The Low Countries are Getting Lower: Land Subsidence, Foundation Risks and Property Prices in the Netherlands

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Key words: Housing market data; Transparency; Land subsidence; Foundation risks; Price effects

SUMMARY

Up to 500,000 of the 8,300,000 houses in the Netherlands are currently at risk of foundation issues, caused by lower and more variable groundwater levels. These hydrological changes undermine soil stability, particularly in regions with soft clay and peat. Both houses with shallow foundations and houses with timber pile foundations are at risk, through respectively soil subsidence and heave, and fungal decay caused by oxygen exposure. Despite the potentially high costs of repairs for homeowners, as well as potential physical dangers, public awareness of foundation risks remains limited. We estimate hedonic price models using OLS to investigate the extent to which foundation risks are reflected in residential property prices, utilizing unique housing market data available to the Kadaster (The Netherlands' Cadastre, Land Registry and Mapping Agency) and combining this with foundation risk indicators published in the Dutch Climate Impact Atlas. Our findings indicate that housing prices are primarily driven by dwelling characteristics, while foundation risk indicators show limited and inconsistent effects. Contrary to expectations, foundation risk indicators (both continuous scores and ordinal classes) do not exhibit strong or systematic negative effects on price. Policy implications include the need for improved risk communication and transparency, as well as targeted interventions in high-risk areas to prevent future structural damage and associated economic losses.

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INTRODUCTION

In the Netherlands, when considering the risks of climate change, thoughts tend to go to flooding, since 26% of the country is below sea level, and another 29% is susceptible to river flooding (PBL, 2025). However, droughts also pose a risk. as became especially clear during the summer droughts of 2018, 2019, 2020, and 2022. During these droughts, ground water levels strongly fluctuated, which negatively affected the foundations of older houses, especially those built before 1970 on timber pilings, or directly on soft clay or peat soils (VEH, 2022; Hommes et al., 2023). As a consequence of these foundation issues, home-owners do not just face construction problems, such as fractures in interior and exterior walls, but also high financial costs as well as feelings of unsafety (RLI, 2024).

KCAF (2025) estimates that up to 500,000 of the 8,300,000 houses in the Netherlands are currently at risk of foundation issues. Despite the high costs of repairs for homeowners, as well as potential physical dangers, public awareness remains limited. Previous research shows that when buyers are aware of foundation risks, potential costs for renovations are calculated into house prices (Hommes et al., 2023; Hofmann et al., 2025). Research by Hommes et al. (2023) shows that, when foundation problems have been irrevocably determined, house prices tend to decrease by on average 12%, or €47,000, partly factoring in the restoration costs, which in 2022 varied between €50,000 and €100,000. Hommes et al. (2023) furthermore found that for apartments, when possible foundation risks are mentioned in the advertisements, the housing price tends to decrease by 1.9%. However, for houses that are potentially at risk based on year of construction, only 2,2% of the publicly available advertisements mention ‘foundation’ (Hommes et al., 2023) – and in these cases, it might mean possible foundation risks, as well as restored foundation, or identified foundation problems. This limited mention of foundation risks suggests that many potential buyers remain unaware of possible risks.

This does however raise the question, to what extent are buyers in the Netherlands *in general* aware of foundation risks and is this reflected in housing prices? By combining unique and detailed housing market data from the Netherlands' Cadastre, Land Registry and Mapping Agency – in short Kadaster – with data from the Foundations Risk Map (Climate Impact Atlas, 2024) developed by Deltares (Kok & Angelova, 2020; Costa et al., 2020), we analyse the extent to which foundation risks are reflected in residential property prices.

LITERATURE

2.1 Climate Change, Droughts and Foundation Risks

In the Netherlands, the subsidence of peat and clay soils, driven by both natural and artificial groundwater lowering and the loading of soft soils, is widespread, leading to significant damage to vulnerable structures and assets (Costa et al., 2020). Climate change is projected to increase the frequency and severity of droughts in the Netherlands, leading to lower and more variable groundwater levels (PBL, 2016; RLI, 2024). These hydrological changes undermine soil stability, particularly in regions with soft clay and peat, and thereby raise the likelihood of foundation damage to houses (Costa et al., 2020; Climate Impact Atlas, 2024). Two mechanisms explain this link:

- Soil subsidence and heave (risk for houses with shallow foundations): Falling groundwater levels accelerate soil consolidation, causing differential settlement. This uneven movement can result in structural damage—such as cracks in walls and floors or façade misalignment—and harm to connected infrastructure like driveways and sewer laterals (Kok & Angelova, 2020; RLI, 2024).
- Timber pile exposure and degradation (risk for houses with timber pile foundations): Timber pile foundations must remain submerged to prevent fungal decay. Drought-induced groundwater decline exposes timber to oxygen, enabling oxidation and biological degradation. Even when submerged, anaerobic bacteria may weaken timber, while negative skin friction from consolidating soils increases load beyond design capacity (PBL, 2016; Kok et al., 2021).

Not all dwellings face equal exposure to foundation risks. Vulnerability depends on building characteristics, foundation type, and soil composition (Costa et al., 2020). Foundations can be classified into three major types: shallow foundations, timber piles, and other (mainly concrete) piles. Post-1975 housing in the Netherlands generally uses concrete foundations and is considered less exposed, whereas pre-1975 dwellings often rely on shallow or timber pile foundations, particularly in peat and clay regions of the west (van Kempen, 2025; Climate Impact Atlas, 2024). Climate-driven groundwater decline amplifies these pre-existing vulnerabilities, resulting in the older housing stock being disproportionately at risk (Costa et al., 2020).

2.2 Economic and Social Costs

The consequences of foundation damage extend beyond technical failure. Repair costs are substantial and typically uninsured, with estimates ranging from €10,000 to €120,000 per dwelling and severe cases exceeding €100,000 (Kok & Angelova, 2020; RLI, 2024; Hommes et al., 2023). At the aggregate level, projections for the Netherlands to 2050 vary widely—from €5 billion to €60 billion—reflecting uncertainty in climate scenarios, soil conditions, and remediation strategies (Kok et al., 2021). Beyond financial burdens, affected households report prolonged uncertainty and feelings of unsafety, underscoring the social dimension of foundation risk (RLI, 2024).

2.3 Scale of the Problem

Since type of foundation is not registered, there are no exact numbers as to how many buildings have which type of foundation – nor do we have any information on buildings with a reinforced foundation. RLI (2024) estimates that, with the total stock of 7,000,000 buildings in 2020 as a baseline, within the next 15 years approximately 75,000 timber-pile buildings and 300,000–350,000 shallow-foundation buildings may face foundation issues; towards 2050 they add another ~5,000 timber-pile and 300,000–350,000 shallow-foundation buildings. FunderMaps/KCAF (2025) report 6,400,000 million buildings in total, of which ~170,000 face urgent risks and ~520,000 are at high risk, with roughly one-third of at-risk buildings having timber piles and two-thirds having shallow foundations. KCAF (2024) estimates that about 500,000 of those are dwellings. These ranges highlight both the societal magnitude of potential impacts and the uncertainty that calls for improved data-sharing and interdisciplinary collaboration.

2.4 Pricing in Risks

These vulnerabilities raise an important question: are foundation risks reflected in housing prices? In theory, risks may be capitalized into transaction prices when they are salient, observable, and perceived as costly to remediate. Empirical evidence shows that environmental and structural risks—such as flood risk, earthquake risk, or energy inefficiency—are often reflected in lower property values, though the magnitude depends on information availability and buyer expectations (Bin & Polasky, 2004; Kousky, 2010; Atreya & Ferreira, 2015; Bouwer & van Ek, 2004; Kok & Jennen, 2012). Conversely, information frictions or expectations of public mitigation can attenuate capitalization (Gayer, Hamilton, & Viscusi, 2000; Pope, 2008). Building on this literature, our empirical analysis examines whether foundation risk signals, expressed as neighbourhood-level scores and classes, are associated with transaction prices in the Dutch housing market.

EMPIRICAL DESIGN

3.1 Data

3.1.1 Data on residential properties

In the Netherlands, the Kadaster (The Netherlands' Cadastre, Land Registry and Mapping Agency) is the responsible agency for collecting and registering administrative and spatial data on property rights. After the official transfer of property at the notary, the deed is filed with the Kadaster. Information from the deed regarding the transaction and property - such as location, price, and size - as well as information on the buyer and seller - such as name, date and place of birth, and current address for individuals or registered address for companies - is processed and recorded in the Basisregistratie Kadaster (BRK – Registration Kadaster) (Plegt & Harleman, 2023). The BRK can then be combined and enriched with other national systems of data-registration, such as the Basisregistratie Adressen en Gebouwen (BAG – Registration of

Addresses and Buildings). The BAG contains information, both administrative and spatial, on the location of all buildings and addresses in the Netherlands. The local information is registered by the Dutch municipalities and administered by Kadaster. Combining the BRK and the BAG allows researchers at the Kadaster to see which buildings fall on what parcels, thereby creating a connection between building and owner – and therefore the characteristics of current and previous owner, as well as other relevant information from the deed, such as transaction price. For a more elaborate description of the BRK, possible combinations with other datasets and examples of research, we refer to Plegt & Harleman (2023). In this research, we focus on two datasets that have been derived from the BRK-BAG: the dataset on the Dutch housing stock, and the dataset on housing market transactions.

3.1.2 Data on foundation risks

Neighbourhood-level foundation risk indicators are derived from maps published in the Dutch Climate Impact Atlas (2024), developed by Deltares and partners and commissioned by the Ministry of Infrastructure and Water Management. These maps estimate risks for two mechanisms: (1) timber pile degradation and (2) differential settlement of shallow foundations, under current and future climate scenarios. While differences between scenarios are limited, outcomes vary at the local level. Risk scores combine three components:

- Exposure: Probability that buildings in a neighbourhood have vulnerable foundation types (timber piles or shallow foundations), based on location, building age, and soil type.
- Sensitivity: Expected groundwater lowering or subsidence, influenced by climate scenarios, pile depth, and soil characteristics.
- Impact: Estimated cumulative damage by 2050, expressed in damage classes (D0-D5), ranging from minor cosmetic repairs to full foundation replacement.

For each neighbourhood, a composite risk score is calculated by weighting the share of vulnerable buildings and their expected damage class (Kok & Angelova, 2020). Municipalities in the southernmost part of the Netherlands are excluded due to missing subsidence data.

Because these risk indicators are only publicly available at the neighbourhood level, we assign the corresponding neighbourhood risk score to each house or housing transaction in our datasets. We spatially match each residential property to its corresponding neighbourhood using official neighbourhood codes. The assigned risk measure reflects the neighbourhoods' characteristics rather than property-specific conditions, but provides a consistent proxy for local exposure to foundation-related hazards. This approach allows us to link area-level foundation risk to individual property prices, acknowledging that the risk measure reflects neighbourhood characteristics rather than property-specific conditions.

Figure 1 illustrates the maps used in this research: (a) pile degradation and (b) differential settlement. For the maps, the scores are categorized into five classes: very low, low, average, high, and very high risk (Kok & Angelova, 2020; Climate Impact Atlas, 2024). The threshold values are shown in table 1.

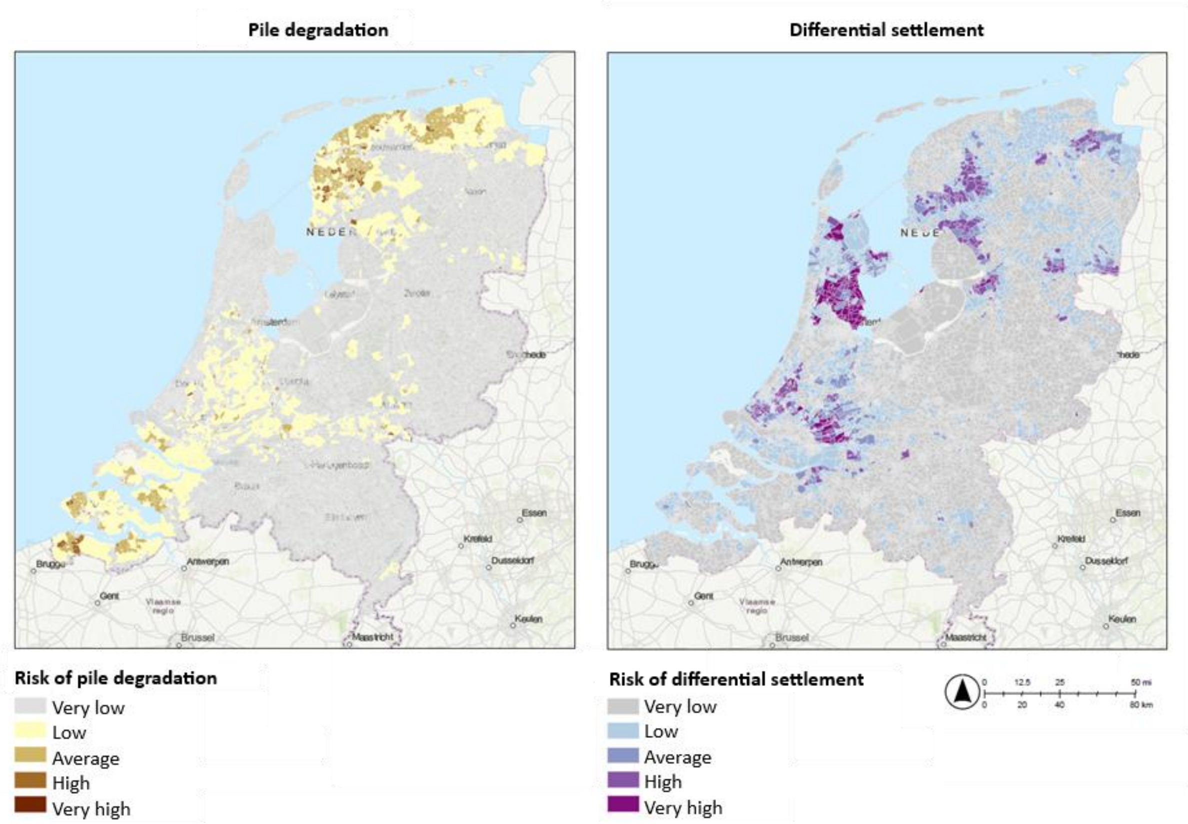

Figure 1. Maps on pile degradation and differential settlement in the Netherlands (Climate Impact Atlas, 2024)

Table 1. Threshold values used to classify neighbourhoods into risk categories for differential settlement and pile degradation.

Differential Settlement		**Pile degradation**	
Neighbourhood score	*Class*	*Neighbourhood score*	*Class*
<1	Very low	<1	Very low
<5	Low	<3	Low
<10	Average	<6	Average
<25	High	<15	High
<100	Very high	<41	Very high

3.2 Analysing Price Effects

We use the dataset of housing transactions enriched with neighbourhood-level foundation risk indicators and contextual characteristics to perform a hedonic price analysis. Observations are filtered to include only valid transactions with complete information on transaction price, dwelling type, surface area, urbanization level, construction year, and foundation risk variables. We only include ground-level homes bought by owner-occupiers. Records with unknown dwelling type, missing surface area, or unrealistic construction years (before 1850) are excluded. The final sample comprises 1,928,676 transactions.

The dependent variable is the natural logarithm of transaction price, enabling interpretation of coefficients as approximate percentage changes. The key explanatory variables are foundation risk indicators, which are available at the neighbourhood level for two mechanisms: pile degradation and differential settlement. These indicators are expressed in two ways:

1. Continuous risk scores, rescaled to a 0-1 range (original ranges: 0-40 for pile degradation and 0-100 for differential settlement) to ensure comparability.
2. Ordinal risk classes (very low, low, average, high, very high), used for robustness checks and interpretability.

In our analysis, we focus exclusively on the high-change climate scenario from the Climate Impact Atlas (2024). This choice reflects the fact that the underlying groundwater projections are based on the KNMI'14 scenarios, which have since been updated in KNMI'23. While new groundwater maps are not yet available, KNMI expects that the lowest groundwater levels will decline further under KNMI'23 scenario compared to KNMI'14 (Climate Impact Atlas, 2024). This trend is expected nationwide, with the strongest effects on elevated sandy soils, except in major infiltration areas such as the Veluwe, Drents Plateau, and Utrechtse Heuvelrug. In areas sensitive to foundation problems, this implies that risks may increase slightly beyond those shown in the current maps. By focusing on the high-change scenario, we approximate a conservative estimate of future risk under climate change.

We include the following control variables:

- **Dwelling characteristics**: log of surface area (m^2), dwelling type (terraced, semi-detached, corner, detached), and construction year in classes.
- **Municipality and time (year and quarter) fixed effects**: to control for macroeconomic trends and spatial price differences.
- **Urbanisation**: five-level classification based on CBS neighbourhood typology.

To address potential confounding between foundation risk and neighbourhood age composition, we add controls for the average construction year and the share of pre-1975 dwellings in each neighbourhood. These contextual variables ensure that estimated risk effects are not driven by the overall age profile of the neighbourhood.

We estimate hedonic price models using OLS. Standard errors are clustered by municipality. Four main specifications were considered:

1. **Baseline model**: includes dwelling characteristics, construction year class, urbanization, continuous foundation risk scores, and neighbourhood composition controls.
2. **Interaction model (continuous risk)**: adds interactions between construction year classes to test whether risk effects vary by construction period.
3. **Ordinal model (ordinal risk)**: replaces continuous scores with ordinal risk classes.
4. **Interaction model (ordinal risk)**: includes interactions between construction year classes and ordinal risk classes.

RESULTS

4.1 Descriptive: Number of Houses at Risk

Combining the maps provided by Climate Impact Atlas (2024) and Kadaster's dataset on housing stock (reference data 1-10-2021 for proper matching), we can estimate the number of houses at risk for foundation issues. We match the various datasets by neighbourhood, and focus on the houses built before 1975, aligning with the definition of the Climate Impact Atlas (2024).

On the first of October 2021, there are slightly over 8 million houses in the Netherlands. About 3.9 million of those were built before 1975. Considering the various Climate Impact Atlas-scenarios, i.e. 1) risk of pile degradation by 2050 based on limited climate change, 2) risk of pile degradation by 2050 based on substantial climate change, 3) risk of differential land subsidence by 2050 based on limited climate change and 4) risk of differential land subsidence by 2050 based on substantial climate change, we estimate that around 245,000 houses are at risk in the first scenario, 250,000 in second scenario, 172,000 in third scenario, and 223,000 in the fourth scenario, as can be seen in **Fejl! Henvisningskilde ikke fundet.**.

Table 2. Estimated number of houses at risk by type of foundation risk and climate change scenario (CC)

Risk	Pile degradation - Limited CC	Pile degradation - Substantial CC	Land subsidence - Limited CC	Land subsidence - Substantial CC
Very high	35,000	35,000	37,000	41,000
High	56,000	60,000	66,000	96,000
Moderate	155,000	156,000	69,000	87,000
Total	245,000	251,000	172,000	223,000

There is however overlap in these numbers; houses can be located in a neighbourhood that is at risk for both pile degradation and land subsidence. Combining both types of risk, while keeping the two climate change scenarios separate, we estimate that 412,000 houses are at risk for foundation issues in the case of limited climate change, and 463,000 houses are at risk in the case of substantial climate change, as can be seen in **Fejl! Henvisningskilde ikke fundet.**. These overall numbers are similar to estimates made by KCAF (2024).

Table 3. Estimated number of houses at risk by climate change scenario (CC) when combining foundation risks

Risk	Combined - Limited CC	Combined - Substantial CC
Very high	72,000	76,000
High	122,000	151,000
Moderate	219,000	236,000
Total	412,000	463,000

4.2 Hedonic Price Model

We estimate four specifications to examine the relationship between foundation risk and transaction prices: continuous neighbourhood-level risk scores (Models m1-m2), ordinal risk classes (Models m3-m4), and interactions with neighbourhood age composition (Models m2 and m4). Figure 2 summarizes the results for the main models and the robustness checks - full regression tables are provided in Appendix A.

For models using continuous risk scores (rescaled to a 0-1 range), coefficients represent the percentage change in transaction price associated with moving from the lowest to the highest observed risk level for a given mechanism. For example, a coefficient of -0.03 for pile degradation implies that properties in neighbourhoods at the highest risk experience approximately a 3% lower price compared to those at zero risk, holding other factors constant. For models using ordinal risk classes, coefficients indicate the price difference relative to the reference category (very low risk). For instance, a negative coefficient for “very high risk” suggests that houses in neighbourhoods classified as very high risk sell at a discount compared to those in very low-risk areas. These categorical effects provide an intuitive interpretation of risk impacts and allow for non-linear relationships between risk and price.

In the main models with neighbourhood age controls, continuous risk scores, both rescaled to a 0-1 range, for pile degradation and differential settlement are near zero and insignificant. Interaction terms allowing risk effects to vary by construction period do not alter this conclusion; coefficients remain near zero and statistically insignificant. Ordinal specifications show a similar pattern: most risk classes are insignificant, with only a minor negative effect for the “low” pile degradation class and one isolated positive interaction for pre-1975 neighbourhoods under high differential settlement risk (≈ +2.7%). However, the isolated nature of this effect and its small magnitude caution against strong interpretation. Moreover, this counterintuitive result may reflect unobserved neighbourhood characteristics correlated with risk classification, such as desirable historic architecture or central location.

The robustness checks excluding neighbourhood age controls yields slightly different results. Continuous pile degradation risk becomes positive and marginally significant (≈ +0.36), and differential settlement risk shows a small negative effect (≈ -0.04). In ordinal models, the highest pile degradation risk classes (“high” and “very high”) display positive and significant associations (≈ +8.6% and +13.6%), while other classes remain insignificant. These shifts likely reflect omitted variable bias rather than genuine market responses, as they disappear when controlling for age composition of the neighbourhood.

Overall, foundation risk signals, whether continuous or categorical, do not consistently influence transaction prices. Adjusted R^2 values remain stable (≈0.793), indicating minimal explanatory contribution from risk variables. The few significant coefficients in robustness checks underscore the importance of accounting for neighbourhood age composition and caution against strong interpretation.

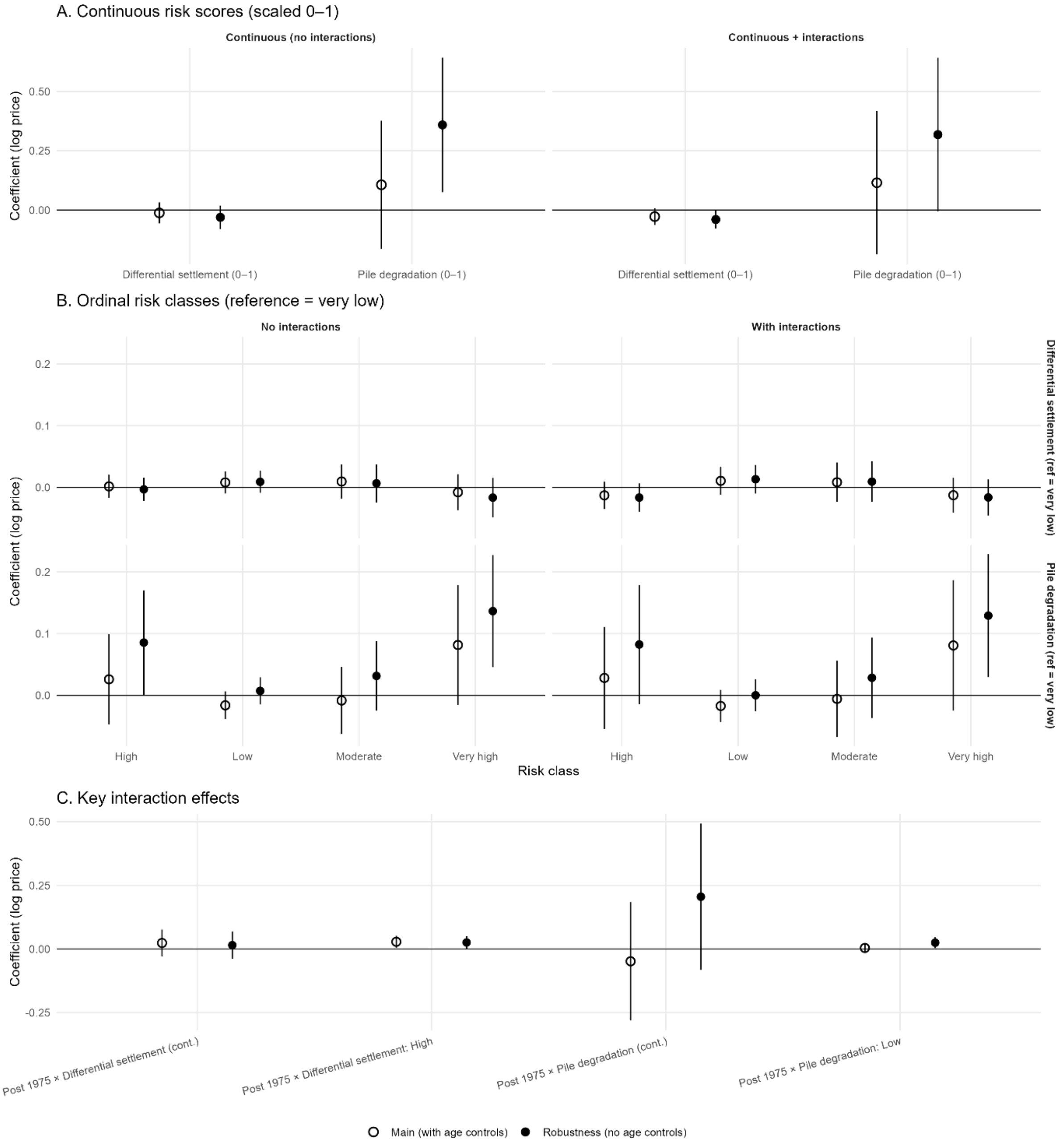

*Figure 2. Comparison of foundation risk effects on housing prices: main models (with neighbourhood age controls) vs. robustness models (without age controls***).** *Hollow markers represent main-model estimates; Solid markers represent robustness estimates; Error bars indicate 95% confidence intervals.* ***Panel A:*** *Continuous risk scores (scaled 0–1). Robustness models show a positive and marginally significant effect for pile degradation, while main models yield near-zero estimates.* ***Panel B:*** *Ordinal risk classes (reference = very low). Robustness models suggest positive effects for "high" and "very high" pile degradation risk, whereas main models show smaller and mostly insignificant coefficients. Differential settlement classes remain near zero in both sets.* ***Panel C:*** *Key interaction terms. Robustness models include two significant post-1975 interactions, but these effects are absent or weaker in main models. Overall, the overlay illustrates that omitting neighbourhood age controls introduces upward bias in some risk estimates, reinforcing the conclusion that foundation risk is not consistently priced once age composition is accounted for.*

CONCLUSION & DISCUSSION

This paper examined whether neighbourhood-level foundation risk is reflected in housing transaction prices in the Netherlands. Using a large dataset of nearly two million transactions enriched with risk indicators from the Climate Impact Atlas, we estimated hedonic price models with both continuous and ordinal measures of risk. Across all specifications, the effects of foundation risk on prices were small and statistically insignificant, suggesting that these risks are not systematically priced in the current market context.

Several factors may explain these findings. First, information asymmetry likely plays a role: buyers may be unaware of neighbourhood-level foundation risks at the time of purchase, particularly in the absence of mandatory disclosure or standardized reporting. Second, risk salience may be low relative to other housing attributes such as location, size, and dwelling type, which dominate price formation. Third, mitigation and adaptation measures, such as prior foundation repairs, local groundwater management, and building reinforcements, may reduce the perceived or actual financial consequences of risk, limiting its impact on transaction prices.

A key limitation of the approach used in this paper is that foundation risk indicators are only publicly available at the neighbourhood level, while housing transactions are observed at the property level. As a result, the assigned risk measure reflects neighbourhood characteristics rather than property-specific conditions. This introduces potential measurement error, as individual buildings within the same neighbourhood may differ substantially in foundation type, maintenance history, and actual vulnerability. Furthermore, the risk maps rely on national models and expert assumptions, which may not capture local variations in groundwater levels, soil heterogeneity, or prior repairs. Certain mechanisms, such as clay shrink-swell behaviour and anaerobic bacterial decay of timber piles, are excluded from the risk assessment, meaning that some sources of damage are not represented in the data. These limitations should be considered when interpreting the estimated effects of foundation risk on housing prices.

From a policy perspective, these results raise questions about the effectiveness of current risk communication strategies. If foundation risk is not reflected in market prices, households may underinvest in preventive measures, increasing long-term vulnerability. Enhancing risk transparency could improve market efficiency and incentivize adaptation. Future research should explore heterogeneous effects under conditions of improved information, such as after public campaigns or regulatory changes. Data sharing and interdisciplinary collaboration would allow for analysis at the property level, and linking transaction data to actual repair costs or insurance claims could further clarify whether and when foundation risk becomes economically relevant.

REFERENCES

Atreya, A., & Ferreira, S. (2015). Seeing is believing? Evidence from property prices in inundated areas. *Risk Analysis, 35(5)*, pp. 828–848.

Bin, O., & Polasky, S. (2004). Effects of flood hazards on property values: Evidence from disclosure and zoning. *Land Economics, 80(4)*, pp. 490–505.

Bouwer, R., & van Ek, R. (2004). Integrated ecological-economic modelling and valuation of wetlands in the Netherlands. *Ecological Economics, 44(1)*, pp. 43–62.

Climate Impact Atlas. (2024). *Foundations Risk Map*. Retrieved 01 02, 2026, from https://www.klimaateffectatlas.nl/en/foundation-risk-map

Costa, A., Kok, S., & Korff, M. (2020). Systematic assessment of damage to buildings due to groundwater lowering-induced subsidence: Methodology for large scale application in the Netherlands. *Proceedings of the International Association of Hydrological Sciences, 382*, pp. 577-582.

FunderMaps/KCAF. (2025). *Stand van het Land - Funderingsproblematiek in Nederland.* Kennis Centrum Aanpak Funderingsproblematiek.

Gayer, T., Hamilton, J., & Viscusi, W. K. (2000). Private values of risk tradeoffs at superfund sites: Housing market evidence on learning about risk. *Review of Economics and Statistics, 82(3)*, pp. 439–451.

Hofmann, L., Dröes, M., & Francke, M. (2025). Sinking land, sinking prices? Land subsidence, flood risk, and property prices. *Tinbergen Institute Discussion Paper,, No. TI 2025-040/IV*(Tinbergen Institute, Amsterdam and Rotterdam).

Hommes, S., Phlippen, S., Van Reeken-Van Wee, J., Schreuder, C., & Ypma, F. (2023). Gemelde funderingsschade leidt tot forse prijskorting bij woningverkoop. *ESB, 108*(4819), pp. 136-139.

KCAF. (2024). *FunderMaps*. Retrieved 12 20, 2025, from https://www.kcaf.nl/fundermaps/

KCAF. (2025). Retrieved 12 13, 2025, from https://www.kcaf.nl/funderingsrisicorapport/

Kok, N., & Jennen, M. (2012). The impact of energy labels and accessibility on office rents. *Energy Policy, 45*, pp. 489–497.

Kok, S., & Angelova, L. (2020). *Impact droogte op funderingen.* Deltares.

Kok, S., van der Putten, S., & Kraus, J. (2021). *Naar een kennisagenda funderingsproblematiek - Duiding van de omvang en aard van de problematiek en kennisvragen daarbij.* Deltares.

Kousky, C. (2010). Learning from extreme events: Risk perceptions after the flood. *Land Economics, 86(3)*, pp. 395–422.

PBL. (2016). *Dalende bodems, stijgende kosten - Mogelijke maatregelen tegen veenbodemdaling in het landelijk en in het stedelijk gebied.* Den Haag: Planbureau voor de Leefomgeving.

PBL. (2025). *Correctie formulering over overstromingsrisico Nederland in IPCC-rapport*. Retrieved 12 13, 2025, from PBL: https://www.pbl.nl/correctie-formulering-over-overstromingsrisico-nederland-in-ipcc-rapport

Plegt, M., & Harleman, F. (2023). Making the housing market transparent with Land Registry data: the role of buy-to-let in the Dutch housing market. *Protecting Our World, Conquering New Frontiers.* Orlando, Florida, USA: FIG Working Week.

Pope, J. C. (2008). Buyer information and the hedonic: The impact of a seller disclosure on the implicit price for airport noise. *Journal of Urban Economics, 63(2)*, pp. 498–516.

RLI. (2024). *Goed gefundeerd - Advies om te komen tot een nationale aanpak van funderingsproblematiek.* Den Haag: Raad voor de leefomgeving en infrastructuur.

van Kempen, E. (2025). *De Olifant onder de kamer - Een nationale aanpak funderingsproblematiek vanuit drie benaderingen.* Den Haag: ABDTOPConsult.

VEH. (2022). *Meer funderingsschade door droogte*. Retrieved 12 13, 2025, from https://www.eigenhuis.nl/nieuws/meer-funderingsschade-door-droogte

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APPENDIX A

Variable	Main models				Robustness			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
ln(floor area)	0.7291*** (0.0148)	0.7291*** (0.0148)	0.7286*** (0.0147)	0.7285*** (0.0148)	0.7284*** (0.0152)	0.7283*** (0.0152)	0.7283*** (0.0153)	0.7279*** (0.0152)
Dwelling type: Terraced end	0.0479*** (0.0017)	0.0479*** (0.0017)	0.0478*** (0.0018)	0.0479*** (0.0017)	0.0484*** (0.0019)	0.0483*** (0.0019)	0.0483*** (0.0019)	0.0483*** (0.0019)
Dwelling type: Semi-detached	0.1448*** (0.0043)	0.1448*** (0.0043)	0.1445*** (0.0043)	0.1445*** (0.0042)	0.1467*** (0.0044)	0.1465*** (0.0044)	0.1465*** (0.0045)	0.1462*** (0.0044)
Dwelling type: Detached	0.2865*** (0.0071)	0.2865*** (0.0071)	0.2862*** (0.0071)	0.2862*** (0.0070)	0.2900*** (0.0072)	0.2898*** (0.0072)	0.2898*** (0.0072)	0.2895*** (0.0072)
Very highly urban	0.0233† (0.0139)	0.0232† (0.0139)	0.0212 (0.0143)	0.0212 (0.0141)	0.0441** (0.0139)	0.0440** (0.0139)	0.0445** (0.0140)	0.0444** (0.0139)
Highly urban	0.0199* (0.0082)	0.0197* (0.0082)	0.0178* (0.0085)	0.0178* (0.0085)	0.0208* (0.0083)	0.0210* (0.0083)	0.0202* (0.0086)	0.0207* (0.0086)
Moderately urban	0.0538*** (0.0069)	0.0537*** (0.0069)	0.0522*** (0.0069)	0.0522*** (0.0069)	0.0470*** (0.0068)	0.0474*** (0.0068)	0.0466*** (0.0070)	0.0472*** (0.0069)
Low urbanity	0.0634*** (0.0065)	0.0633*** (0.0065)	0.0621*** (0.0063)	0.0622*** (0.0063)	0.0549*** (0.0059)	0.0553*** (0.0059)	0.0542*** (0.0058)	0.0548*** (0.0058)
Neighbourhood mean year built	-0.0016*** (0.0003)	-0.0016*** (0.0003)	-0.0017*** (0.0003)	-0.0017*** (0.0003)				
Year built 1830–1880	-0.1397*** (0.0167)	0.0268 (0.2518)	-0.1419*** (0.0163)	0.0286 (0.2501)	-0.0838*** (0.0241)	-0.0794** (0.0241)	-0.0838*** (0.0235)	0.0739 (0.2514)
Year built 1880–1900	-0.1364*** (0.0118)	0.0302 (0.2503)	-0.1384*** (0.0120)	0.0318 (0.2487)	-0.0770*** (0.0212)	-0.0730*** (0.0217)	-0.0763*** (0.0209)	0.0811 (0.2499)
Year built 1900–1930	-0.1565*** (0.0080)	0.0105 (0.2501)	-0.1560*** (0.0080)	0.0144 (0.2488)	-0.1057*** (0.0169)	-0.1030*** (0.0172)	-0.1045*** (0.0167)	0.0526 (0.2491)
Year built 1930–1950	-0.1174*** (0.0075)	0.0495 (0.2498)	-0.1169*** (0.0076)	0.0535 (0.2487)	-0.0735*** (0.0138)	-0.0713*** (0.0141)	-0.0725*** (0.0137)	0.0843 (0.2482)
Year built 1950–1975	-0.1711*** (0.0041)	-0.0038 (0.2474)	-0.1713*** (0.0042)	-0.0006 (0.2462)	-0.1433*** (0.0070)	-0.1416*** (0.0072)	-0.1429*** (0.0070)	0.0133 (0.2444)
Year built 1975–1990	-0.1193*** (0.0044)	-0.1193*** (0.0044)	-0.1203*** (0.0045)	-0.1201*** (0.0044)	-0.1041*** (0.0057)	-0.1040*** (0.0057)	-0.1043*** (0.0058)	-0.1041*** (0.0057)
Year built 2010+	0.0678*** (0.0052)	0.0680*** (0.0052)	0.0683*** (0.0052)	0.0685*** (0.0052)	0.0624*** (0.0045)	0.0624*** (0.0045)	0.0625*** (0.0045)	0.0624*** (0.0045)
Pile rot risk (scaled)	0.1064 (0.1381)	0.1151 (0.1546)			0.3593* (0.1450)	0.3183† (0.1658)		
Differential settlement (scaled)	-0.0123 (0.0226)	-0.0279 (0.0180)			-0.0309 (0.0252)	-0.0402* (0.0197)		
Post-1975 (dummy)		0.1669 (0.2468)		0.1703 (0.2455)		0.2051 (0.1465)		
Post-1975 × pile rot (scaled)		-0.0485 (0.1186)				0.0150 (0.0272)		
Post-1975 × differential settlement (scaled)		0.0236 (0.0268)					0.0073 (0.0112)	0.0002 (0.0134)
Pile rot 2050: low risk			-0.0161 (0.0115)	-0.0172 (0.0133)			0.0315 (0.0287)	0.0285 (0.0332)

Pile rot 2050: moderate risk			-0.0083 (0.0277)	-0.0057 (0.0315)			0.0856* (0.0431)	0.0824† (0.0493)
Pile rot 2050: high risk			0.0260 (0.0374)	0.0282 (0.0422)			0.1365** (0.0463)	0.1291* (0.0508)
Pile rot 2050: very high risk			0.0816 (0.0495)	0.0809 (0.0539)			0.0091 (0.0091)	0.0133 (0.0118)
Settlement 2050: low risk			0.0081 (0.0091)	0.0107 (0.0115)			0.0066 (0.0158)	0.0094 (0.0168)
Settlement 2050: moderate risk			0.0096 (0.0142)	0.0084 (0.0163)			-0.0031 (0.0097)	-0.0164 (0.0117)
Settlement 2050: high risk			0.0017 (0.0096)	-0.0128 (0.0113)			-0.0165 (0.0163)	-0.0162 (0.0149)
Settlement 2050: very high risk			-0.0078 (0.0149)	-0.0126 (0.0144)				0.1544 (0.2417)
Post-1975 × pile rot 2050: low risk				0.0040 (0.0090)				0.0246* (0.0110)
Post-1975 × pile rot 2050: moderate risk				-0.0156 (0.0256)				0.0092 (0.0267)
Post-1975 × pile rot 2050: high risk				-0.0167 (0.0357)				0.0038 (0.0395)
Post-1975 × pile rot 2050: very high risk				0.0286 (0.0397)				0.0531 (0.0402)
Post-1975 × settlement 2050: low risk				-0.0055 (0.0113)				-0.0090 (0.0125)
Post-1975 × settlement 2050: moderate risk				0.0025 (0.0212)				-0.0051 (0.0232)
Post-1975 × settlement 2050: high risk				0.0282* (0.0120)				0.0255* (0.0127)
Post-1975 × settlement 2050: very high risk				0.0074 (0.0177)				0.0003 (0.0180)
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,928,676	1,928,676	1,928,676	1,928,676	1,928,676	1,928,676	1,928,676	1,928,676
R-squared	0.79274	0.79274	0.79287	0.79290	0.79109	0.79111	0.79109	0.79116
Adj. R-squared	0.79270	0.79270	0.79283	0.79286	0.79104	0.79107	0.79104	0.79112