WORKING PAPER

N° 2026-3

EXTERNALITY EFFECTS OF BUILDING COLLAPSES DUE TO INSUFFICIENT RENOVATION

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TEPP – Theory and Evaluation of Public Policies - FR CNRS 2042

Externality Effects of Building Collapses due to Insufficient Renovation

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Abstract

This paper quantifies the negative externalities generated by building collapses attributable to insufficient renovation in French urban areas. Over 2010–2022, more than 66 such collapses occurred. We construct an original dataset of collapses and merge it with transaction-level dwelling price data. Exploiting spatial and temporal variation, we implement a difference-in-differences design to identify causal impacts on local housing markets. We find that collapses reduce nearby property values by approximately 9 % and by up to 20 % in immediate surroundings. Heterogeneity analyses indicate that heightened perceived collapse risk is a central transmission channel.

Keywords : Building collapse, Externality, Hedonic analysis, difference-in-differences.

JEL codes : *D62, H23, R21, R31*

1 Introduction

In 2018, in Marseille, the second largest city in France, two buildings located Rue d'Aubagne, in a poor neighborhood near the city center, collapsed, causing the death of eight people. The subsequent trial pointed out the major disrepair of the buildings and the lack of renovation despite multiple warnings to the owners of the buildings and the city services. This tragedy was heavily broadcast and led to the evacuation of many other shabby buildings, a third of which were located in the vicinity of the collapsed buildings.[1]

Although the consequences are often less dramatic, this kind of collapse due to a lack of renovation is not specific to Marseille or to France. Indeed, most major French cities have been affected, and such events also occur often in countries like Italy.[2]. In the United States, the dramatic collapse of a building in Florida led to the death of 98 people. Although the building was not very old (constructed in 1981) and potential construction flaws may help explain the collapse, it appears that a lack of renovation also played a role.[3]

These types of events raise questions about why building owners may fail to invest adequately in renovation to ensure the continued viability of a structure. Beyond the human toll, such collapses also raise concerns about negative externalities. A building collapse can reduce the amenities in the surrounding area and increase fears of similar collapses among residents living in comparable buildings nearby. The issue at stake is important, because, if the negative externalities are substantial, this may provide an additional rationale for public authorities to implement policies or regulations aimed at preventing such collapses that can be seen as market failures.

In this study, we assess the externalities of building collapses in France. We collect original data on building collapses from 2010 to 2022 and distinguished between those

[1] *Le Monde*, « Effondrements de la rue d'Aubagne : le procès d'une chaîne de négligences et d'aveuglements », 7 November 2024, https://www.lemonde.fr/societe/article/2024/11/07/effondrements-de-la-rue-d-aubagne-le-proces-d-une-chaine-de-negligences-et-d-aveuglements_6380877_3224.html, accessed 30 July 2025.

[2] *La Repubblica*, « Crolla palazzina a Saviano: morti due bambini e la madre », 22 September 2024, accessed 30 July 2025, https://napoli.repubblica.it/cronaca/2024/09/22/news/napoli_crolla_palazzina_a_saviano_morti_due_bambini_e_la_madre-421765020/.

[3] *The New York Times*, "Collapse of Florida Condo Leaves 98 Dead, Many Questions Unanswered," 25 June 2022, accessed 30 July 2025, https://www.nytimes.com/2022/06/25/us/surfside-building-collapse-anniversary.html

due to a lack of renovation and those caused by gas explosions, another frequent cause of collapse. To our knowledge, we are the first to build such a dataset for collapses due to disrepair. Using a housing price dataset covering the same period, we track the evolution of housing prices before and after each collapse. We employ a difference-in-differences strategy, comparing the evolution of housing prices in the immediate vicinity of the collapse to prices farther away, in order to control for unobserved differences between affected and unaffected areas.

Conducting heterogeneity analysis, we explore and disentangle potential mechanisms by which a collapse could adversely affect local prices. Three potential mechanisms could be at play.

The first possible mechanism is that prices are driven down in the vicinity of a collapse due to the visual and sound pollution of the aftermath of the collapse, especially the subsequent clearing of the rubble and reconstruction (Theebe, 2004; Jensen et al., 2014). These might also affect the accessibility of the area. If this is the main mechanism at play, then the effect should be very localized and disappear rather quickly, though the proximity of a construction site might have a lasting negative impact. We test this by varying treatment groups by bins of distance to the collapse.

The other two mechanisms are not directly related to the distance of the collapse and are based upon the mental association between a collapse and a degraded neighborhood or a safety hazard. We test the existence of these mechanisms by differentiating collapses according to the attention they were given in the media, considered as a proxy for collapse awareness.

We then specifically test for the adjustment of risk perception after a rare event (Theebe, 2004). Before the collapse, risk may be underestimated. After the event, it may instead be overestimated or adjusted, with lower prices reflecting a higher perceived risk or higher uncertainty on the safety and thus the value of the building and dwellings inside it. This effect is unlikely to occur if the collapse is perceived as entirely random. However, in areas subjected to natural risk, for example the shrinkage-swelling of clay, which increases vulnerability of structures, this effect would cause a more significant decline in prices. We test this mechanism by providing heterogeneity analysis based on the intensity of the clay hazard where the collapse occurred and on the quality of the dwelling.

The third and final mechanism we consider is the negative signal sent by a collapse on the quality of a given neighborhood. We test this by changing our control group to the neighborhood where the collapse took place rather than the distance to the collapse and by comparing collapses due to disrepair to collapses due to gas leaks, the other main cause of building collapses in France. These collapses can be considered exogenous to the quality and the safety of the building and should therefore cause similar effects on prices in the absence of other mechanisms further affecting prices.

The results we find show that collapses due to a lack of renovation lead to a persistent reduction in housing prices in the surrounding area. Over the entire observation period, prices decrease by an average of around 9% for dwellings located less than 400 meters from the collapse site compared to those located between 1 and 3 kilometers away. Furthermore, the effect is increasing over time: seven years after the collapse, average prices decrease by about 20%. We also show that the effect of a building collapse is stronger as the distance to the collapse decreases, with an average decrease of 19% at 200 m and of 12% at 300 m, suggesting a reduction in amenities in the surrounding area. Nevertheless, we suggest that the increase in the perceived probability of collapse is one of the main mechanisms explaining the magnitude of this decrease. This is supported by the fact that the negative effect is larger for the lowest-quality dwellings (-26% on average at 400 m). Furthermore, we find that the effect of collapses due to a lack of renovation is stronger when the soil in the neighborhood is classified as at high risk of clay shrinkage-swelling(-22%). The fact that this risk is bound to increase with climate change provides further motivation to prevent such collapses by creating appropriate incentives for homeowners to renovate, which could be inspired by the incentives for energy retrofitting. We show collapses to be the symptom of a major market failure with lasting negative effects on local housing markets, thus calling for local authorities to undertake preventive renovation measures or push landlords to take them. Renovation can be considered as a local public good.

Our article contributes in an alternative manner to two strands of the literature. On one hand there is a vast literature in economics assessing the effects of public programs aimed at renovating dwellings in deprived neighborhoods. These programs generally target the renovation of public housing in countries where such housing exists — such as the Netherlands and France— or private housing in countries like the United States. They typically mobilize tens of millions of euros when implemented at the city level (Rossi-Hansberg et al., 2010), and tens of billions when implemented nationally (Chareyron et al., 2022). The evaluations of these programs are not unanimous: some studies show that they increase neighborhood attractiveness (Galster et al., 2006; Rossi-Hansberg et al., 2010; Collins and Shester, 2013; Koster and van Ommeren, 2019; Yau et al., 2008), while others find no significant or limited effect on housing prices (Chareyron et al., 2022; Barthélémy et al., 2007; Ahlfeldt et al., 2017; Ding et al., 2000; Aarland et al., 2017; Albanese et al., 2021).

Nevertheless, the efficiency of such renovation policies depends on tenure status. Tenure status partially determines renovation needs, as renter-occupied housing is often found to be of lower quality (Iwata and Yamaga (2008)), lower energy efficiency (Kholodilin et al. (2017), Hope and Booth (2014)) and more rapidly deteriorating than owner-occupied housing (Gyourko and Linneman (1990), Shilling et al. (1991)) because of overutilization of the housing by tenants and misaligned incentives between tenants and landlords, especially when there is rent control (Gyourko and Linneman (1990)). This negative rental externality (Henderson and Ioannides (1983)) is thus a source of market failure that could partially determine building collapses. This externality and more generally tenure status also impacts the undertaking and efficiency of renovation policies, with Rehdanz (2007) finding lower investments in energy efficiency in private rentals and Cairns et al. (2024) in multi-owned properties. However, tenants' willingness to pay and approval for renovations policies is also limited, because they fear higher rents (Mjörnell et al. (2019)) and neighborhood gentrification (Ahlfeldt (2011)).

A second strand of literature related to our research question is the assessment of urban hazards and their impact on property prices. Most of these hazards are natural disasters. In our case, the main cause is not a natural event of high intensity, but the methodology used (distance-based difference-in-differences) and the mechanisms we investigate are similar. The main hazard featured in the literature is flooding (Bin and Polasky, 2004; Bin and Kruse, 2006; Zhang, 2016; McKenzie and Levendis, 2010), although some articles focus on earthquakes (Shi and Naylor, 2023), wildfires (Athukorala et al., 2016; Dong, 2024; Adachi and Li, 2023) or hurricanes (Ortega and Taṣpınar, 2018). We have found one article analysing the effect of gas explosions on housing prices (Liao et al., 2022), but to the best of our knowledge, none on building collapses.

The consensus in the urban risk literature is that the occurrence of a natural disaster has a negative effect on property prices in at-risk areas, whereas the risk was underestimated prior to the disaster (Hansen et al., 2006; Dubé et al., 2021; Adachi and Li, 2023) thus estimate a strong negative premium on housing prices after respectively a flooding and a wildfire, with Zhang (2016) showing that the effect is greater on the cheapest houses.

However, Bin and Kruse (2006) consider that in coastal areas, the valuation of this proximity is stronger than the flood risk premium and therefore prices are not lower, even though housing there is at risk. Dong (2024) also does not find a statistically significant effect on home values in neighborhoods affected by wildfires. With respect to the mechanisms at play, Hornbeck and Keniston (2017) show that the Great Boston fire, forcing early reconstruction, caused positive spillover effects on neighborhood housing prices and land values. However, they also find that individual building fires do not increase land values when other nearby buildings are not destroyed. Athukorala et al. (2016) find a negative effect on prices when natural disasters continue to occur in a given area. Liao et al. (2022) attribute the negative impact of a Taiwanese gas explosion to an adjustment in households' risk perceptions, as do Freybote and Fruits (2015) after the construction of a natural gas transmission pipeline. A similar mechanism appears to have operated following the Fukushima nuclear accident. Several studies report a decline in rental prices in the vicinity of nuclear power plants in Switzerland (Boes et al., 2015) and China (Zhu et al., 2016), whereas no such effect is found in the United States (Fink and Stratmann, 2015) or in Germany after the closure of nuclear facilities (Bauer et al., 2017). Similarly, Hansson (2024) finds a capitalization effect on housing prices of information on uranium and radon radiation exposure.

The main difference with our setting is that the risk is not environmental in nature. In addition, the negative effect of disrepair and collapse risk may be offset by the high attractiveness of central locations, which, in European cities, tend to be more expensive than suburban areas. Furthermore, most of these articles do not have data housing transaction prices and must estimate them, usually using a hedonic model.

The remainder of the paper is organized as follows. In the next section, we present our collapse data and describe the neighborhoods where they take place. Then, in Section 3, we detail our empirical strategy. The data and descriptive statistics are presented in Section 4, while the results are reported in Section 5. Finally, we discuss the results and conclude in Section 6.

2 Building collapses in France

To the best of our knowledge, there was no existing dataset documenting building collapses in France. The sample of building collapses we study in this article is built from the Europresse archives that provide access to international, national and regional press titles from over 10 000 sources. All collapses that occurred in mainland France, between 2010 and 2022 and mentioned in at least one newspaper article, constitute the original sample.

From the original sample of 99 collapses, we exclude 8 cases where only a balcony, a few floors or a roof fell. In other words, we focus on collapses of the shell of the building, whether this collapse be partial or total. Two reasons justify these exclusions. The main reason is that small collapses that do not affect the building in its entirety are more likely to be overlooked. The second reason is that including these events would require accounting for the intensity of the treatment. Beyond the increased complexity in the specification, all collapses are not described in the same way in the press, so the intensity of the collapse is ultimately difficult to assess.

We also only keep collapses where the cause is attributed to disrepair or where no cause was given. This excludes 25 collapses due to gas leaks or fires which are accidents and unlikely to be related to the level of disrepair of the building. Since gas leaks or fires are easy to identify, we consider the absence of a specific reported cause for the collapse to mean that it is due to disrepair and lack of renovation, since in most cases warnings had been issued or cracks observed. Nevertheless, there might be unobserved factors (architectural mistakes, storms, nearby construction sites) that caused the collapse or that compounded with disrepair. We argue however that such factors would not suffice to cause a collapse on a building in good shape.

From the sample of 66 collapses due to disrepair, we further restrict it to collapses located in cities of over 20,000 people, *i.e* medium or large cities, in order to ensure enough observations for each event and because such cities have more dynamic housing markets. There is a risk that collapses in small cities and rural areas would not be mentioned in the press and therefore go unreported. We therefore could not be sure to have all such collapses in our sample and nearby potential buyers might even be unaware of it. This brings down the sample to 46 collapses.

Table 1 records when the collapses take place and shows that there is no clear trend in the timing of collapses in our sample. The year with most collapses is 2014 with 10 col-

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Collapses disrepair	1	1	6	1	10	2	2	3	5	3	2	4	6

Table 1: Collapses by year

Season	Winter	Spring	Summer	Autumn
Collapses	12	5	14	14

Table 2: Collapses by season

lapses in our sample that year. In most recent years, since 2020, collapses have somewhat increased, though we cannot rule out the possibility that this increase is simply due to a better media coverage of collapses and that collapses in the early 2020s were overlooked because we could not find them in the press. Furthermore, more recent data would be needed to confirm an increase of collapses since Covid. In terms of seasonal trends, Figure 2 suggests that collapses more often occur in the summer or in the fall, possibly because collapses are more frequent when disrepair compounds with the shrinkage-swelling of clay which is mostly a problem during droughts and thus in the summer. Furthermore, in clay-exposed areas, the overwhelming majority of collapses (74 % : 20 out of 27) happen in the summer or in the fall. In comparison, on areas not exposed to this risk, only 44% (8 out 18) of collapses occur during these seasons.

Figure 1 highlights the geographical distribution of building collapses resulting from the poor condition of the housing stock. Compared to explosions (Figure A5 in the appendix), these incidents are more numerous and more spatially concentrated. They tend to occur in medium-sized cities located in the south and the center-east of France, such as Nîmes, Toulon, Agde, Lyon, as well as in the suburban belts surrounding Lyon and Paris. This pattern reflects the presence of older urban neighborhoods where long-standing physical degradation is compounded by insufficient maintenance and chronic under-investment in renovation. These collapses serve as markers of urban decline, often affecting working-class districts located in dense city centers. The map clearly shows that structural deterioration is not confined to rural or peripheral areas. It is also a major concern in central urban environments. In addition, Figure A4 in the appendix identifies which of these collapses occurred in areas exposed to clay-related ground hazards.

Using census and fiscal data[4] from 2010, Table 3 compares the neighborhood in which a collapse takes place to the other neighborhoods in the same city in order to better

[4] Revenus fiscaux localisés

Table 3: Neighborhood Characteristics

	Neighborhoods with no collapse [1]				Collapse Neighborhoods [2]				T-test
Variable	mean	sd	min	max	mean	sd	min	max	p_value
Socio-demographic characteristics									
Population	2431	914	1	8041	2968	1025	196	5672	< 0.01
Pop over 65 (%)	15.6	0.07	0	66.4	13.9	0.06	4.5	30.1	0.11
French citizens (%)	90.3	0.08	41.7	100	89.5	0.09	66.8	98.4	0.46
Other nationalities (%)	9.7	0.08	0	58.3	10.5	0.09	1.6	33.2	0.46
Immigrants (%)	13.3	0.1	0	61.9	13.8	0.1	2.9	38.7	0.72
Working pop (between 15 and 64) (%)	69	0.09	0	100	69.6	0.11	29.2	85	0.64
Unemployed (%)	16.9	0.09	0	83.3	20.9	0.15	6.8	78.9	< 0.01
Farmers [3](%)	0.2	0	0	6.1	0.1	0	0	1	0.68
Self-employed (%)	4.5	0.03	0	32.1	5	0.02	1.9	9.5	0.22
Executives and intellectuals (%)	17.9	0.12	0	85.7	17.9	0.1	2.6	44.6	0.98
Intermediate professions (%)	24.4	0.07	0	60	24.5	0.05	12.5	32.5	0.93
White-collar workers (%)	29.8	0.08	0	100	28.2	0.07	8.8	50.3	0.16
Blue-collar workers (%)	21.2	0.11	0	100	20.8	0.08	3.7	37.4	0.83
Households with families (%)	52.7	0.14	0	100	46.3	0.14	16.8	76.1	< 0.01
Median fiscal income (€)	24253	6877	5548	56823	21211	7184	4025	40696	< 0.01
Gini coefficient	0.38	0.06	0.23	0.61	0.42	0.08	0.29	0.69	< 0.01
Building characteristics									
Nb of dwellings	1350	979	2	28388	1790	662	144	3289	< 0.01
Main residence (%)	90	0.07	7.4	100	85.5	0.08	51.6	96.6	< 0.01
Secondary properties (%)	2.2	0.05	0	92.5	3	0.05	0	20.9	0.27
Vacant dwellings (%)	7.9	0.05	0	66.7	11.5	0.05	2.6	29.8	< 0.01
Houses (%)	27.3	0.28	0	100	17.1	0.16	1	67	0.01
Apartments (%)	71.5	0.27	0	100	81.8	0.16	33	98.4	0.01
Owner-occupied main residence (%)	37.4	0.21	0	100	30.6	0.13	2.8	68.6	0.03
Rented main residence (%)	60	0.21	0	100	67.2	0.13	30.5	94.3	0.02
Social housing (%)	24	0.27	0	100	15.2	0.14	0	73.1	0.03
Observations	1267				46				

[1] Neighborhoods with no collapse are located in the same cities as the collapses in our sample.Neighborhoods are defined by their iris code.

[2] Collapse neighborhoods are neighborhoods in which the collapses in our sample take place.

[3] Occupations are based on the French CSP classification.

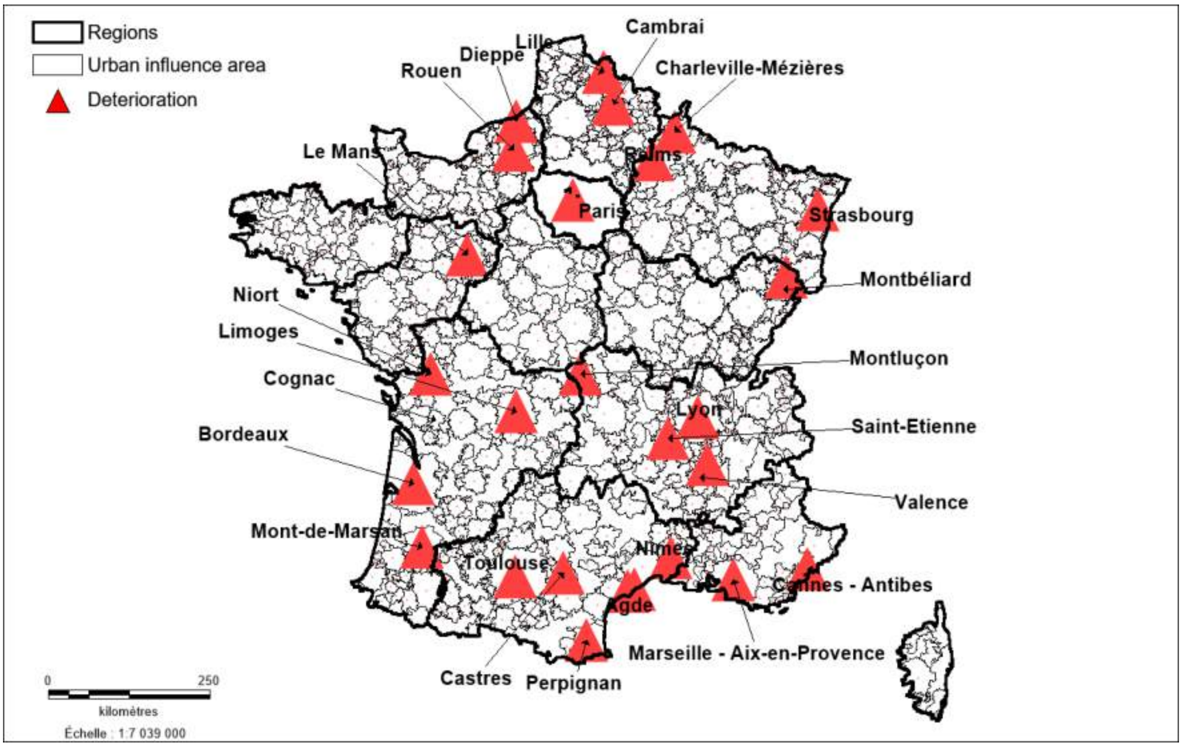

Figure 1: Building Collapses Due to Structural Deterioration

understand where collapses take place within the city. We use data from 2010 to avoid capturing potential effects from a collapse. At the city level, collapses occur in slightly more populated and younger neighborhoods. These neighborhoods do not display any significant differences in terms of ethnic composition, but have significantly more unemployed workers (20.9% vs 16.9%). The only difference in terms of employment structure is the slightly lower share of self-employed, blue-collar and white-collar workers. There are also significantly fewer households with families (46.3% vs. 52.7%), and the median income per household is around €3,000 lower. The Gini coefficient is significantly higher, which indicates a more unequal and therefore less economically homogeneous neighborhoods. This points to collapses due to disrepair occurring in less advantaged and poorer neighborhoods within cities.

If we turn to housing characteristics and tenure status, there are more dwellings in neighborhoods with collapses, suggesting higher density in more populated neighborhoods. This probably why there are significantly fewer houses and more apartments (81.8% vs 71.5%). There are also significantly fewer main residences, and thus more secondary properties and vacant dwellings, and less social housing. The main residences are less owner-occupied and more often rented, even though the difference is only significant at the 5% level. The difference in the share of vacant dwellings is particularly high, as 11.5% of dwellings in neighborhoods with collapses are vacant, compared to 7.9% on average in the rest of the city. These patterns most likely partially explain lower levels of renovation and collapses, because of the rental externality identified by Henderson and Ioannides (1983), because tenants fear rent increases and gentrification and because owners might also have less means to renovate or expect lower returns on investment in declining neighborhoods.

3 Empirical Strategy

To identify the causal effect of building collapses on housing dynamics, we adopt a staggered difference-in-differences (DID) framework with binary absorbing treatment and heterogeneous effects. Our identification strategy compares the variation in housing prices for transactions in the immediate vicinity (less than 400 meters) of a collapsed building with the variation in prices for transactions located farther away (between 1 and 3 kilometers from the collapse). We exclude from our control group transactions between 400m and 1 km of the collapse, in order to avoid potential spillover effects. This buffer zone of 600m derives from the observation that housing externalities and local externalities disappear after a few hundred meters (Rossi-Hansberg et al., 2010; Ahlfeldt et al., 2015). While Ahlfeldt et al. (2017) choose a buffer of 500 m, we adopt a slightly larger one of 600 meters. Figure 11 in the appendix visually describes our identification strategy, with Figure 12 describing how we treat collapses where the control groups would overlap.

Alternative control groups include transactions between 1 and 2 km of the collapse and between 2 and 3 km. This strategy is based on distance rather than neighborhoods in order to capture localized effects specific to the collapse that might go beyond neighborhood borders. We assume a collapse has a local effect and therefore prices in further locations within the same neighborhood should not be more affected than closer dwellings in another neighborhood.

We choose a 400 meter radius in order to minimize heterogeneity between our treated group and the control group. A small treatment radius limits the risk that the causal effect that we estimate is caused by confounding factors or broad market dynamics, enhancing the comparibility of pre-treatment trends and adding credibility to the parallel trends assumption. To assess the spatial boundary of the impact of collapses on nearby property values, we will vary the treatment radius by increments of 100 meters.

Compared to the classical difference-in-differences design, in our case the treatment is absorbing, binary and there is variation in treatment timing. This allows us to estimate the causal effect on housing prices of building collapses that occurred at different times.

We use the heterogeneity-robust estimators provided by Borusyak et al. (2024) to overcome the issues with two-way fixed effects (TWFE) in the case where the effects are dynamic and not constant over time or group and the design is staggered. In such designs, TWFE estimators are not robust, due to negative weights pondering the various estimated treatment effects which might even yield an average effect of the wrong sign. Furthermore, pre-trend tests will not be valid (Sun and Abraham, 2021), making it impossible to corroborate the parallel trends assumption that lies at the core of DID estimations.

We first illustrate the intuition of our identification strategy using the standard TWFE event-study model, including leads and lags of treatment, as commonly used in the literature. However, it is well known that this estimator may produce biased estimates in the presence of treatment effect heterogeneity and staggered treatment timing (Sun and Abraham, 2021). For this reason, our main results rely on the imputation-based estimator proposed by Borusyak et al. (2024), which corrects for these issues while preserving the interpretability of event-study coefficients. The event-study regression we estimate is the following:

$$\ln Price_{g,t} = \alpha_g + \lambda_t + \sum_{l=-K;l\neq-1}^{L} \beta_l \mathbb{1}_{\{F_g=t-l\}} + \varepsilon_{g,t} \qquad (1)$$

with $\ln Price_{g,t}$ the natural logarithm of the housing price per square meter of the dwelling in the treated group g at year t, our outcome of interest, α_g group fixed effects, λ_t time (year) fixed effects and F_g the first year in which group g is treated. Thus, $\mathbb{1}_{\{F_g=t-l\}}$ equals 1 if a collapse happened l years ago within 400 meters of the dwellings in group g. A non-negative l enables to estimate the cumulative effect of the l+1 treatment periods, while $l \leq -2$ yields placebo coefficients comparing outcomes for the control and treated groups that received treatment (*i.e* saw a building collapse in their vicinity) |l| years ago, thus testing parallel trends.

We do not include any control variables in our main specification, following the recommendation of De Chaisemartin and d'Haultfoeuille (2023). They indeed argue that "if the pre-trend coefficients in the TWFE regression without controls [...] are precisely estimated and not significantly different from zero, there may not be a compelling reason to include controls in the estimation". (p 119) In the infrequent case where these conditions are not fulfilled, we control for following dwelling and building characteristics: the size of the dwelling, the size squared, whether the dwelling is a flat or a house, the number of floors, the presence of a parking space, a pool and a terrasse, and the age of building.[5] We choose Borusyak et al. (2024)'s estimator as the main one, because of its higher efficiency. Alternative treated groups are considered to estimate the radius of the impact.

As a robustness check, we include the other robust TWFE estimators developed in the literature (Callaway and Sant'Anna, 2021; De Chaisemartin and D'Haultfoeuille, 2022; Sun and Abraham, 2021). In our case, with binary treatment and no not-yet-treated observations in the control group, these estimators are supposed to yield the same results, but they are not all equally precise and especially they compute pre-treatment outcomes in different manners, adding robustness to our parallel trends tests.

Our identification strategy relies on two assumptions. The first is that prices in the treatment group would have evolved similarly to those in the control group if the collapse had not occurred. The second is that there are no anticipation effects. This first assumption is most likely to be verified due to the spatial and temporal variability of collapses. Collapses take place all across France and in every year of our sample. This ensures that it is unlikely that a specific confounding shock specifically affecting all treated areas at the time of each collapse could have taken place. The second assumption is corroborated by the fact that some collapses caused casualties, since the collapsed building would have previously been evacuated prior to the collapse had the collapse been anticipated. Though some buildings were already unoccupied and in most cases did not cause any casualties, the collapses seem to be considered as a surprise if we look at the reactions collected in the newspaper articles on the collapse.[6]

Some collapses may have been anticipated, when cracks or safety issues had already been reported to the authorities, but the exact location and timing of most collapses is most likely not anticipated. Furthermore, if there were anticipation effects, this would cause a divergence in pre-treatment outcomes between the treated and the control group, which we do not observe. Thirdly, even if there remains some anticipation effects, causing our estimators to be biased, De Chaisemartin and D'Haultfoeuille (2022) show that the

[5]More specifically, we control for buildings with no floors, buildings with over 4 stories, buildings built after 2012 and dwellings built at least five years before the recorded transaction.

[6]See the article in *Le Monde*, « Effondrement d'immeubles rue d'Aubagne : les huit vies fauchées du numéro 65 », November 7, 2024, available online: https://www.lemonde.fr/societe/article/2024/11/07/effondrement-d-immeubles-rue-d-aubagne-les-huit-vies-fauchees-du-numero-65_6380730_3224.html

estimator in Borusyak et al. (2024), our preferred estimator, is less biased than those of Sun and Abraham (2021) or Callaway and Sant'Anna (2021).

In order to provide evidence on the mechanisms through which a collapse affects neighborhood prices, we provide a range of heterogeneity analyses. We consider media attention,the intensity of clay hazard, the quality of dwellings and the cause of the collapse as pointing to the different mechanisms behind the decline in prices we observe. The impact of these elements on housing prices can be of interest to policy makers. For instance, the swelling-shrinkage of clay is a major risk for buildings, as it can cause cracks, and is expected to increase due to increases in droughts resulting from climate change.

A collapse might further deteriorate the image of a neighborhood and draw attention to its lack of economic and demographic vitality, prompting regeneration or revitalization policies.

4 Sample selection and Descriptive Statistics

Sample selection

To determine the sample used for the empirical analysis, we merge the data on building collapses with housing price data from the Demande de Valeur Foncière (DV3F), which provides detailed information on all housing transactions in France between 2010 and 2022. This includes information on dwelling characteristics, ancillary features or transaction type. A key advantage of this dataset is that each transaction is geo-localized which allows us to compute the distance to the nearest collapse and to merge the dataset with the French map of shrinkage-swelling clay hazard, the *Géorisque* map.

We only consider sales of constructed dwellings (*i.e.* we exclude auctions, expropriations, sales in a future state of completion, etc.) and also exclude sales of industrial, commercial or similar premises and auxiliary housing. We only retain homes priced between 10,000 and 10 million € with a living area between 9 and 290 square meters.
We exclude two collapses that occurred in districts not covered by the housing price data (namely Alsace and Sarthe). We also exclude 3 collapses for which we were unable to determine the exact address and 10 collapses that occurred within a 1 km radius from a previous collapse, in order to mitigate contamination effects. This ensures that our control group includes only never-treated units and no not-yet-treated ones. Through these

restrictions, we obtain a final sample of 32 events.

We also merge the dataset with census data from 2010. This data provides demographic and social information on the French population at the neighborhood level. We use this data to better understand characteristics of neighborhoods where collapses took place, comparing them with those of neighborhoods in the city but with no collapses. These zones do not match perfectly our treated and control groups, but allow us to get a sense of where collapses happen within cities. We use data from 2010 in order to avoid contamination effects from collapses.

Descriptive Statistics

If we first examine the evolution of housing prices from one year before the collapse to several years after (Figure 2), we observe a consistent downward trend. Regardless of distance within a 5-kilometer radius, prices tend to decline in the years following a collapse. On average, within 200 meters of the site, prices per square meter are 0.4% lower one year after the event compared to the year before. After two years, the decline reaches 1%, then 2% after three years, and more than 3% four years after the collapse. This gradual decrease suggests a sluggish market response to such events.

The spatial dimension of this price evolution is also noteworthy. One year after the collapse, properties located farther from the site tend to show slightly larger price decreases than those closer in. However, this relationship reverses over time and becomes more pronounced. Three years after the collapse, dwellings located within a one-kilometer radius have declined by about 1%, while those situated closer (especially within 400 meters) have experienced significantly steeper drops. In contrast, prices of properties beyond 500 meters tend to stabilize between the third and fourth years, although they also exhibit a decline in the earlier years. Meanwhile, dwellings located within 400 meters continue to see their prices fall as time goes on.

These trends suggest that although housing prices gradually adjust downward across all distances, the decline is more severe and persistent in close proximity to the collapse. This pattern supports the idea that building collapses generate localized negative externalities on nearby property values.

If we now turn to characteristics of the treated and control groups, we see that they differ on many aspects. First of all, the sample size is 14 times larger for the control group, which encompasses dwellings in an area 50 times larger. This shows that the

Table 4: Dwelling Characteristics

	Control group[1]				Treated group[2]				p-value T-test
	mean	sd	min	max	mean	sd	min	max	
Price of the dwelling (K euros)	214.7110	212.99	20	19100	181.8905	153.93	20	6623	1.1e-120
Price of the dwelling per sqm (K euros)	3.2028	2.41	0	729	3.0016	1.93	0	125	2.63e-36
Surface of the dwelling (sqm)	70.3285	79.86	1	22326	67.1685	56.94	1	3303	1.93e-09
Share of flats	0.8144	0.39	0	1	0.9176	0.28	0	1	0
Share of parking places	0.5184	0.50	0	1	0.2744	0.45	0	1	0
Surface of the main rooms (sqm)	69.9786	78.19	0	22326	66.5320	54.79	0	3303	2.88e-11
Maximum nb of floors of the building	4.1365	3.04	0	41	3.7212	2.03	0	16	2.83e-95
Share of buildings over 3 stories high	0.2196	0.41	0	1	0.1706	0.38	0	1	2.15e-70
Nb of bedrooms	1.8794	1.21	0	60	1.5517	1.11	0	32	2.09e-52
Share of dwellings built before 1914	0.2310	0.42	0	1	0.4977	0.50	0	1	4.57e-60
Share of dwellings built after 2013	0.0806	0.27	0	1	0.0531	0.22	0	1	6.89e-49
Share of old dwellings[3]	0.8274	0.38	0	1	0.8684	0.34	0	1	9.13e-60
Share of new dwellings[3]	0.1185	0.32	0	1	0.0870	0.28	0	1	0
Share of recent dwellings[3]	0.0127	0.11	0	1	0.0106	0.10	0	1	0.0052221
Share of unoccupied dwellings	0.1199	0.32	0	1	0.1683	0.37	0	1	1.3e-107
Observations	340856				23840				

[1] The control group includes dwellings located between 1 and 3 km from the collapsed dwelling.

[2] The treated group includes dwellings less than 400 m from the collapsed building.

[3] Old dwellings are dwellings built at least 5 years before the sale, recent dwellings were built between 1 and 5 years before the sale and new dwellings were built less than a year before the sale.

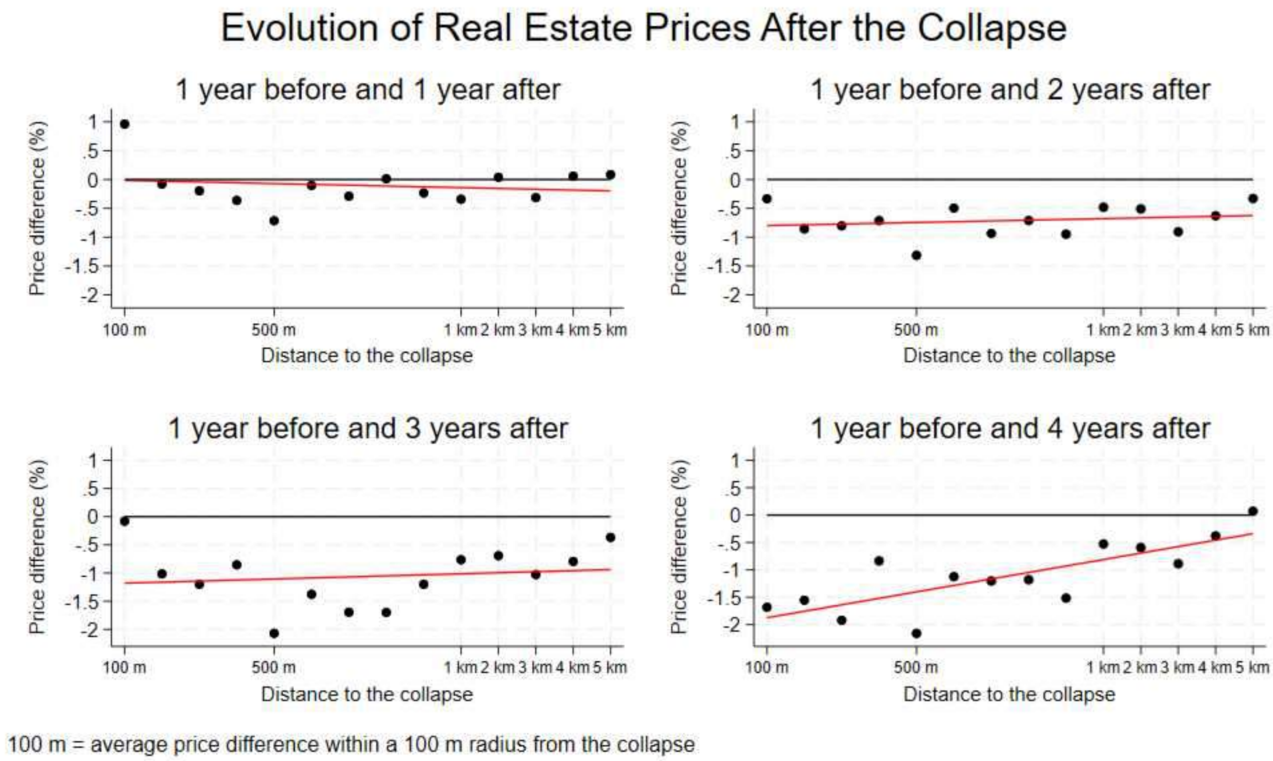

Figure 2: Evolution of housing prices at different points after the collapse

control group is more sparsely populated than the treated group, perhaps more in the suburbs than the city center, where most of the collapsed buildings are located. Housing prices are on average lower for dwellings situated less than 400 m away from the fallen building (our treated group) than for those located between 1 and 3 km from the fall. An average square meter costs 200€ less in the treated group. The price dispersion is lower, which is probably due to the smaller number of observations. Dwellings are also 4% smaller in the treated group (67 square m vs 70 square m). Furthermore, collapsed buildings are mostly located in central, densely populated neighborhoods, where prices tend to be higher (at least in France). 92% of the dwellings in the treated group are indeed apartments, while the share is only 81% in the control group.

Counter-intuitively, buildings are on average higher in the control group, but the variance is also higher. Dwellings are more often vacant in the treated group, which could indicate lower demand and thus that areas where buildings collapsed were already less attractive, despite being located closer to the city center. The lower number of transactions might also be partly explained by this, though the main cause is likely the much smaller land coverage.

The treated group comprises a higher share of older dwellings, with 87% of buildings being built at least 5 years before the sale took place, compared to 83% in the control group. 8% of dwellings in the control group are in buildings built after 2013, while only 23% were built before 1914. These shares are of 5% and 50% in the treated group. The age of the building could be considered as a proxy for quality or inversely the need for renovation. It also lends support to the claim that the buildings that collapsed were old, deteriorated and that they fell due to their shabbiness. It also suggests a correlation between the need for renovation and lower housing prices.

Alternative specifications for the treated group considered dwellings within a 200 m distance from the fall, but this leads to an important loss of observations (7,814 compared to over 26,000) and ultimately lower statistical power. For the control group, considering only dwellings between 1 and 2 km or between 2 and 3 km divides the sample size by around 2. Dwellings closer to the fall are cheaper, smaller, located in lower buildings and older than those further away. It is unlikely that these characteristics are due to spillover effects from the fall, since there is always a 600 m buffer between our treated and control group and the literature shows that spillover effects typically disappear after a few hundred meters (Ahlfeldt et al. (2015)). However, a larger control group also helps mitigate some of these concerns. Furthermore, we do not have information on all the dwellings in the vicinity of the fall, only on those subject to a transaction between 2010 and 2023. We thus cannot rule out the possibility that the dwellings sold are not representative of all the dwellings of the area.

5 Results

5.1 Insufficient repairs

Figure 3 gives the ATT of collapses on housing prices for various treated groups, defined by the distance to the collapse. The Figure shows that the effect increases steadily as the treatment radius decreases, suggesting a concentrated effect in close proximity to the collapse. Unlike the TWFE specification presented earlier (Equation 1), the event-study results shown in Figure 3 are estimated using the imputation method of Borusyak et al. (2024), which does not require omitting any specific event-time period. As a result, the coefficient at $l = -1$, corresponding to the period immediately before the collapse, is included in the graph and can be interpreted as an absolute treatment effect at that time.[7]

At 200 meters from the collapse, the house price declines relative to houses farther away from the collapse, with the strongest effect 7 years after the collapse. The effect is thus increasing overtime: seven years after the collapse, average prices decrease by about 20% within a 400 m radius and by almost 40% within a 200 m radius. This is surprising, as we would expect prices to catch up after a few years, either due to renovation sparked by the collapse or by actors forgetting about the collapse after a while. As the radius increases, the effect becomes weaker, takes longer to materialize and is no longer statistically significant after eight years for distances beyond 400 meters. Over the entire observation period, prices decrease by an average of around 9% for dwellings located less than 400 meters from the collapse site compared to those located between 1 and 3 kilometers away (see Table A1 in the appendix). Pre-trends are also slightly better, leading us to prefer this specification. For distances above 200m, there is no statistically significant effect on prices until 3 years after the collapse, which might indicate a gradual adjustment of prices and the sluggishness of the housing market. These results indicate that the effect is very localized, with the effect losing its intensity as the treatment radius increases. This adds credibility to the claim that the nearby collapse is responsible for the decrease in housing prices we observe.

Adding various robust TWFE estimators allows us to check the robustness of these results. Figure 4 confirms a negative effect on housing prices 3, 4, 6 and 7 years after a collapse. However, depending on the estimator, this effect is not always statistically significant. Sun and Abraham (2021) yields the closest results to our main estimator, namely the one by Borusyak et al. (2024). OLS is statistically significant 3 and 4 years after the collapse. The estimators finding the least impact are De Chaisemartin and D'Haultfoeuille (2022) and Callaway and Sant'Anna (2021), with a statistically significant negative effect only respectively 6 and 7 years after the collapse. Overall, the different estimators tend to agree with Borusyak et al. (2024)'s estimator, confirming the robustness of our results.

Furthermore, Figure A2 in the appendix disaggregates the time period in order to identify more precisely when we first observe an impact. Focusing on this estimator, we observe the first statistically significant impact on prices 5 quarters after the collapse.

[7] This differs from traditional TWFE designs where $l = -1$ is omitted and serves as the reference category.

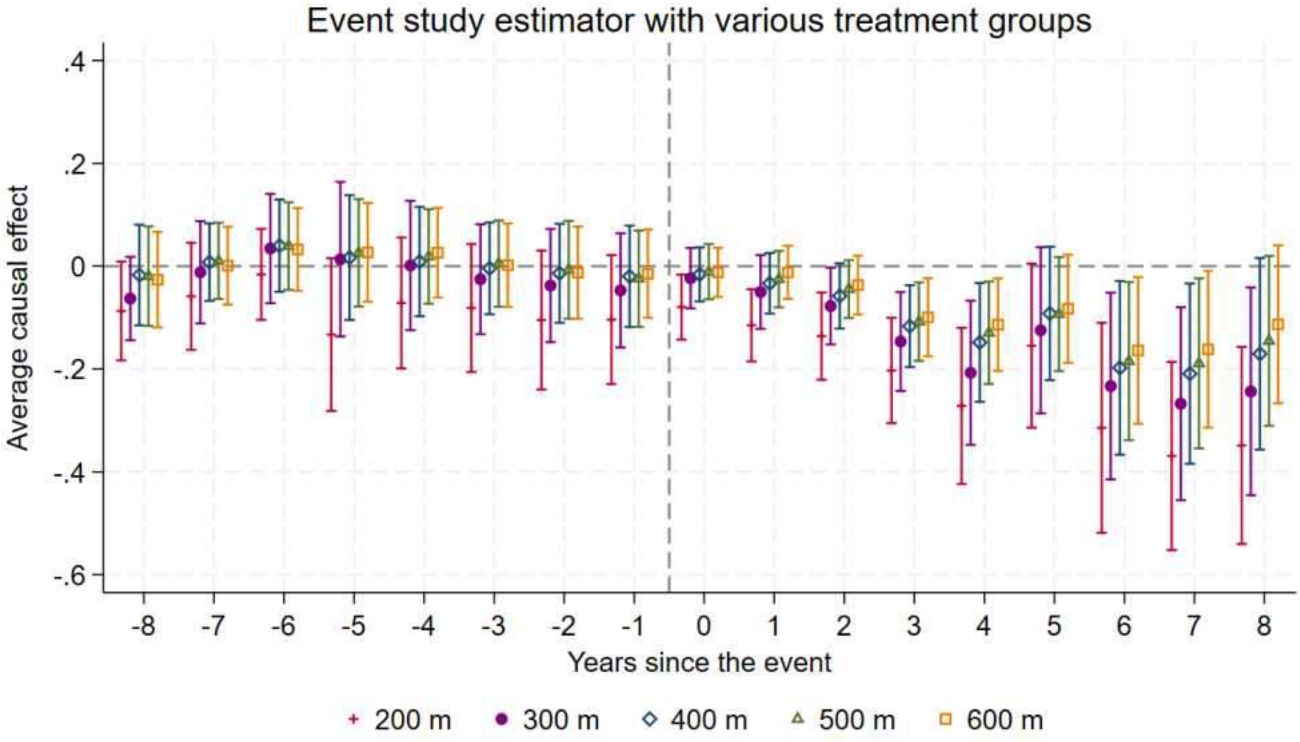

Figure 3: Event-study estimator for varying treatment groups

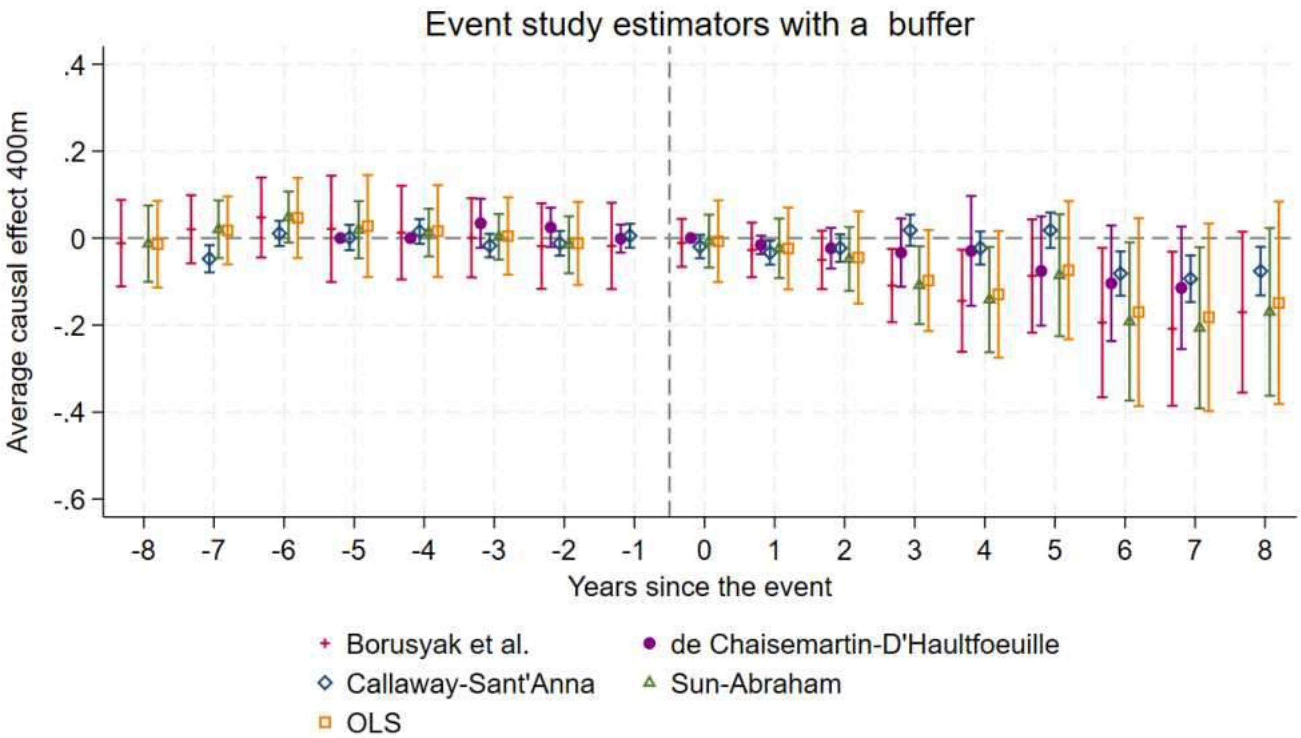

Figure 4: Impact on housing prices of building collapses due to lack of renovation

The effect then remains consistently negative from the 8th to the 16th quarter, which corresponds to a period between 2 and 4 years after the collapse. The most pronounced decline, approximately 20%, is observed during the 15th and 16th quarters.

Finally,Figure A1 in the appendix shows the results for a different control group, namely dwellings in buildings between 1 and 2 km from the collapse. The results do not significantly change, lending further robustness to our results.

6 Heterogeneity analysis

We now turn to the mechanisms driving the decrease in prices in close vicinity to the collapse. There are three potential mechanisms that might explain the decrease in prices caused by a collapse : the visual and sound inconvenience derived from forced proximity to a collapse, the negative signal a collapse sends on the quality and safety of a given neighborhood and the increase in risk perception after a rare event.

6.1 The inconvenience effect

The first potential mechanism is an inconvenience effect, where the visual and sound inconvenience from seeing a building's shell or a pile of rubble and hearing the clearing and subsequent construction site drives a decline in attractiveness for the dwellings closest to the collapse. The steeper decline in prices within closer range of the collapse, as seen in figure 3 lends support to this hypothesis. We are not able to go below this threshold of 200 m because of a lack of observations.

6.2 Beyond the inconvenience effect

6.2.1 Exclusive distance thresholds

To test whether other mechanisms might be at play, Figure 5 displays the price variation for control groups built upon exclusive thresholds of distance to the collapse. While, in figure 3, the effect at 300 or 400m might only be a diluted effect of the decline within 200m of the decline, we here exclude observations included within a closer distance. Thus, the 400 m control group (represented by the blue curve) only includes dwellings between 300 and 400 m from the collapse for example. We observe that, while the effect is strongest for dwellings within 200 m of the collapse, dwellings between 300 and 400 m and especially

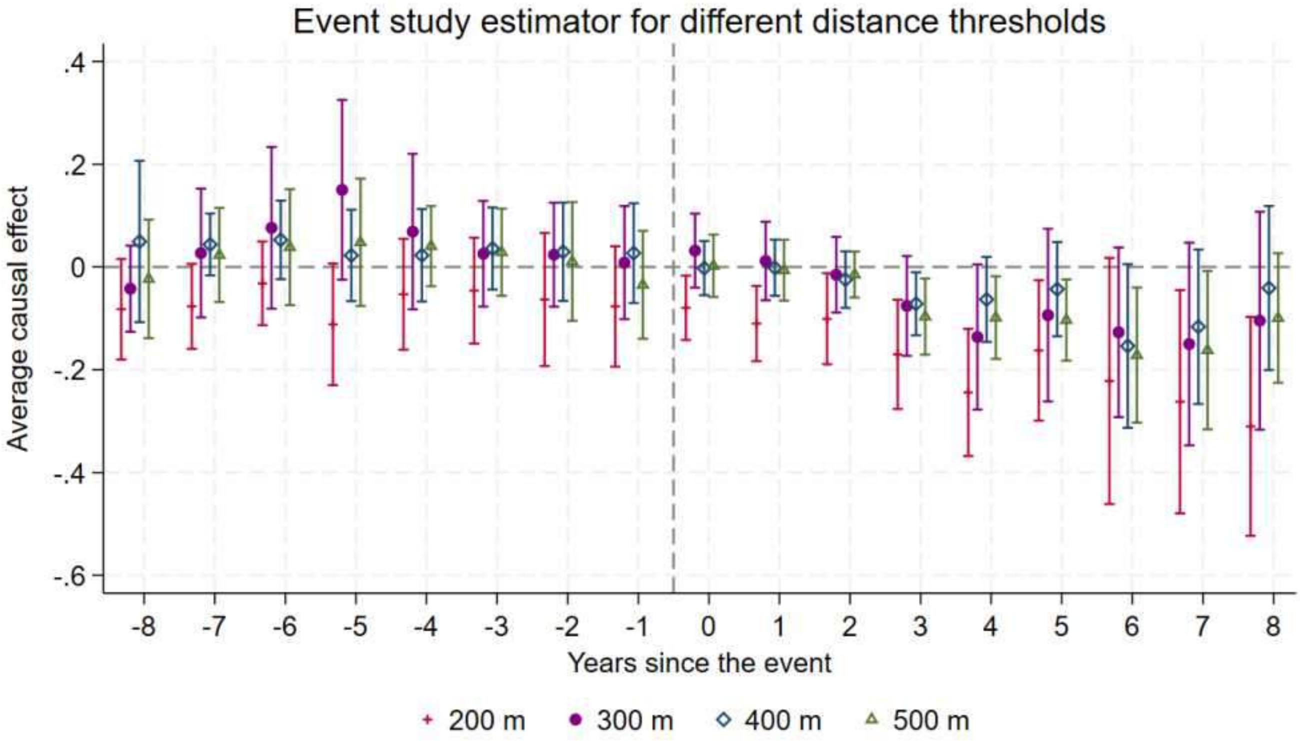

Figure 5: Impact on housing prices of building collapses based on the distance to the collapse

between 400 and 500 m, also experience a significant decline in prices fall after the collapse. This suggests that other mechanisms are at play, because the inconvenience effect is very localized and therefore unlikely to affect buildings beyond 100 or 200m of the collapse.

6.2.2 Media exposure

Another way to identify causal mechanisms beyond inconvenience is to look at media exposure. Indeed, any of the other two potential mechanisms might be triggered by increased media attention. The negative signal sent by a collapse might be broadcast by the media, but media discussion of the collapse could also bring to light risks that were previously unknown or underestimated by potential buyers. If collapses subject to high media exposure experience a sharper decline in prices, then other mechanisms beyond the inconvenience effect are at work.

We measure media attention by the relative number of Google searches for the terms "building collapse" in the month of each collapse of our sample relative to the highest frequency in the time period (figure 6). This frequency is set at 100 and coincides with the 2022 collapse in Lille. To our knowledge, no other collapse took place in the same

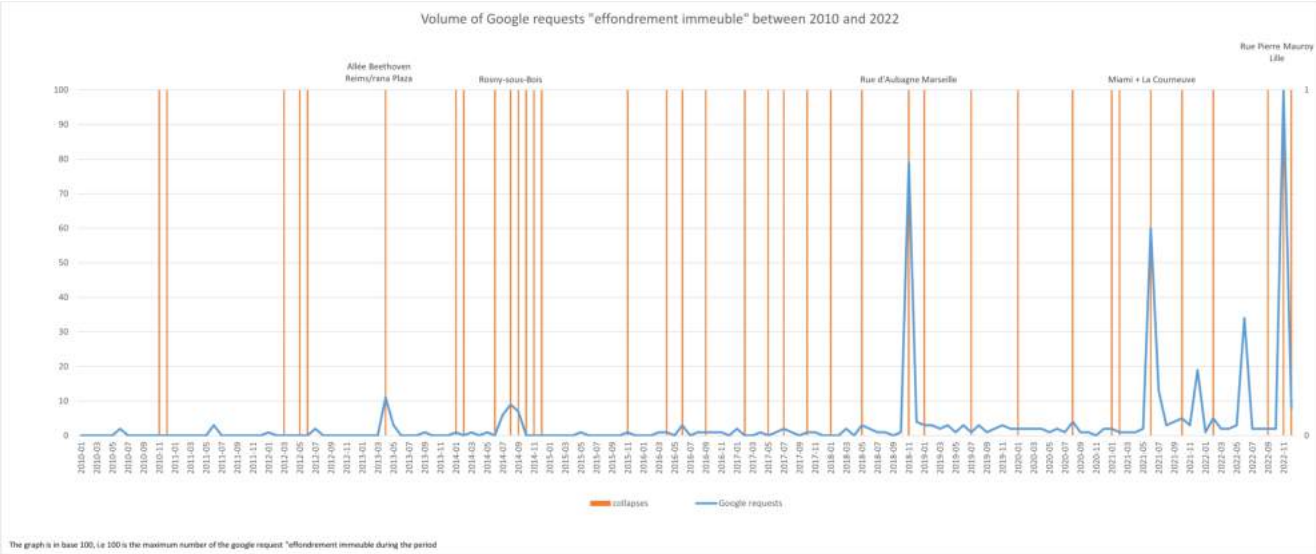

Figure 6: Google requests and collapse timeline

month. As half of our collapses are associated with less than 2/100 of the 2022 collapse in Lille, when the number is zero, we define the the collapse as having no media attention. This is the case for 12 of our collapses. Important media attention is defined by at least 1 Google search.

Since Google searches may reflect events unrelated to the collapse in our sample, such as another collapse in the same month, trial decisions or growing concern about urban risks, we also use the number of Europresse articles mentioning the collapse in the three months that follow as an additional measure. In this case, high media attention refers to collapses with more than 10 articles. However, the same article can sometimes appear multiple times in Europresse if at least one character differs between two versions, which affects the accuracy of this measure. Although the additional Google searches are not necessarily caused by the collapse in our sample, they still reflect increased attention to building collapses. While Google searches or press articles are not specific to the neighborhood, this heightened attention suggests that potential buyers become more sensitive to the proximity of a collapse.

Figure 7 displays significant differences depending on whether collapses were given media attention at the time of the collapse. Similar results for Europresse articles can be found in the appendix (figure A3). When people were more concerned by collapses, prices are significantly lower (by around 20%) near a collapse, whereas there is no significant effect when there was no interest in collapses at the time of the collapse. Furthermore, this trend accentuated over time, with the effect increasing to 40% 6 years after the collapse.

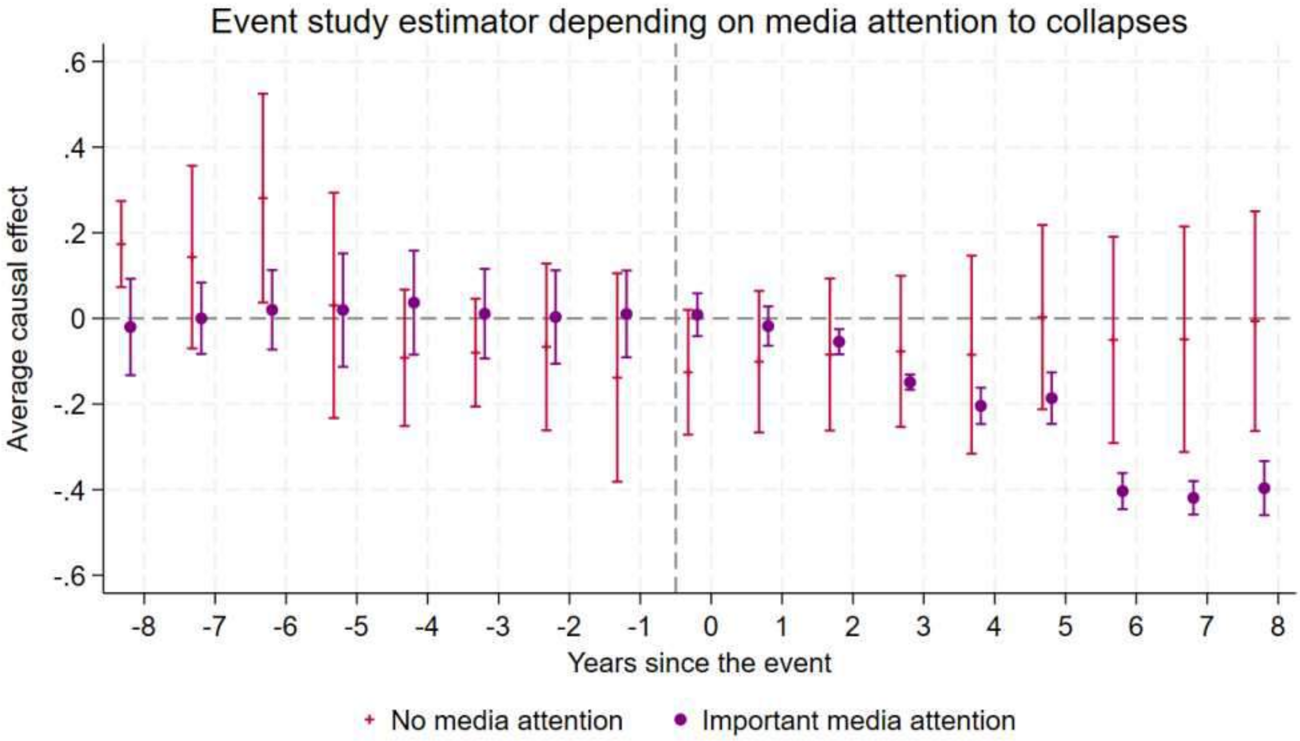

Figure 7: Impact on housing prices of building collapses based on the intensity of media attention

These results support the claim that the decline in prices is steeper when buyers are more likely to be aware that a collapse took place nearby. Whether it specifically affects the neighborhood of a collapse through a negative signal or an increase in risk perception cannot be tested by this mean.

6.3 The risk perception mechanism

6.3.1 Exposure to clay hazard

In order to test whether the decrease in prices after a collapse is due to an updated perception of a pre-existing risk, we conduct heterogeneity analysis with respect to clay hazard and the intensity of this risk. If risky dwellings are subject to a risk premium, but only after the realization of an event drawing attention to this risk, then prices decreases will be strongest in areas the most exposed to clay hazard. The shrinkage-swelling of clay, caused by variations in soil humidity is a major cause of building degradation by creating cracks. Thus, buildings exposed to this risk are more likely to collapse and this risk is increasing due to climate change and the higher frequency of droughts. This risk is well acknowledged as it has been covered since 1989 under the natural disaster compensation scheme, in which it is listed in second place for compensation purposes (with flooding listed in first place).[8] Heterogeneity analysis with respect to the exposure to this hazard highlights the perception of this risk in the presence of a nearby collapse, which could draw increasing attention to it.

We split our initial sample of collapses caused by insufficient renovation between collapses located in areas exposed or strongly exposed to this hazard and collapses in areas not affected (or only feebly affected) by this risk. The level of exposure is given by the Géorisque database and is computed as the product of susceptibility, defined by hydraulic and geological conditions, and sinistrality, i.e the density of claims by urbanized square km. 18 out of the 32 collapses in our sample happen in areas exposed to a medium or strong clay hazard and 5 in areas exposed to strong clay hazard (see Figure A4 in the appendix). Figure 8 shows that in such areas, results strongly resemble those in the full sample, except that the effect takes longer to observe, but then remains negative over time. Point estimates are lower in exposed areas 5 years after the collapse, but the confidence intervals are also bigger. In not-exposed areas, the effect of a collapse on real estate prices is negative and statistically significant immediately after the collapse but becomes positive at the end of the period. After 9 years, we do not observe any significant price difference between treated and control areas when the collapse occurred in a location not exposed to clay hazard. However, the pre-treatment dynamics suggest a potential violation of the parallel trends assumption, possibly due to anticipation effects.

The effect remains negative across all specifications but is never statistically significant in moderately exposed areas, whereas it becomes significant in non-exposed zones. In contrast, the effect is consistently negative and of greater magnitude in areas strongly exposed to clay risk. This suggests that clay hazard is accounted for by potential buyers and thus significantly decreases housing prices only when this risk is strong.

6.3.2 Dwelling quality

Differentiating dwellings by their quality allows to test the same mechanism of an increase in risk perception, but at the micro level. We split our sample by the levels of quality as defined by the land registry ranking. This ranking consists of eight categories of comfort,

[8] https://www.brgm.fr/en/news/feature-article/risks-spatial-planning-clay-shrinkage-swelling. Coincidentally, flooding is also the main natural disaster investigated in the literature

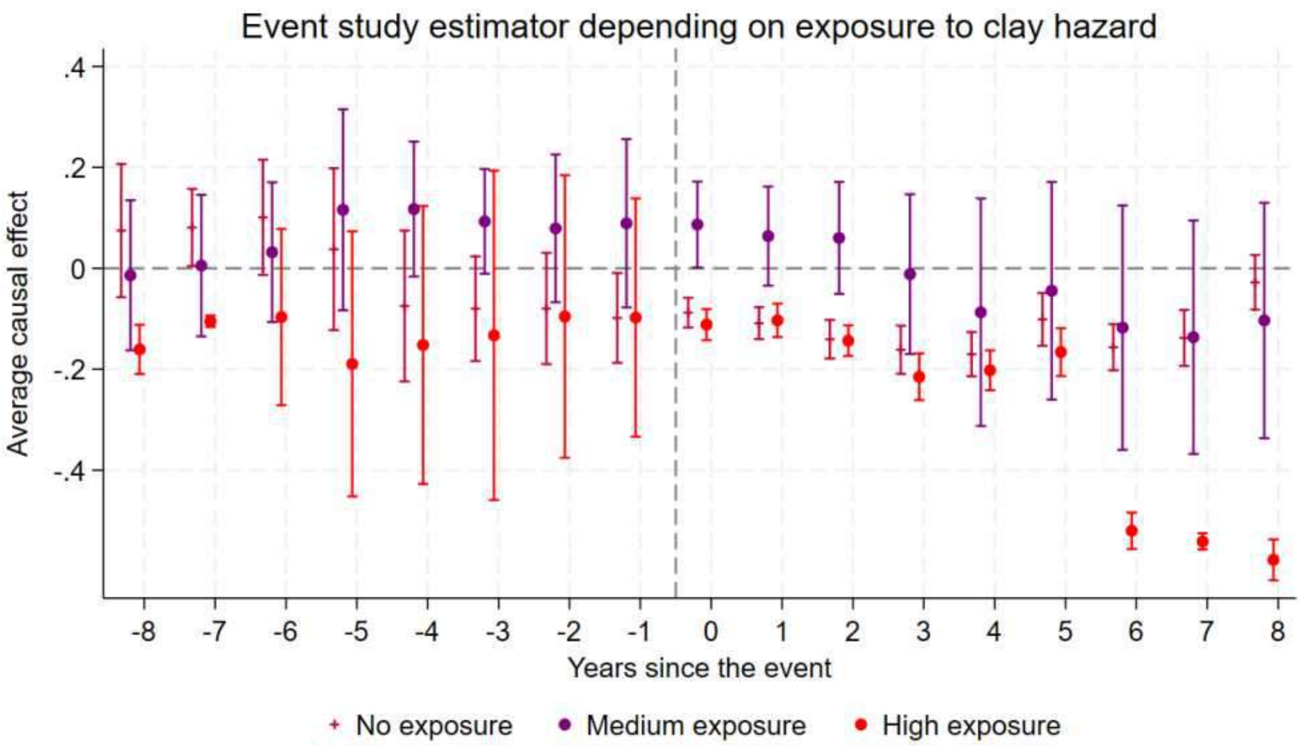

Figure 8: Impact on housing prices of building collapses depending on exposure to clay hazard

from high luxury to very mediocre, which we consider a proxy for quality. To ensure sufficient sample size and increase readability, we aggregate these categories into three broader ones. The first consists of good quality dwellings (20.6% of dwellings in our sample), the second, most common category, is decent quality (76.8%), and the third of mediocre or low quality dwellings. Only 3% of dwellings are in this category. Figure 9 highlights how the worst dwellings experience the sharpest decline in prices after a collapse, with this effect lasting throughout time. Though all dwellings see their price decrease at one point after a collapse, the effect is not statistically significant throughout the time frame, with high quality dwellings even catching up at the end of the period. Though the point estimates are mostly lower for basic quality dwellings, the confidence intervals do not allow to conclude to a significant difference between these two categories. Pre-trends are never statistically different from zero and while confidence intervals are quite large for low quality dwellings, this is probably due to the smaller sample size (19,810 observations).

Table A1 complements these results in two ways. First of all, it shows that, once again, dwellings nearer to the collapse suffer from a stronger decrease in prices. While the

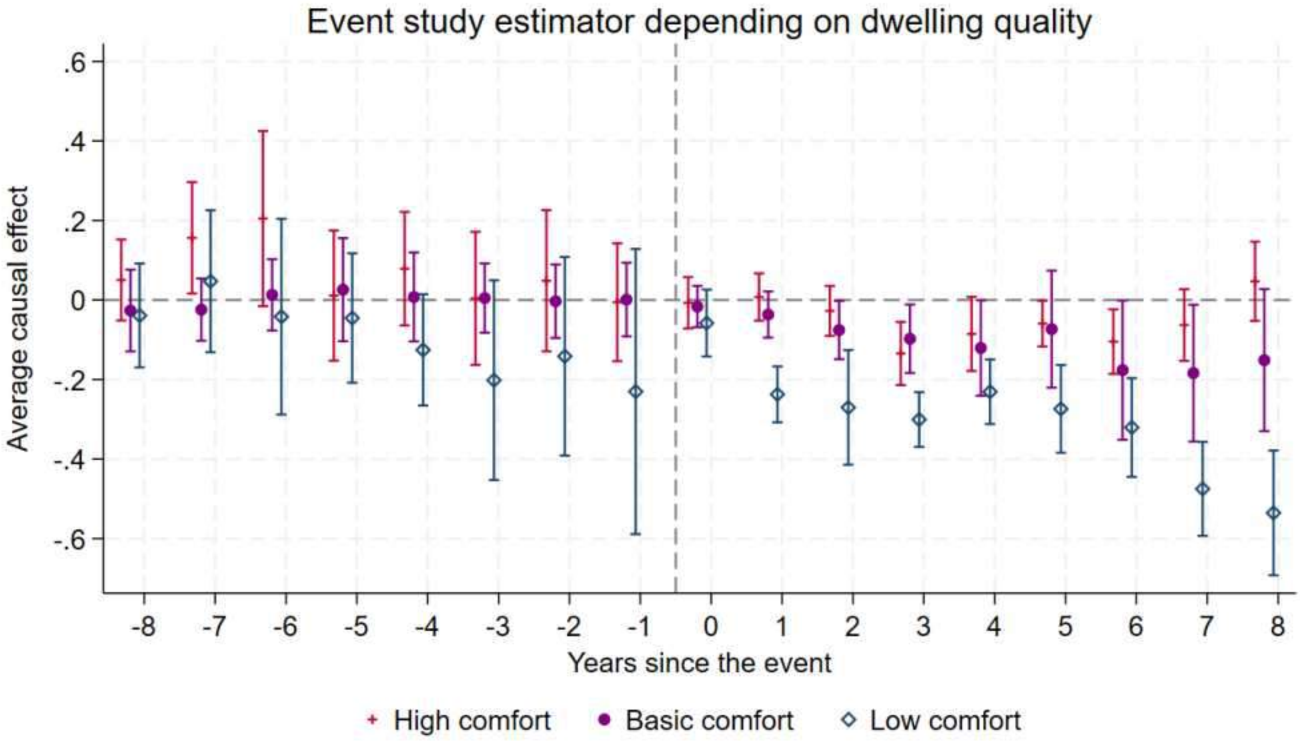

Figure 9: Impact on housing prices of building collapses for varying dwelling quality

average affect for good quality dwellings at 400 m is 4%, it is 7% at 200 m. This gradient is stronger as the quality decreases (8% vs 17% for basic quality dwellings, 26% vs 39% for low quality dwellings). These effects are on par with those for high clay hazard, and much higher than the overall average effect, confirming the existence of a stronger negative premium for dwellings considered risky or in riskier areas after a collapse, pointing at an increase in the perception of a safety hazard where there is an intrinsic risk due to a collapse.

6.4 The negative signal mechanism

The third and last mechanism that might be at work is a negative signal of a collapse on the quality and safety of the local neighborhood. Contrary to the risk perception mechanism, this mechanism leads to a decrease in prices, independently from the cause of the collapse or the intrinsic risk of collapse of surrounding buildings. There are two ways we can test this mechanism. The first is to compare collapses based on their cause, distinguishing collapses from disrepair, our main focus in this paper, and collapses due to gas leaks or explosions. If any collapse sends a negative signal on surrounding dwellings,

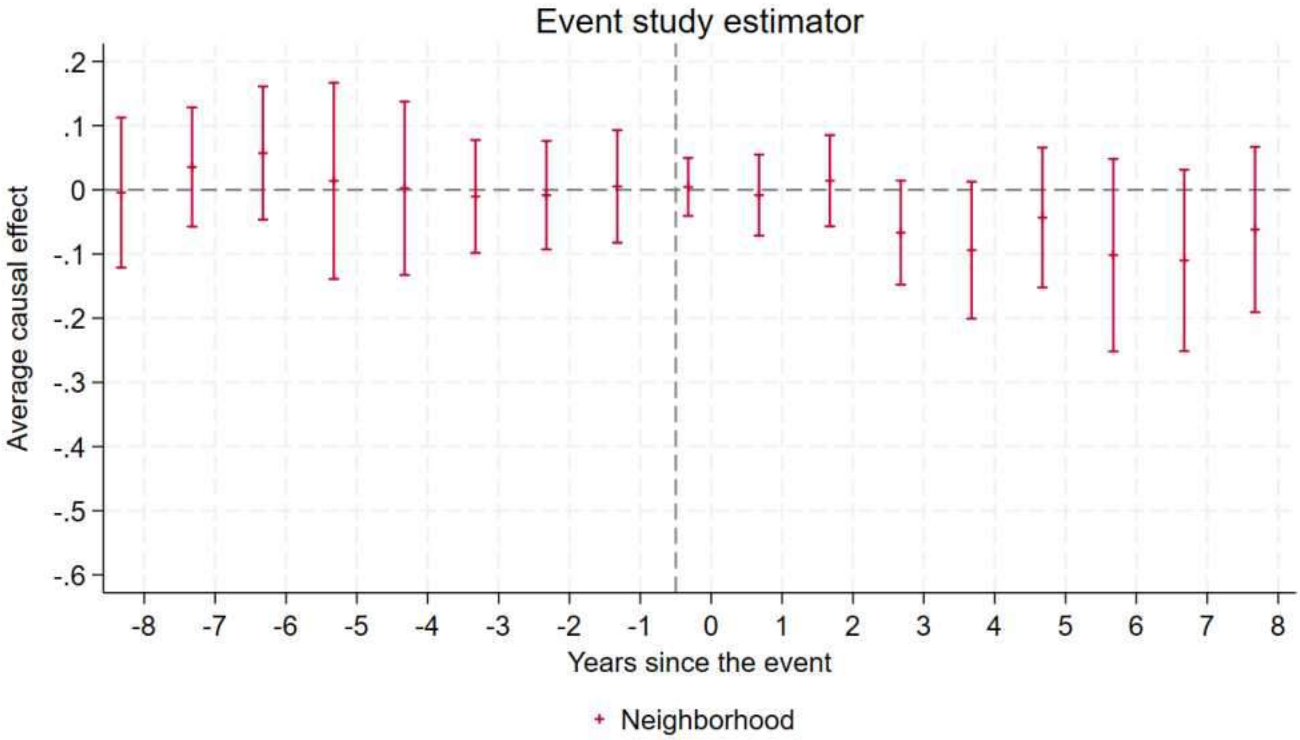

Figure 10: Impact on neighborhood housing prices of building collapses

then collapses due to different causes should have similar effects. However, we are unable to fully test this, because the results for collapses due to gas are inconclusive, as the parallel trend assumption is violated, even when adding controls or changing the control group. They are therefore presented in the appendix.

Another way this mechanism could be tested is by considering the effect not only on surrounding dwellings based on their proximity to the collapse but at the neighborhood level. We use the statistical definition of a neighborhood, called iris, used by the INSEE, that is based upon continuous density of the built environment and demographic and geographical homogeneity. In this specification, our control group is the iris of the collapse, while our control group is composed of the other iris of the city, excluding the ones adjacent to the control group, in order to avoid diffusion effects. Figure 10 shows a non statistically significant negative effect on prices, suggesting there is no specific neighborhood effect. This highlights that distance to the collapse is a better metric to measure the negative externality of the collapse than the neighborhood. In terms of mechanisms, though further testing of the negative signal effect should be undertaking, this result tends to discard the explanatory power of this mechanism.

7 Discussion and Conclusion

In this article, we assess the externality effects of the growing issue of building collapses due to a lack of renovation. We show that a collapse significantly reduces the price of dwellings located in its vicinity : 9% on average for dwellings located less than 400 meters from the collapse. The impact is highly localized, with the strongest declines observed within 200 to 400 meters, while effects fade beyond 1 kilometer. The effect persists in the long run and even reaches 20% seven years after the event. This suggests that collapses are not perceived as isolated accidents but rather as indicators of structural weaknesses in the local built environment. The magnitude of the effect varies depending on context: it is greater in areas exposed to clay-related hazards and for low quality dwellings. The heterogeneity analysis reinforces the idea that what matters is not simply the physical damage, but the increase in the risk perception sent by a collapse due to building deterioration.

This adjustment may be directly caused by the collapse, but may also be an indirect consequence, if the collapse triggers municipal or national measures to prevent further collapses in an already dilapidated neighborhood. These measures, such as the *Permis de louer* which requires owners to obtain explicit permission from the municipality before letting their dwelling, likely trigger sales at lower prices to avoid that the substandard dwelling become a stranded asset. In several collapse events in our sample, in Marseille or Bordeaux for example, this requirement was decided as a result of the collapse. The subsequent decline in prices could therefore be directly caused by the *Permis de louer*. A case-by-case analysis of local measures following collapses would be useful to provide further evidence on the chain of events causing a decrease in housing prices.

These elements contribute to a better understanding of how the real estate market internalizes, or fails to internalize, urban fragility. We also identify a correlation between collapses and neighborhood owner-occupation and vacancy rates, pointing to the importance of tenure status when addressing these issues.

Evidence of this type of market failure supports the case for public policies aimed at correcting it. Currently, the cost of cleaning up after a collapse falls on the municipality, while the decrease in housing prices is borne by the owners of dwellings located near the collapse. One solution would be to require the owner of the collapsed building to cover all associated costs. However, situations vary between collapsed buildings. In some cases—such as the Rue d'Aubagne incident—the building is primarily owned by a single individual who rents out rooms without covering renovation expenses. In other cases, condominiums owned by multiple resident-owners fall into a negative spiral of declining attractiveness due to aging infrastructure. This leads to rising maintenance costs, which in turn accelerate the departure of owners who can afford to leave, ultimately leaving behind only the poorest homeowners who are unable to move.

In the first case, it is conceivable to make the owner pay for the negative externalities; in the second, it is less feasible. One solution could be to create a form of insurance, paid by all property owners in France, which would cover all costs—including negative externalities—in the event of a collapse, similar to the natural disaster insurance system in France. However, the problem with this type of solution is that it would not prevent collapses from occurring. More preventive measures and policies specific to each tenure status should therefore be considered.

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A Appendices

Details on the identification strategy

For collapses between 1 and 3.4 km of each other, the control groups of the first event will overlap with a future treated group. To avoid this, for each problematic transaction, we exclude it from the control or treated group of the furthest collapse. Figure 12 illustrates our strategy concerning such collapses. Consider two collapses occurring at time t=1 and t=2, located at 1,1 km of each other.[9] The shaded circles around each collapse represents the treated groups. Since the collapses are over 800 meter apart, these groups never overlap. The colored circles represent the inner and outer bounds, 1 and 3 km, of both control groups. If there were no second collapse, the control group would be the whole donut delimited by the purple and grey circles. However, in the case of a second collapse, all transactions in the donut but out of the purple zone are closer to the second collapse. We thus exclude them from the control group for collapse 1 and include them in the control group for collapse 2. This leads to a loss of observations, which we can quantify. In terms of area coverage, each original control group spans an area of 25 square km.[10] In the case of a second collapse located 1.1 km away, the area of the control group is reduced to 14.8 square km, a little under 60% (58.91) of the original area. The further the collapses are from each other, the less the control group is reduced. Therefore, in the most problematic case, we only lose around 40% of coverage. The exact number of lost observations depends on the urban density of the control area, but in our sample we have enough observations for our regressions to run satisfactorily.

[9] Any collapses closer to each other have been excluded from our sample, due to potential spillover effects.

[10] The area of the outer circle is $3 \times 3 \times \pi$ square km, while the inner circle covers $1 \times 1 \times \pi$ square km. The area of the donut is thus $8\pi \simeq 25$ square km. By means of comparison, the treated group covers an area of 0.5 square km

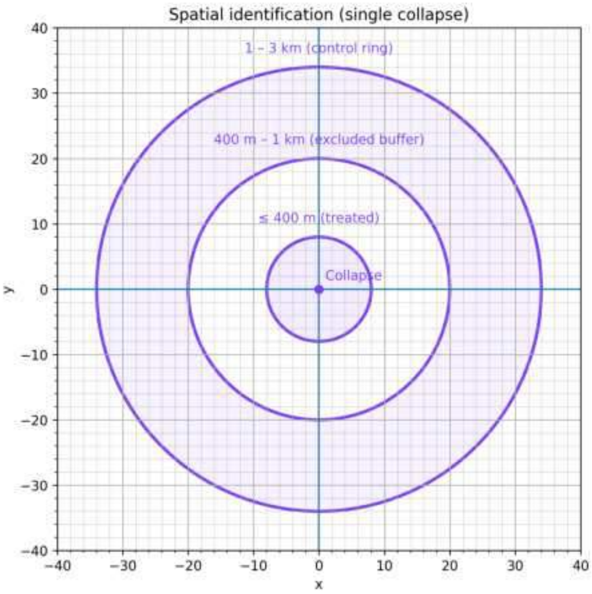

Figure 11: Identification strategy

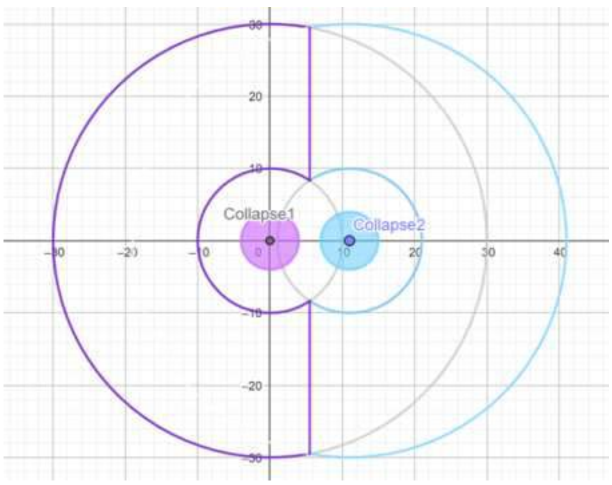

Figure 12: Identification strategy for two collapses located at 1.1 km of each other

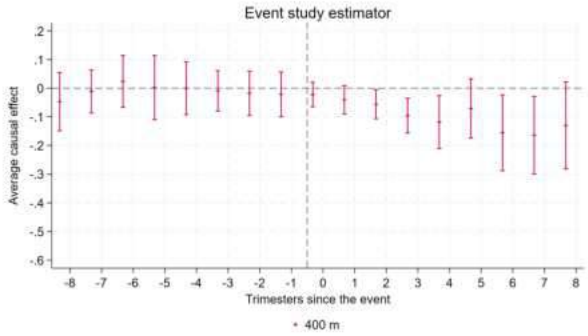

Figure A1: Impact on housing prices of building collapses due to lack of renovation with control group 2

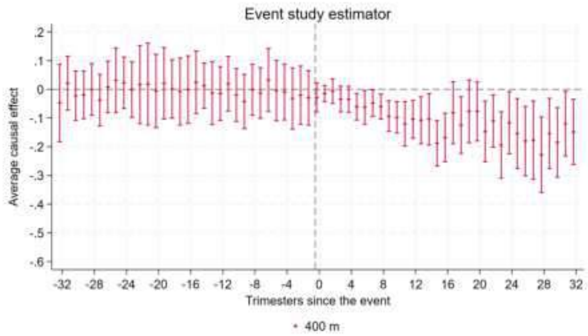

Figure A2: Short-term Impact on housing prices of building collapses due to lack of renovation

Additional robustness checks

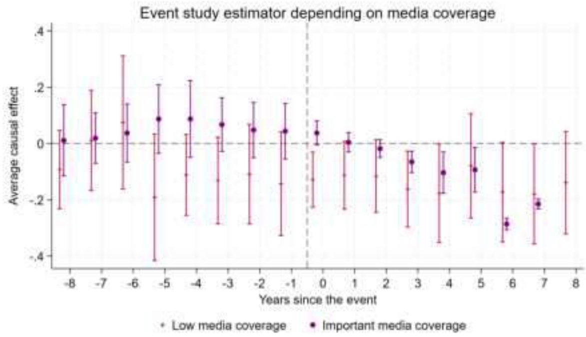

Figure A3: Heterogeneity analysis based on the number of Europresse articles

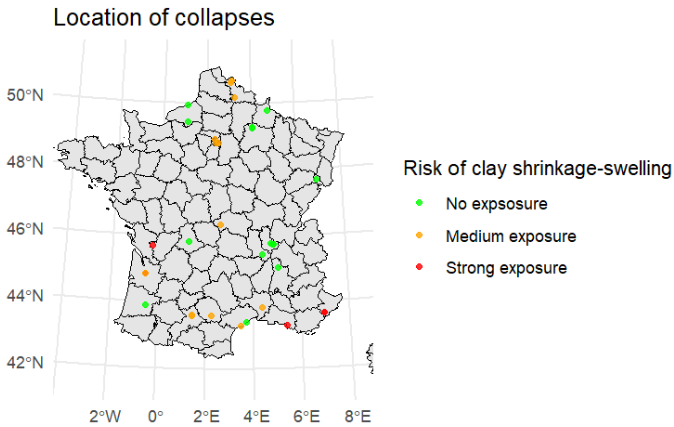

Figure A4: Location of disrepair collapses based on exposure to clay hazard

Media exposure based on Europresse articles

Map of collapses based on the intensity of clay hazard

Figure A5: Explosions and building collapses in Urban Areas

Gas leaks

To determine whether lack of renovation is the driving force behind the price drop following a collapse and disentangle between potential mechanisms, we run the same regressions on collapses caused by gas leaks. If the main mechanism is an increase in the perceived risk of collapse, then collapses not caused by disrepair should not lead to the same decline in prices as those due to disrepair, since they are less likely to be seen as a signal that poorly maintained buildings are at risk of collapsing. However, if the main mechanism is the visual and noise inconvenience of the construction site following the collapse, then there should be no difference based on the cause of the collapse. This is however unlikely beyond a very small perimeter. Thus, distinguishing between causes allows us to disentangle potential mechanisms behind the fall of housing price we previously observed.

Figure A5 maps the location of building collapses caused by explosions within the urban influence zones of French cities. Although the total number of events remains relatively low at the national level, their spatial distribution is clearly not random. A noticeable concentration appears around major metropolitan centers, including Paris, Lyon, Marseille, Bordeaux and Toulouse. These explosions are often linked to structural weaknesses in the housing stock, particularly issues related to gas infrastructure, the use of gas cylinders, faulty connections or insufficient maintenance of equipment. The presence of such events in both dense central areas, such as inner Paris, and in more sparsely populated regions suggests that this form of risk is not confined to large cities. Several explosions also occurred in smaller urban areas and semi-rural settings, where buildings may be older, degraded or insufficiently monitored. The pattern observed in the southwest confirms that this phenomenon affects both rural and peri-urban territories.

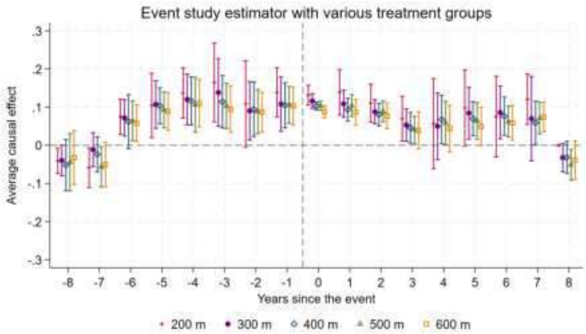

Figure A6: Event-study estimator for varying treatment groups with collapses due to gas leaks

The comparison between this map and the one in section 2 reveals two distinct spatial patterns of urban risk. Explosions appear as isolated and often unpredictable events. In contrast, collapses linked to deterioration reflect a more structural and chronic vulnerability, concentrated in disadvantaged urban settings where housing conditions remain persistently poor. Several cities, including Marseille, Toulouse, Lyon and Paris, appear on both maps. This suggests the presence of overlapping vulnerabilities, combining aging buildings, fragile infrastructure and substandard housing. Marseille, Bordeaux, Paris and Lille are also located in areas subject to clay hazard, which further increases their exposure. It should be noted that no collapse is recorded in rural areas. However, this absence is explained by the sampling strategy, which excludes urban units with fewer than 20,000 inhabitants.

Figure A6 presents the results for varying treatment radii using our main estimator, focusing on collapses caused by gas leaks explosions. Prices in the treatment group increased compared to the control group during the period from 9 to 6 years before the treatment. However, the price trends in the treatment and control groups appear similar over the 6 years following the treatment. Price differences remain relatively stable after the treatment.

The estimators from De Chaisemartin and D'Haultfoeuille (2022) and Callaway and Sant'Anna (2021), which show no pre-trend differences (Figure A7), further confirm the absence of any post-collapse effect on housing prices. This tends to support the idea that the market perceives collapses differently depending on their causes, leading to varying impacts on housing prices.

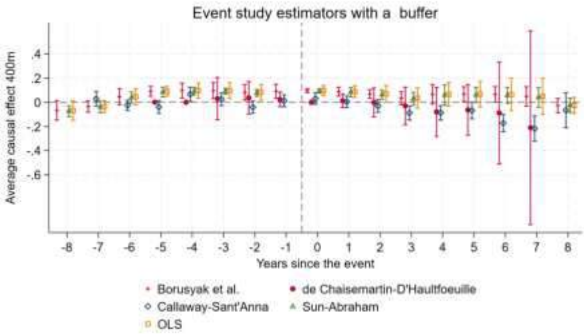

Figure A7: Impact on housing prices of building collapses due to gas leaks

City dynamics We also distinguish between dynamic and declining cities based on recent demographic trends. Dynamic cities are defined as those where the population increased over the five years preceding the collapse, reflecting growth and urban attractiveness. In contrast, declining cities are defined as those that experienced a population decrease over the same period, which may indicate urban shrinkage or reduced residential demand. The negative effect on real estate prices is expected to be greater in such cities, because the incentive to rebuild after a collapse or to renovate beforehand is weaker when housing demand is low and the city less attractive. If the city is already in decline, we expect the effect of a collapse to be stronger, by further deteriorating the image of an already less attractive area or by convincing neighbors to move. However, if the population is already poorer or older, it might also be less mobile. This could worsen the effect, with only a captive population remaining and making the neighborhood even less attractive. Furthermore, poorer residents and municipalities might also be seen as less able to finance renovation or implement additional safety measures, which could increase the perceived likelihood of another collapse once one has already occurred. This question is further investigated in Glaeser and Gyourko (2005).

Figure A8 seems to confirm this trend, though we need to add control variables in our declining cities sample in order to respect parallel trends. While in dynamic cities, we do not see any clear effect on prices, the effect is negative and significant in declining cities up until 9 years after the collapse. In such cities, a collapse could be seen as a trigger to leave for people nearby who can afford it and thus widening the divide between less attractive neighborhoods and more dynamic (and likely better-off) ones. There might also be less reconstruction after a collapse in a city where the housing market is under less stress.

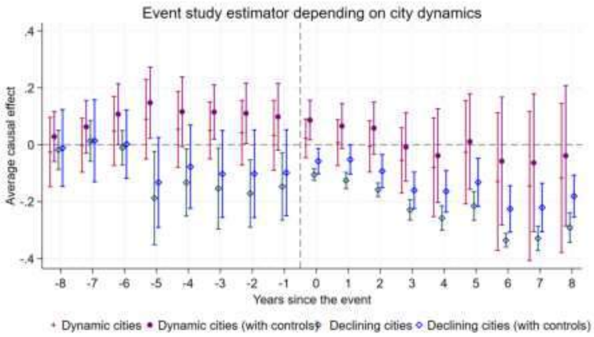

Figure A8: Impact on housing prices of building collapses depending on city dynamics

Table A1 measures the average effect by treatment radius. Like in previous estimations, the effect is stronger as the vicinity to the collapse increases, providing evidence to the second causal mechanism. By comparing the ATTs in this table to the ones for clay exposure, we test for the joint mechanism of declining image and increased risk perception. If the two mechanisms are simultaneously at play, then prices should be on average lower than for clay exposed areas, which should only affect the image of the neighborhood through increased risk perception. Since the coefficients are not significantly lower than for clay exposure (-0,2 at 400 m vs -0,22 for clay hazard), we do not find evidence of a feedback effect between the two mechanisms.

Table A1: Average Treatment Effect on the Treated (ATT)

Treatment radius	ATT	No media exposure	Media exposure	No Europresse	Europresse > 10	Medium or strong clay hazard	No clay hazard	Medium clay hazard	Strong clay hazard	Dynamic cities	Declining cities	High comfort	Basic comfort	Low comfort
200 m	-19%	-14%	-23%	-28%	-6%	-22%	-15%	-9%	-42%	-10%	-35%	-7%	-17%	-39%
	[−0.30, −0.10]	[−0.40, 0.11]	[−0.26, −0.21]	[−0.45, −0.11]	[−0.10, −0.04]	[−0.32, −0.11]	[−0.18, −0.12]	[−0.26, 0.09]	[−0.44, −0.39]	[−0.27, 0.07]	[−0.35, −0.34]	[−0.11, −0.03]	[−0.28, −0.07]	[−0.44, −0.34]
300 m	-12%	-8%	-15%	-19%	-3%	-12%	-12%	-3%	-29%	-5%	-26%	-2%	-11%	-32%
	[−0.23, −0.02]	[−0.31, 0.16]	[−0.18, −0.12]	[−0.36, −0.01]	[−0.06, −0.00]	[−0.24, −0.01]	[−0.16, −0.08]	[−0.21, 0.14]	[−0.31, −0.26]	[−0.21, 0.10]	[−0.28, −0.23]	[−0.07, 0.04]	[−0.22, −0.01]	[−0.38, −0.26]
400 m	-9%	-6%	-11%	-13%	-2%	-7%	-12%	0%	-22%	-3%	-20%	-4%	-8%	-26%
	[−0.18, 0.00]	[−0.26, 0.15]	[−0.14, −0.08]	[−0.29, 0.02]	[−0.05, 0.01]	[−0.18, 0.04]	[−0.16, −0.09]	[−0.15, 0.15]	[−0.25, −0.19]	[−0.16, 0.10]	[−0.23, −0.18]	[−0.10, 0.01]	[−0.18, 0.02]	[−0.32, −0.20]
500 m	-8%	-6%	-10%	-12%	-2%	-6%	-12%	0%	-18%	-3%	-17%	-6%	-7%	-20%
	[−0.16, 0.00]	[−0.24, 0.12]	[−0.13, −0.06]	[−0.26, 0.02]	[−0.05, 0.00]	[−0.16, 0.04]	[−0.15, −0.09]	[−0.14, 0.15]	[−0.22, −0.15]	[−0.15, 0.09]	[−0.20, −0.15]	[−0.11, −0.00]	[−0.16, 0.02]	[−0.26, −0.14]

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