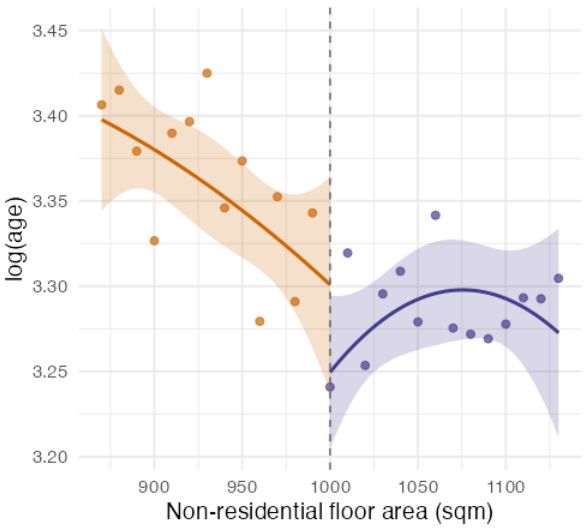


(a) 2018 **(b)** 2019 **(c)** 2020

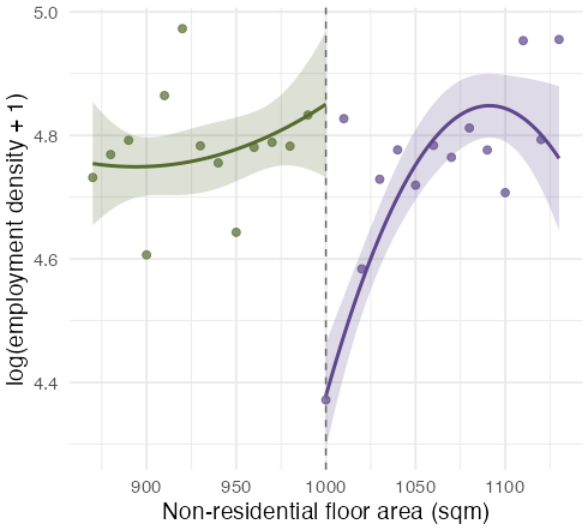
(d) 2021 **(e)** 2022 **(f)** 2023

Notes: This figure displays year-by-year graphical estimates of the effect of the *Décret Tertiaire* on transaction prices using a sharp regression discontinuity design. Each subfigure corresponds to a different year from 2018 to 2023. The outcome variable is the logarithm of transaction price. All regressions control for the logarithm of transacted building area and the logarithm of local employment density. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter regulatory cutoff. Red dots represent binned means for units below the threshold (control), and blue dots represent those above (treated). Lines show separate second-order local polynomial fits on each side of the threshold. Shaded areas represent 95% confidence intervals.

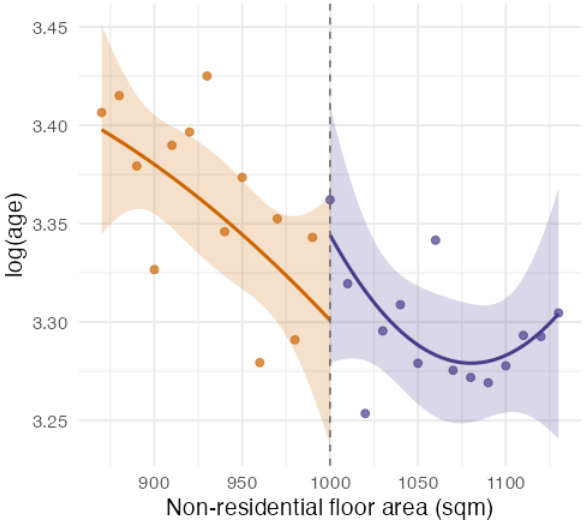
Figure A8: Covariates Continuity at the Policy Cutoff



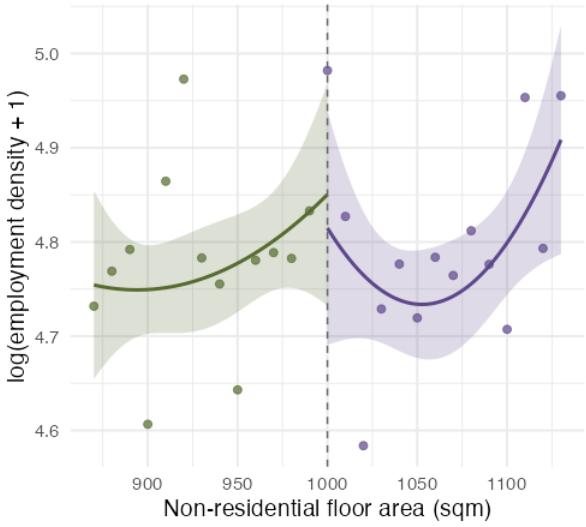
(a) Age



(b) Density



(c) Age, trimming 1,000 sqm obs.



(d) Density, trimming 1,000 sqm obs.

Notes: This figure presents a placebo tests based on model (1), using the logarithm of building age (Panel (a)) and the logarithm of municipal employment density ((Panel (b)), both measured in 2018, as dependent variables. The aim is to test the continuity of predetermined characteristics around the policy cutoff. The horizontal axis shows non-residential floor area (in square meters), centered around the 1,000 square meter cutoff defining regulatory exposure. Dots represent binned means with distinct colors for units below the cutoff (control) and for those above (treated). Fitted lines are local polynomial regressions of second order, estimated separately on each side of the threshold. Shaded areas represent 95% confidence intervals. Panel (c) and Panel (d) show the equivalent tests, excluding the observations where the non-residential area is exactly equal at 1,000 square meters.