Explaining Housing Under-Delivery: A Municipal-Level Spatial Analysis of Constraints in the Netherlands

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Contents

This project examines why Dutch municipalities fail to meet housing delivery targets by focusing on the role of spatial constraints. It aims to explain variation in under-delivery across municipalities and identify key constraints. Using a mixed-methods approach, the study combines spatial analysis and regression modelling comparing results with qualitative insights from municipalities. Its broader significance is to shift attention from housing supply and prices to delivery failure and to offer relevant insights into how geographically uneven constraints shape housing-delivery and ultimately housing supply.

Keywords: housing under-delivery • spatial constraints • municipalities • housing supply • Netherlands

1 Introduction

As a response to the 2024 deficit of 400,500 dwellings, equivalent to 4.9% of the housing stock (ABF Research, 2024, pp. 5–6), the Dutch government aims to build over 900,000 homes between 2025 and 2030, with an annual target of approximately 100,000 dwellings (Rijksoverheid, 2026). While municipalities play a central role in translating national housing ambitions into actual delivery, as local land-use plans are determined at this level (Claassens et al., 2020, p. 4), current delivery falls significantly short of these ambitions. A recent survey shows that Dutch municipalities have failed to deliver more than a quarter of the homes they planned to build since 2022 (NOS, 2026a), and there is little sign this will improve. The severely constrained land availability, rapid population growth and rural-urban migration (Bruinsma & Koomen, 2018, ABF Research, 2024), places additional pressure on an already underperforming system and reinforces the centrality of housing as an issue.

The gap between housing targets and actual delivery reflects a broader policy challenge, as municipalities must balance quantitative housing goals with competing spatial and environmental constraints (Jonkman et al., 2022). As population growth is expected to add 1,172,000 people over the next 15 years (ABF Research, 2024), these tensions are likely to intensify.

While existing literature identifies spatial and regulatory constraints affecting housing supply elasticity (Caldera & Johansson, 2013; Glaeser et al., 2008; Saiz, 2010), limited research examines how these factors vary spatially across municipalities to explain uneven housing delivery outcomes. This study addresses that gap by combining quantitative spatial analysis with qualitative insights from municipal survey responses. It seeks to answer the question: to what extent can spatial factors explain variation in housing under-delivery across Dutch municipalities? By integrating these methods, the research aims to capture municipal variation and highlight potential discrepancies between qualitative and quantitative patterns.

This paper is structured as follows. First, the theoretical background discusses current debates around housing supply inelasticity and the specific constraints on housing delivery in the Dutch context. Second, the data sources and methods used for the analysis are presented. Third, the results of the statistical analysis of spatial variation in housing delivery rates across Dutch municipalities are reported. Finally, the discussion draws on these results to address the research question and suggest directions for future research.

2 Research context

2.1 Housing supply inelasticity and land constraints

To understand why housing delivery fails, it is useful to situate municipal performance within the broader literature on housing supply inelasticity. Research on house price variation offers a good starting point for generating hypotheses about delivery failure. Glaeser et al. (2008) were among the first to show that more inelastic housing markets experience significantly stronger house price growth, while areas with more developable land see more limited price increases (p. 207). This suggests that where physical or regulatory constraints are the tightest, price growth should be largest, motivating the hypothesis that spatially uneven constraints drive uneven housing outcomes across municipalities. It is important to note that house prices are not the focus of this research but serve as an indicator of limited supply responsiveness.

One of the main drivers of low supply elasticity is the presence of geographical constraints, as "physical limitations on land for development" directly influence the availability of land for housing (Caldera & Johansson, 2013, p. 243). Albert Saiz (2010), studying US metropolitan areas, uses GIS to identify developable land by subtracting terrain elevation and water bodies, finding that housing supply is less elastic where physical constraints are stronger (p. 1286). While topographic variation is less relevant in the flat Dutch landscape, the principle remains; physical constraints on development, whether topographic or land-use based, reduce housing supply responsiveness. Hilber and Vermeulen (2016) operationalise this for Great Britain by classifying land cover into non-developable, developable undeveloped, and developed land (p.

393). Together, these approaches are useful to the Dutch case as it suggests a way to measure land constraints not only though topographic variation, but also through land cover categories.

2.2 The Dutch context

Caldera and Johansson (2013) identify the Netherlands as one of the least price-responsive housing markets in the OECD, reflecting deep structural constraints both on the supply and demand-side (p. 243). Demand-side factors include borrowing capacity and mortgage interest rates (Bruinsma & Koomen, 2018, p. 66; DNB, 2020), which fall outside the scope of this study as the focus here is on municipal-level structural constraints that directly prevent housing from being built.

The constraints examined in this study fall into three categories: policy constraints, capturing municipal housing ambition levels; regulatory and infrastructure constraints, including nitrogen permitting barriers and grid congestion; and land use constraints, encompassing both restrictive factors such as protected nature areas and enabling ones such as agricultural and greyfield land. Socioeconomic factors, particularly local resistance to housing development, are also considered.

2.2.1 Policy constraints

Housing under-delivery in the Netherlands has been linked to the gap between municipal ambition and delivery capacity. According to Jonkman et al. (2022), excessively high ambitions and a 'piling-up' of policy objectives are frequently mentioned as causes of non-conformance with quantitative housing objectives in the Netherlands (p. 2). They find that housing delivery gaps result not only from exogenous constraints but also from municipalities prioritising qualitative objectives such as affordable housing, climate adaptation, and inclusive neighbourhood (p. 2). Where ambitions are highest, the burden of balancing competing objectives is greatest, suggesting that higher targets relative to capacity are likely to predict larger delivery gaps.

2.2.2 Regulatory and infrastructure constraints

Housing supply constraints in the Netherlands take specific contemporary forms, most notably through nitrogen-related permit barriers and growing pressure on electricity infrastructure. A report by Interprovinciaal Overleg (IPO) identifies nitrogen regulations as the single biggest obstacle to housing construction in the Netherlands (IPO, 2025, p. 15). Many planned housing projects are located close to protected Natura 2000 areas, making permits difficult to obtain.

The report notes that since approximately half of all planned housing lies within 5km of nitrogen-sensitive areas, a very large share of projects is affected through delays, additional studies, or outright cancellations (IPO, 2025, pp. 15–16).

However, Rouwendal (2023) finds a contrasting result. Analysing building permits over the period 2012–2022, he finds that after the 2019 Council of State nitrogen ruling, permits did not decline nationally, and that building activity even intensified in the outer rings of nitrogen-sensitive areas as developers shifted activity away from the most constrained zones (p. 571). In November 2022, the Council of State annulled the construction exemption (bouwvrijstelling) introduced in 2021, which had temporarily relieved housing projects from individual nitrogen assessments, requiring once again that each project individually demonstrate limited environmental harm (DutchNews.nl, 2022). Given these contrasting findings, the direction and magnitude of the nitrogen effect on housing delivery remains uncertain, and its empirical relationship with completion rates remains to be addressed.

The second major strain on housing delivery is grid congestion (IPO, 2025, p. 20). Grid congestion occurs when the electricity network lacks sufficient capacity to connect new homes or support construction activity. In the Netherlands this problem is particularly intense, driven by ambitious energy transition targets on both the production and consumption side (IEA, 2025). As shown in Figure 2, this problem affects almost all provinces, particularly Flevoland, Gelderland, and Utrecht, and already impacts more than 30% of housing construction (IPO, 2025, pp. 20–21). Developers may postpone or cancel projects due to uncertainty, since a home without an electricity connection cannot be sold (IPO, 2025, p. 22). Both nitrogen exposure and grid congestion vary spatially across municipalities suggesting that their explanatory power for housing under-delivery is likely to differ by location.

Beyond their direct physical effects, spatial constraints can also affect housing delivery indirectly through investor uncertainty. When the regulatory environment is unstable, as with the prospect of grid connection issues, developers may defer or abandon projects because the risk of committing capital is too high (IPO, 2025, p 22). More broadly, uncertain policy decisions such as rent freezes and deteriorating returns on real estate investment, partly due to inflation and construction costs, make investors more wary in committing to affordable housing (IPO, 2025). Research also suggests that developers tend to respond to uncertainty by waiting for more favourable conditions rather than building, using price to manage demand rather than increasing supply (Ploegmakers et al., 2013), adding indirect channels through which spatial and regulatory constraints translate into housing under-delivery.

2.2.3 Land use

While their focus is on densification rather than housing completion rates, Broitman and Koomen (2015) find that the availability of re-developable land, which including building lots, commercial and retail areas, is the strongest local predictor of new housing unit addition, suggesting that greyfield availability enables housing production (p. 40). This resonates with Claassens et al. (2020) who demonstrate the increasing importance of greyfield land[1] for urban development in the Netherlands, now being the dominant driver of intra-urban development, with its share more than doubling from 14% in 2000 to 34% in 2017 (p. 10).

Even where physical land is available, housing supply can be constrained by regulatory frameworks. Caldera and Johansson (2013) note that land-use policies, while intended to reduce negative externalities, can also restrict supply when poorly designed or implemented (p. 243). Broitman & Koomen (2015) also find that municipalities with designated protected nature areas (NEN and Natura 2000) see significantly fewer housing units added both within existing urban areas and in residential expansion zones, with protected areas associated with substantially lower housing densities in newly developed areas (p. 40).

Furthermore, in a spatially explicit transition analysis of residential areas between 2000 and 2010, approximately 75% of all residential expansion results from the conversion of agricultural land or available building lots, with agricultural land alone accounting for 52% of newly developed residential area (Broitman & Koomen, 2015, p. 35). The authors explicitly describe agricultural land and building lots as a "proxy for the amount of land that is most easily available for residential expansion" (p. 35), suggesting that municipalities with greater agricultural land shares have more development potential. While these findings use housing unit addition as their dependent variable rather than completion rates, the same land availability constraints are likely to apply; municipalities with more greyfield and agricultural land are expected to show higher completion rates, while those with larger protected area shares are expected to underdeliver relative to their targets.

[1] Greyfield land is defined as areas similar to brownfields; themselves defined as "abandoned, idle, or under-used industrial and commercial properties", but without the environmental contamination aspect (Claassens et al., 2020, p. 5).

2.2.4 Socio-economic constraints

Local resistance is another explanatory factor: Klement et al. (2023) show that socioeconomic and political characteristics influence opposition to new housing developments, finding that homeowners exhibit higher levels of opposition, while centre and centre-right voters report lower opposition rates (pp. 317, 321). As these constraints vary considerably across municipalities; these dynamics differ significantly across the Dutch territory.

2.3 Research gap

Although a substantial body of literature explains housing supply elasticity, land-use restrictions, and geographical constraints on development (Glaeser et al., 2008; Caldera & Johansson, 2013; Saiz, 2010; Jonkman et al., 2022), far less attention has been paid to why housing targets continue to be missed at the municipal level. In the Dutch context, this gap is particularly relevant given that both national and local governments have adopted ambitious targets, yet actual delivery continues to lag behind (IPO, 2025; Jonkman et al., 2022). There is limited empirical work testing which factors are associated with housing under-delivery, and little research has examined how these factors vary spatially across municipalities. This study addresses that gap by examining whether spatial and socioeconomic constraints help explain why some municipalities consistently deliver far less housing than planned.

3 Data and Methods

3.1 Dependent variable

The dependent variable is the share of the 2022-2026 housing target met per municipality, calculated as BAG-recorded completions divided by the NOS-reported municipal target. No consistent, publicly accessible record of municipal housing targets exists for this period (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025). The closest available source is a survey by Dutch public broadcaster NOS, to which 282 out of 342 municipalities responded, though not all provided concrete usable figures. Of these, only 167 had official targets from the 2022 coalition agreement; for 92 others, NOS constructed a proxy from longer-term planning documents; and for 23, no target could be calculated. Two regression models are estimated: the main model includes all municipalities with a usable target (n = 259), while a second model restricts the sample to municipalities with official targets from the 2022 coalition agreement only (n = 167), serving as a robustness check on the reliability of the target data.

Two sources exist for completion figures: NOS self-reported completions and the CBS StatLine BAG database "Levensloop van woningen en niet-woningen" (last updated March 2026), covering January 2022–December 2025. While on average, municipalities self-report 18% more completions than BAG records, the discrepancies are bidirectional. For instance, BAG records 154 completions in Ameland against a target of 48, yielding a completion rate of 321%, while NOS reports only 92 completions for the same period, likely reflecting inconsistencies in how completion is defined. Similarly, BAG records 444 completions in Texel against a self-reported target of 176, a figure that closely resembles the municipality's 2020-2030 Woningbouwprogramma of 440 homes, suggesting that housing completed in prior periods was counted within the study window. However, the pattern of systematic overreporting by municipalities suggests that self-reported figures are more prone to inflation than BAG data. BAG is therefore used as the completion measure for the dependent variable, as it constitutes objective administrative data independent of municipal interests.

The CBS StatLine BAG dataset contained four defunct municipality codes with usable data: Weesp (merged into Amsterdam, March 2022) and Brielle, Hellevoetsluis, and Westvoorne (merged into Voorne aan Zee, January 2023). These were reassigned to their respective successor municipalities. The remaining defunct codes predating 2022 carried no data and were excluded. The resulting dataset was compiled into table alongside NOS-reported targets and municipality codes, then imported into QGIS and joined to the municipal boundary layer.[2] Completion rate maps were produced for both NOS-reported and BAG-reported completions (Figure 4).

As shown in Figure 1, the dependent variable exhibits a right skew, with 13 municipalities (5% of the sample) recording completion rates exceeding 150% with the municipality of Ameland scoring the highest completion rate with 320.8%. As discussed above, many of these extreme values likely reflect measurement inconsistencies rather than genuine overperformance. There are no observations below the lower whisker threshold, indicating the absence of statistical outliers at the lower end of the distribution. The dependent variable was therefore winsorized at the 95th percentile (150%) to limit the influence of extreme outliers on OLS estimates. Results using the uncapped dependent variable are presented as a robustness check.

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[2] Municipal administrative boundaries were downloaded from PDOK as the "Bestuurlijke Gebieden" dataset, which includes all 342 municipalities as they exist in 2026. Water areas were removed in QGIS. All spatial variables in this study are expressed as a share of total municipal land area. All other datasets were subsequently aggregated to this boundary layer.

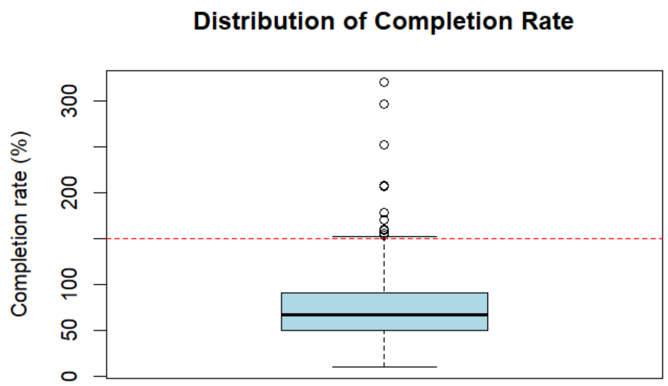

Figure 1: Distribution of municipal housing completion rates (2022-2026), with winsorization threshold indicated at 150%.

3.2 Independent variables

3.2.1 Ambition level

Drawing on Jonkman et al. (2022), ambition level is included as a key explanatory variable, operationalised as the NOS-reported municipal housing target divided by the 2022 housing stock, capturing the scale of a municipality's housing ambition relative to its existing capacity.

Municipal housing stock for 2022 was extracted from the CBS StatLine dataset Regionale Kerncijfers Nederland under the variable 'woningvoorraad'. NOS-reported housing targets were then divided by municipal housing stock and multiplied by 100 to obtain ambition level as a percentage, representing the targeted growth of the housing stock over the study period.

A potential methodological concern in the main model is the presence of spurious correlation between the ambition level variable and the completion rate dependent variable. Kronmal (1993) warns that "the use of ratios in regression analyses can lead to incorrect or misleading inferences" (p. 1), as ratios sharing a common component produce biased correlations – in this case, housing target appearing both in the numerator of the independent variable and the denominator of the dependent variable. To break the direct mathematical link between the two variables, an additional specification is estimated as a robustness check in which ambition level is replaced by a quartile rank variable. Municipalities are ranked by their continuous ambition level and assigned a score of 1 to 4 based on which quartile of the distribution they fall in, with 4 representing the most ambitious municipalities.

3.2.2 Nitrogen-sensitive areas

While Rouwendal (2023) finds that between 2012 and 2022 stringent permitting requirements near nitrogen-sensitive areas did not result in a measurable decline in permit issuance nationally, IPO (2025) notes that proximity to sensitive areas significantly complicates permit obtention. Nitrogen-sensitive areas were consequently selected as an independent variable and are expected to be negatively associated with housing completion rates.

The dataset for nitrogen-sensitive areas was obtained from Vereniging Deltametropool. The data dates from 2020 and lists all areas considered nitrogen-sensitive due to nitrogen overload, based on Natura 2000 protected areas. Every Natura 2000 area has a kritische depositiewaarde (KDW); a critical load threshold indicating the maximum amount of nitrogen it can receive before ecological damage occurs. The dataset defines nitrogen-sensitive areas as Natura 2000 areas containing habitat types with a KDW below 2,400 mol N/ha/year (Van Dobben et al., 2023, p.20). Water-based Natura 2000 areas were excluded as they are classified as less or not sensitive to atmospheric nitrogen deposition (p. 30).

Six buffer distances were constructed around nitrogen-sensitive Natura 2000 areas: 500m, 1km, 3km, 5km, 7km and 10km. For each distance, two variants were tested: one including the nitrogen-sensitive area itself, and one capturing only the surrounding buffer zone. All buffers were clipped to municipal boundaries, excluding water areas. The share of each municipality's land area falling within each buffer was calculated, yielding twelve continuous variables. Figure 3 presents all nitrogen-sensitive Natura 2000 areas in the Netherlands and the 1, 5, and 10 km buffer zones around them. A large part of these areas is concentrated in the province of Gelderland and along the North Sea coastline, though smaller areas are scattered across the country. Notably, in provinces like Limburg, the buffer zones cover a considerably larger surface area than the nitrogen-sensitive areas themselves, suggesting that even relatively small nature areas could have a substantial impact in terms of nitrogen regulation.

Livestock density was included as an alternative operationalisation of nitrogen-related constraints, independent of proximity to protected Natura 2000 areas. Livestock farming generates ammonia emissions that contribute to nitrogen deposition on nearby nature areas (Compendium voor de Leefomgeving, 2025), potentially reducing the available permit space for housing construction.[3] Where nitrogen policy functions as intended, higher livestock density should translate into stricter permit constraints and lower completion rates. A non-significant result would therefore potentially indicate a policy failure in which nitrogen emissions are not accounted for. Municipal-level animal counts for pigs and poultry were extracted from the CBS StatLine dataset 'Landbouw; gewassen, dieren en grondgebruik naar gemeente' for 2023 and divided by municipal land area to obtain a density measure in animals per km².

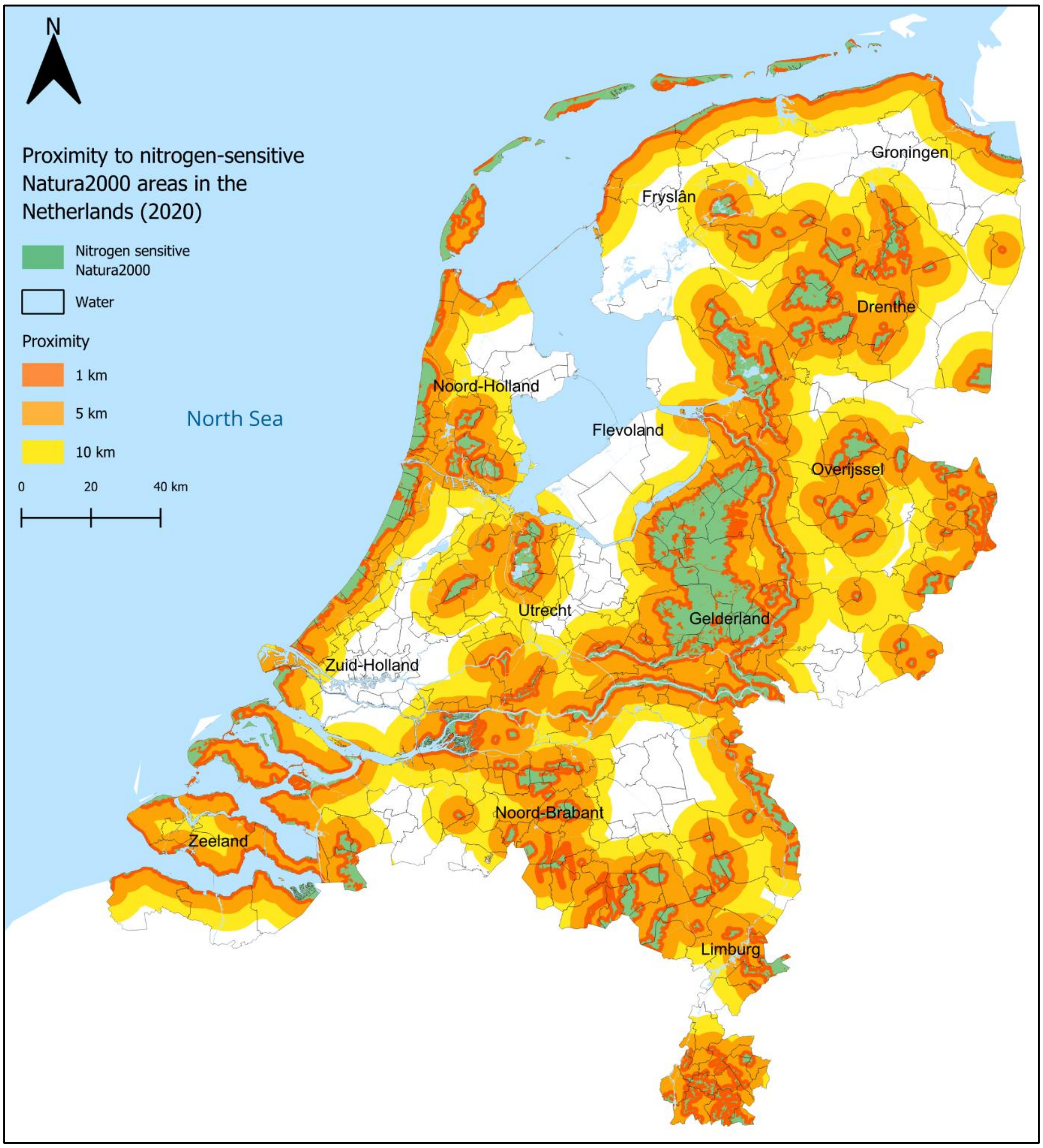

Figure 2: Nitrogen-sensitive Natura2000 areas and 1, 5, and 10 km buffer zones in the Netherlands. Source: Vereniging Deltametropool (2020)

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[3] Nitrogen deposition in areas with intensive livestock farming can reach 3,500 mol N/ha/year, far exceeding the 2,400 mol N/ha/year critical load threshold below which habitats are classified as nitrogen-sensitive (Compendium voor de Leefomgeving, 2025; Van Dobben et al., 2023).

3.2.3 Grid congestion

Grid congestion was selected as an independent variable based on the Interprovinciaal Overleg report (IPO, 2025), which identifies it as one of the two primary constraints on housing delivery in the Netherlands, affecting more than 30% of housing construction across almost all provinces. It is therefore expected to be negatively associated with housing completion rates.

Data on grid congestion was retrieved from Netbeheer Nederland and modified for GIS purposes by Vereniging Deltametropool in 2023. The 2023 dataset is used as it falls within the study period and captures grid congestion at a critical moment in its escalation. Grid congestion in the Netherlands grew rapidly from 2020 onwards, with TenneT, the national transmission system operator, spending six times more on congestion management in 2022 than in 2020 (IEA, 2025). A limitation of this variable is that the 2023 dataset represents a single snapshot of the spatial distribution of congested areas.

The dataset records electricity consumption congestion at the six-digit postcode level on a four-point scale, ranging from 0 (no congestion) to 3 (full congestion, no new connections possible). As shown in Figure 2, municipalities in the provinces of Noord-Brabant, Limburg, and Noord-Holland are most affected by full congestion, while severe and full congestion combined is widespread across the majority of Dutch municipalities. The less populated provinces of Groningen and Zeeland appear least affected (Netbeheer Nederland, 2023). To operationalise this as a municipal-level variable, two thresholds were tested: full congestion only (score 3) and serious congestion (scores 2–3). The share of each municipality's land area covered by congested postcodes was then calculated, yielding two continuous variables.

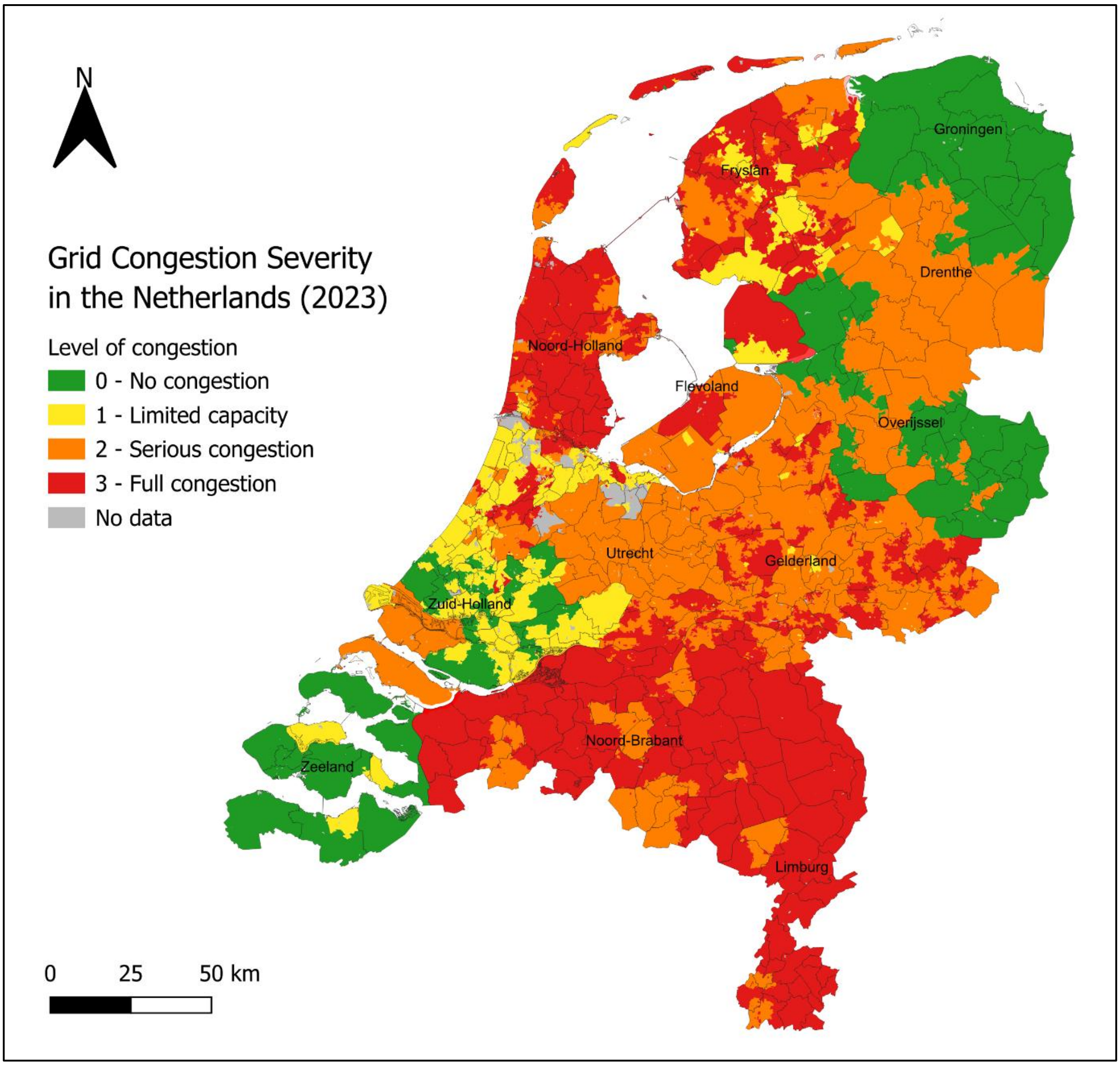

Figure 3: Severity of electricity grid congestion for offtake by municipality in the Netherlands. Source: Netbeheer Nederland, 2023.

3.2.4 Land use availability and constraints

Three land use variables are included: two hypothetically facilitating housing delivery (greyfield and agricultural land) and one acting as a restrictive force (protected areas). Greyfield land and agricultural land are included because they represent the two dominant sources of new residential development in the Netherlands, together accounting for approximately 75% of residential expansion between 2000 and 2010 (Broitman & Koomen, 2015, p. 35). Protected areas (Natura 2000 and NNN) are included as a constraint variable, given evidence that their presence significantly reduces housing unit addition in both existing urban areas and expansion zones (Broitman & Koomen, 2015, p. 40). As greyfield land, agricultural land and protected areas together account for a substantial share of total municipal land area, their simultaneous inclusion risks multicollinearity. VIF diagnostics were therefore conducted to assess the severity of this issue.

Land use data used to identify agricultural land and greyfield land were derived from the CBS Nieuw Bestand Bodemgebruik (NBBG) 2022. Greyfield sites were identified using the reclassification scheme developed by Claassens et al. (2020), shown in Table A1 (Appendix), adapted to the updated NBBG class codes. Solar parks, absent from the original classification, were additionally included as greyfield given their roof-adaptability and redevelopment potential. Agricultural land was identified by selecting the classes "Glastuinbouw", "Overig agrarisch terrein", "Akker en meerjarige teelt" and "Agrarisch grasland" from the NBBG classification table presented (Table A2, Appendix).

Protected areas were operationalised by merging the Natura 2000 and Natuurnetwerk Nederland (NNN) layers, published respectively by RVO (Rijksdienst voor Ondernemend Nederland) and BIJ12, both publicly available via PDOK. For all three variables, water areas were excluded and each area was expressed as a share of total municipal land area.

3.2.5 Control variables

Homeownership rate is included as a proxy for local resistance to new development, following Klement et al. (2023), who find that homeowners have stronger incentives to oppose construction projects due to concerns about property values and neighbourhood character. This variable was also retrieved from CBS Regionale Kerncijfers Nederland, under the variable 'koopwoningen', expressed as the percentage of owner-occupied dwellings per municipality. While Klement et al. (2023) identify political preference as a factor of local resistance, its operationalisation in the Dutch context is complicated by the dominance of local parties that do not map cleanly onto a left-right spectrum and was therefore excluded from the analysis.

Income is included as a control variable, as wealthier municipalities may differ in ways not fully captured by the other independent variables. Its directional effect on completion rates is ambiguous as higher income may reflect stronger demand incentivising development or alternatively, higher land values and greater development complexity, or higher local opposition to development. Results are therefore interpreted inductively. Data were extracted from CBS Regionale Kerncijfers Nederland under the variable 'gestandaardiseerd inkomen' (standardised income), expressed as a municipal average in EUR1000, excluding students.

Municipal population from 2022 is included as a control variable, log-transformed to address the right-skewed distribution driven by a small number of large cities such as Amsterdam and Rotterdam. The expected direction of the effect is ambiguous: larger municipalities may benefit from greater administrative capacity to plan and enforce housing delivery, while at the same time facing more competing spatial claims and greater stakeholder resistance, making target achievement more difficult. Population data from January 2022 was retrieved from CBS StatLine, and the natural log was applied to better capture the diminishing marginal effect of population size on housing delivery.

3.3 Analytical approach

Since housing completion rate is a continuous variable, Ordinary Least Squares (OLS) regression is used to model its linear relationship with the independent variables. All statistical analysis was conducted in R (RStudio).

Several model specifications were tested before arriving at the final model. First, six nitrogen buffer distances (500m, 1km, 3km, 5km, 7km and 10km) were compared based on adjusted R^2 and coefficient significance. The 5km donut buffer, which excludes the protected area itself, emerged as the best performing specification, consistent with the IPO (2025, pp. 15–16) policy threshold for nitrogen permit constraints. Second, all variables were tested simultaneously, and Variance Inflation Factors (VIF) were examined to detect multicollinearity, with a threshold of 5 applied as the exclusion criterion. Where multicollinearity was detected between theoretically related variables, each was tested independently and the specification producing the highest adjusted R^2 with theoretically coherent coefficient signs was retained. Third, variables returning highly insignificant results across all tested specifications were excluded. The final model was validated through a Moran's I test using a queen contiguity spatial weights matrix to check for spatial autocorrelation. Island municipalities with no contiguous neighbours were assigned zero weights and excluded from the test statistic calculation.

4 Results

4.1 Completion rates mapped

The two choices for the dependent variable are shown in Figure 4: housing completion rate per municipality, with NOS target data against NOS self-reported housing completion rates at the top, and against BAG data at the bottom. Most municipalities being in red or orange shows that the majority are well below their housing targets for 2022-2026, consistent with the NOS report which states that municipalities failed to deliver more than a quarter of their housing targets (NOS, 2026a).

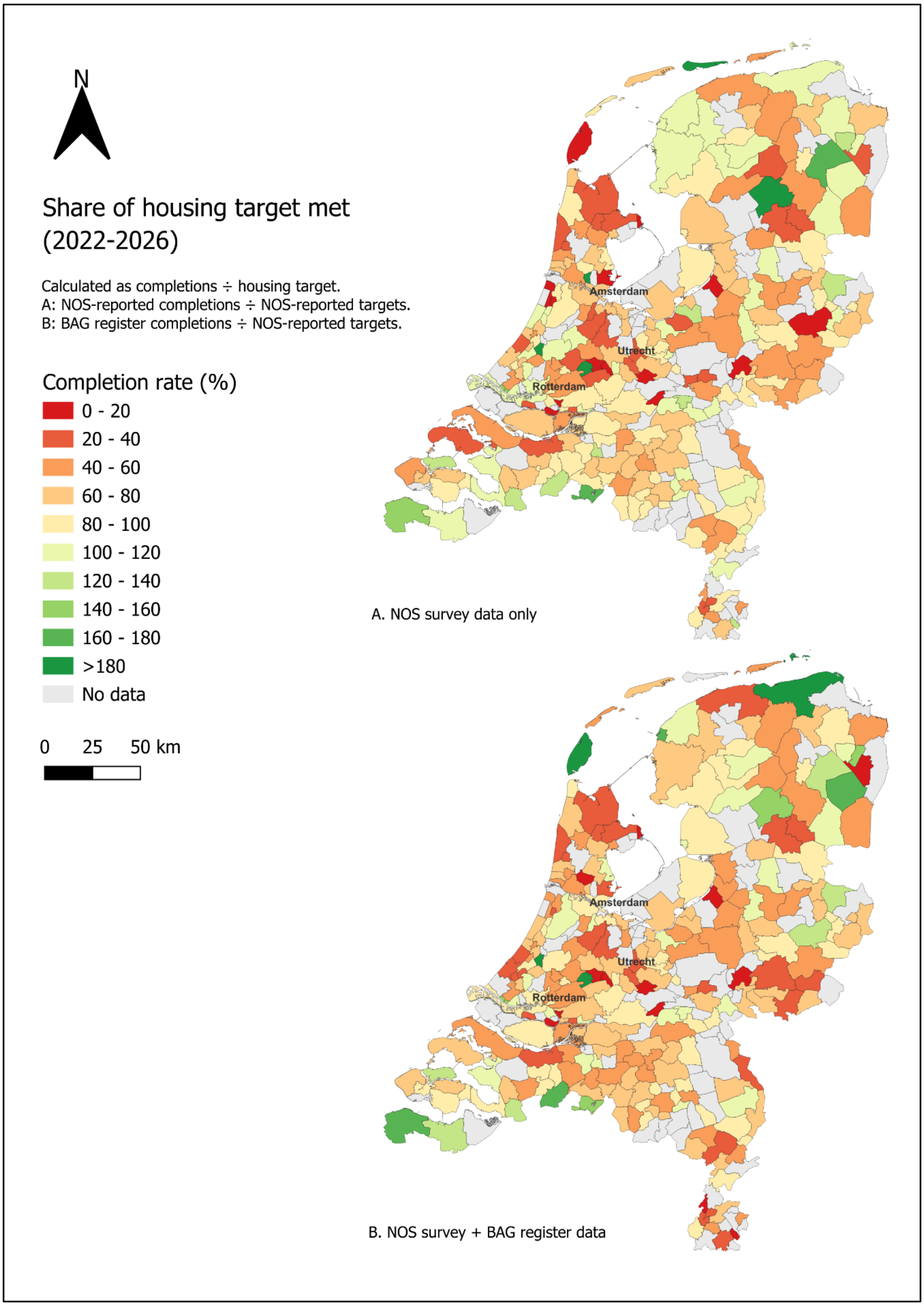

Figure 4: Map showing housing completion per municipality in the period 2022-2026 (%). Municipalities that did not respond to the NOS survey are shown as no data. Sources: NOS, PDOK.

Underperformance seems to be concentrated in the Randstad region (Amsterdam, Rotterdam, Utrecht), and some in the east of the country, but generally in urbanised areas. The north-east of the country (Groningen) shows more variation. Dark green municipalities (>180%) are few and scattered. Some are much higher in the BAG map, such as Groningen, which could mean a genuinely high completion rate, low targets to begin with, or inconsistencies in calculations. Visually, differences seem to be bidirectional, with the south-east and east of the country, near the Belgian and German borders, showing lower completion rates in the BAG-based map, particularly strong at the province level. Overall, the two maps are broadly consistent, which suggests the NOS survey is reasonably reliable.

4.2 Preliminary analysis

As shown in the descriptive statistics in Table 1, the sample consists of 259 municipalities, after excluding the 83 municipalities with missing target data. The dependent variable, housing completion rate, has a mean of 73.63%, and a standard deviation of 41.34%, indicating considerable variation across municipalities. Following the winsorization of the 13 municipalities, the standard deviation reduced to 32.47%, confirming that these outliers were disproportionately driving variance in the dependent variable.

Ambition level, defined as NOS municipal housing targets relative to their respective 2022 housing stock, has a mean of 5.24, suggesting that the average municipality aims to expand their housing stock by 5.24% over the study period. With a mean of 48.58% and a standard deviation of 34.57%, the Nitrogen buffer exposure variable reflects the uneven spatial distribution of sensitive nature areas across the Netherlands. Agricultural land accounts for on average 53.18% of municipal area, greyfield land for 8.21%, and severe grid congestion affects on average 68.76% of municipal postcodes, highlighting the spatially constrained nature of the

Dutch built environment. Average 2023 municipal standardised household annual income stands at €42,250 excluding students.

Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Completion rate (capped) (%)	259	71.17	32.47	10.00	150.00
Completion rate (uncapped) (%)	259	73.63	41.34	10.00	320.83
Ambition level (%)	259	5.24	2.86	0.93	24.47
Nitrogen buffer exposure (%)	342	48.58	34.57	0	100
Livestock density (animals/km²)	342	2,782.73	6,004.51	0	54,969
Severe congestion (% of postcodes)	342	68.76	42.57	0	100
Agricultural land (% of municipal area)	342	53.18	22.95	0.00	89.54
Greyfield land (% of municipal area)	342	8.21	6.60	1	44
Protected nature areas (% of municipal area)	342	21.87	18.02	0.00	97.56
Income (EUR 1,000)	342	42.25	9.17	32.10	148.20
Homeownership (% of dwellings)	342	64.94	8.76	29.50	89.40
Population (inhabitants)	342	51,434.71	75,825.44	944	903,399
Population (log)	342	10.46	0.83	6.85	13.71

Table 1: Descriptive statistics of the main variables used in the analysis.

The correlation matrix presented in Figure 2 reveals that the strongest correlation with the dependent variable and independent variable is between ambition level and completion rate (r = -0.38). Correlations with the remaining independent variables are moderate, with agricultural land (r = 0.19) and severe congestion (r = -0.18) showing the next strongest correlations. Nitrogen buffer exposure and greyfield land score considerably lower at r = -0.10 and r = -0.03 respectively. Among independent variables, correlations remain modest except for agricultural land and greyfield land (r = -0.68), which indicates potential multicollinearity. Additional strong correlations were observed between greyfield land and homeownership (r = -0.64), agricultural land and homeownership (r = 0.60), homeownership and population (r = -0.53), and population and greyfield land (r = 0.48), further informing the exclusion of certain variables from the final model.

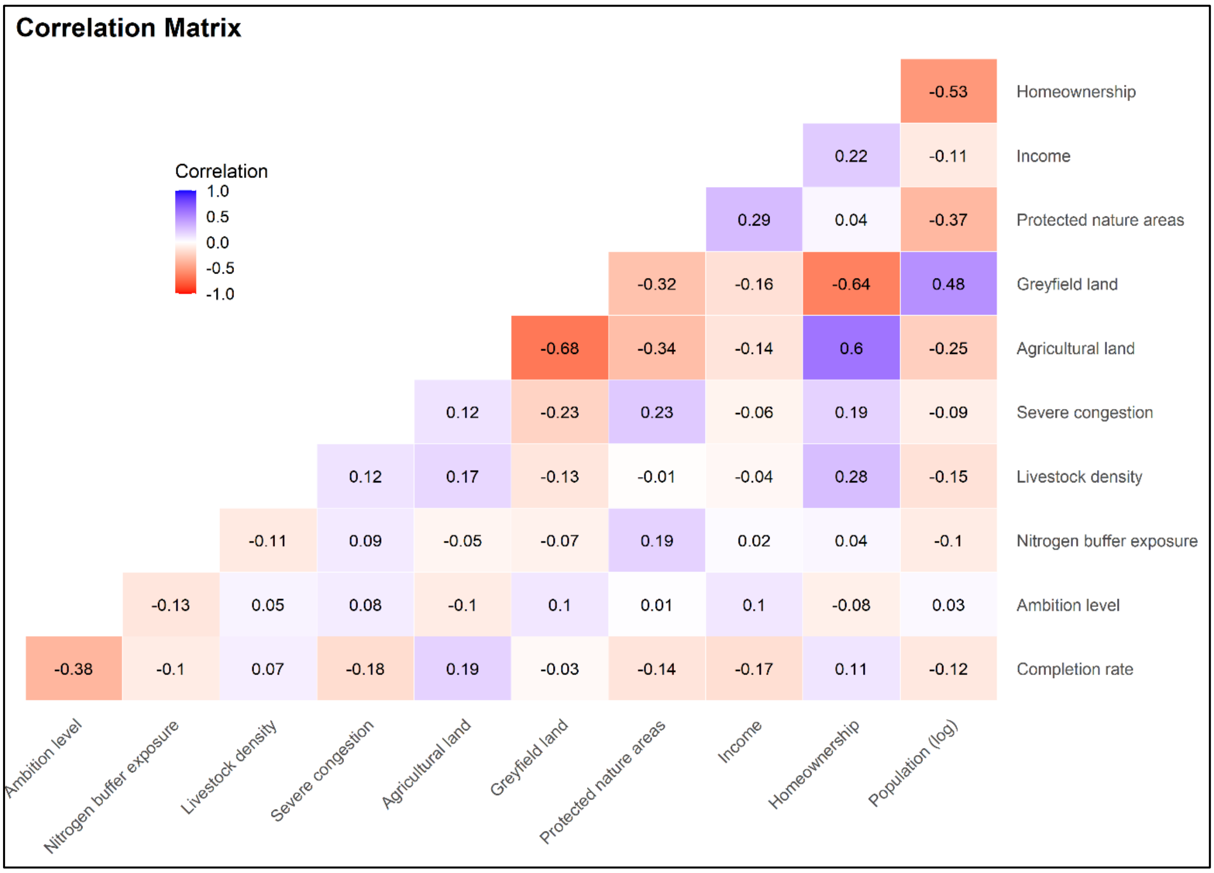

Figure 5: Correlation matrix of dependent and independent variables.

4.3 Main findings

The results of the full model and the final model can be found in Table 2. The full model (Model 1) achieves an adjusted R^2 of 0.229, indicating that the included variables explain approximately 23% of the variation in municipal housing completion rates, at the cost of retaining several insignificant variables. The final model (Model 2) has a slightly lower adjusted R^2 of 0.219, which is justified by the elimination of insignificant variables and those with multicollinearity issues. The F-statistic is significant across both models, confirming that at least one of the independent variables have a relationship with completion rate.

OLS Regression Results: Determinants of Municipal Housing Target Completion Rates

	Dependent variable:	
	Completion rate (capped)	
	Full model	Final model
	(1)	(2)
Ambition level	-4.169***	-4.027***
	(0.643)	(0.640)
Nitrogen buffer exposure	-0.114*	-0.123*
	(0.054)	(0.053)
Protected nature areas	0.240	
	(0.199)	
Agricultural land	0.493*	0.171*
	(0.195)	(0.083)
Severe grid congestion	-0.126**	-0.130**
	(0.045)	(0.043)
Greyfield land	1.609*	
	(0.675)	
Homeownership	0.172	
	(0.330)	
Income	-0.571	-0.774*
	(0.358)	(0.315)
Livestock density	0.0002	
	(0.0003)	
Population (log)	-5.143	-4.622*
	(2.820)	(2.242)
Constant	128.202**	178.415***
	(47.312)	(31.000)
Observations	259	259
R^2	0.259	0.237
Adjusted R^2	0.229	0.219
Residual Std. Error	28.503 (df = 248)	28.685 (df = 252)
F Statistic	8.673*** (df = 10; 248)	13.081*** (df = 6; 252)
Note:		*p<0.05; **p<0.01; ***p<0.001
		Standard errors in parentheses.

Table 2: OLS regression results for municipal housing completion rates (2022-2026)

Turning to individual coefficients, ambition level is the strongest predictor across both models ($\beta = -4.027$ in Model 2), indicating that a one percentage point increase in municipal ambition level is associated with a decrease in completion rate of approximately 4 percentage points. Concerns surrounding mathematical coupling between the ambition level variable and the dependent variable will be addressed in the robustness checks presented in Section 4.5. Severe grid congestion is negative and consistent across both models (β = -0.130 in Model 2), suggesting that municipalities with a higher share of severely congested postcodes tend to miss their targets more. The nitrogen buffer exposure variable is similarly negative across both models (β = -0.123 in Model 2), indicating that municipalities with a greater share of their area within 5km of nitrogen-sensitive nature areas tend to underdeliver relative to their targets. Agricultural land is positively associated with completion rates (β = 0.171) and income is negatively associated (β = -0.774) in the final model. The limited improvement in adjusted R^2 when adding protected nature areas, greyfield land, homeownership, and livestock density to the final model (from 0.219 to 0.229) confirms that these variables contribute little independent explanatory power beyond the variables retained in the final specification.

In the full model, ambition level returns the highest significance (p = 4.71e-10), which raises suspicions of mathematical coupling between the dependent and independent variables; this will be addressed in the robustness checks presented in Section 4.5. Protected nature areas, homeownership, and livestock density all returned statistically insignificant coefficients ($p > 0.05$) and were excluded from the final model specification.

4.4 Model diagnostics

Consistent with their strong negative pairwise correlation (r = -0.68), a VIF check revealed potential multicollinearity between greyfield land and agricultural land, with values of 5.92 and 6.27 respectively, both exceeding the conventional warning threshold of 5. Intuitively, municipalities with more agricultural land have less developed urban land available for greyfield redevelopment and vice versa, producing a strong negative correlation between the two variables. Both variables were tested independently in the final model specification. Dropping greyfield land resolved the collinearity issue while preserving explanatory power and significance (β = 0.219). Dropping agricultural land instead produced a slightly lower adjusted R^2 of 0.206, suggesting agricultural land is the more relevant land use variable in this context and was therefore retained in the final model. Protected nature areas (VIF = 3.76) and homeownership (VIF = 2.66) are elevated but remain below the threshold, consistent with the pairwise correlation between them (r = 0.60); however, both were excluded based on insignificant coefficients and low explanatory power. Following the exclusion of greyfield land, homeownership, livestock density and protected nature areas, all VIF values in the final model fall below 1.13, well within the threshold of 5, confirming the absence of multicollinearity.

The residuals of the final model were tested for spatial autocorrelation using Moran's I. The test yields a Moran's I statistic of 0.084 ($p = 0.031$), which falls just under the 0.05 significance threshold, indicating a weak but significant spatial autocorrelation in the residuals, suggesting that OLS standard errors may be slightly underestimated.

4.5 Robustness check

Across all four robustness check specifications (Table 3), adjusted R^2 remains stable, ranging from 0.194 to 0.219, suggesting that the explanatory power of the model is not sensitive to the methodological choices tested.

When re-estimating the model on uncapped completion rates (Model 2), all variables except agricultural land ($\beta = 0.155$, $p = 0.152$) retain their sign and significance, with ambition level, nitrogen buffer exposure, severe grid congestion, income, and log population all remaining significant. This confirms that the winsorization of 13 outliers does not drive the main findings.

The quartile ambition model (Model 3) yields essentially the same results as with the ambition level variable tested in the final model, with ambition remaining the most significant variable ($\beta = -10.359$, $p = 2.17e\text{-}09$). While the strong significance even after replacing the continuous ratio with an ordinal rank can support the robustness of this finding, mathematical coupling may not be fully eliminated, as municipalities are still ranked by their original ratio values, which remains a limitation of this study.

In the official targets model (Model 4), a few variables lose significance, notably agricultural land becoming borderline insignificant ($p = 0.064$), and income and log population showing substantially higher p-values. On the other hand, the nitrogen buffer coefficient strengthens ($\beta = -0.194$, $p < 0.01$ compared to $\beta = -0.123$, $p < 0.05$ in the final model), though whether this reflects a genuine difference in constraint severity among municipalities with official targets cannot be determined from the current analysis.

OLS Regression Results: Robustness Checks

	Dependent variable:			
	Final model	No cap	Quartile ambition	Official targets (n=167)
	(1)	(2)	(3)	(4)
Ambition level	-4.027***	-4.623***		-4.093***
	(0.640)	(0.829)		(0.765)
Ambition quartile			-10.359***	
			(1.668)	
Nitrogen buffer exposure	-0.123*	-0.162*	-0.097	-0.194**
	(0.053)	(0.069)	(0.053)	(0.065)
Agricultural land	0.171*	0.155	0.165*	0.195
	(0.083)	(0.108)	(0.083)	(0.104)
Severe grid congestion	-0.130**	-0.141*	-0.122**	-0.114*
	(0.043)	(0.055)	(0.043)	(0.053)
Income	-0.774*	-0.935*	-0.718*	-0.376
	(0.315)	(0.408)	(0.317)	(0.430)
Population (log)	-4.622*	-9.548**	-2.333	-4.212
	(2.242)	(2.901)	(2.280)	(2.670)
Constant	178.415***	246.004***	155.274***	161.816***
	(31.000)	(40.111)	(30.999)	(38.163)
Observations	259	259	259	167
R^2	0.237	0.213	0.235	0.245
Adjusted R^2	0.219	0.194	0.217	0.216
Residual Std. Error	28.685 (df = 252)	37.116 (df = 252)	28.733 (df = 252)	28.349 (df = 160)
F Statistic	13.081*** (df = 6; 252)	11.340*** (df = 6; 252)	12.897*** (df = 6; 252)	8.637*** (df = 6; 160)

Note: *p<0.05; **p<0.01; ***p<0.001

Standard errors in parentheses. Dependent variable: completion rate (capped at 150%) for Models 1, 3 and 4; uncapped completion rate for Model 2. Model 3 replaces continuous ambition level with quartile rank (1-4). Model 4 restricted to municipalities with official coalition agreement targets only.

Table 3: OLS regression robustness checks for municipal housing completion rates (2022–2026).

5 Discussion and limitations

Municipalities tend to underperform most significantly when initial targets were set too ambitiously, when grid congestion is severe, or when a large part of municipal land falls within 5km of a nitrogen-sensitive area. Among land use variables, a greater share of agricultural land is associated with higher completion rates, suggesting more land available for conversion enables delivery. Among socioeconomic controls, income is negatively associated with completion rates, and larger municipalities tend to miss their targets more.

In this section the findings will be compared with qualitative responses from municipalities from the NOS survey, and to previous studies, before outlining the main assumptions and limitations of this research.

5.1 NOS survey responses

From their qualitative survey results, NOS coded the main obstacles to housing construction over the 2022-2026 period into 13 categories (Table 4). Out of these, 4 are attributable to spatial variables that were included in our variables (Nitrogen, Grid congestion, Regulation related to nature and environment and Agricultural land).

Survey factor	Count	% citing	Model variable
Appeal and objection procedures	80	28.30%	—
Nitrogen	64	22.60%	Nitrogen buffer 5km
Construction and material costs	49	17.30%	—
Grid congestion	49	17.30%	Severe congestion
Construction and permit procedures	41	14.50%	—
Role of housing corporations	38	13.40%	—
Regulation related to nature and environment	37	13.10%	Protected areas
Land (scarcity obstacles)	30	10.60%	Agricultural land
Provincial interference	20	7.10%	—
Staff shortages	20	7.10%	—
Population shrinkage	7	2.50%	—
Role of project developers	7	2.50%	—
Construction materials	3	1.10%	—

Table 4: Self-reported reasons for housing under-delivery among Dutch municipalities, based on the NOS survey (2026), and their correspondence to empirical model variables.

Reported nitrogen constraints align consistently with empirical findings: it is significant in the model and 22.6% of municipalities cite it as an obstacle. Survey responses across municipalities to the question “Why was it possible or not to achieve the objective?" reveals that proximity to or location within nitrogen-sensitive nature areas causes delays. The Frisian municipality of Terschelling, which completed 69% of its target, states that lying within a Natura 2000 area makes many plans difficult to realise. Bloemendaal in Noord-Holland, which completed 40% of its target, flags policy instability rather than nitrogen itself as the core issue, noting that because national nitrogen policy keeps changing, many plans have been delayed. This suggests that an unstable regulatory landscape around nitrogen may discourage investors from committing to certain housing markets independently of permit obtention.

With 13.1% of municipalities citing nature and environment regulation, this only partially aligns with empirical results. The protected areas variable returned a borderline insignificant coefficient ($p = 0.07$). Municipalities of Oldebroek and Beek cite flora and fauna legislation as a factor behind their underdelivery, referring to rules protecting specific species on or near development sites under the Omgevingswet, which apply independently of formal protected area designation. The insignificance of the protected areas variable may therefore reflect a measurement limitation rather than an absent relationship.

17.3% of municipalities cited grid congestion as a problem, aligning with the empirical negative relationship. What is surprising is that many qualitative responses frame congestion as a future threat rather than a present one. Vijfheerenlanden, which completed 90% of its target, attributes its relative success partly to not yet being affected by congestion, while Alphen aan den Rijn, which reached 98%, describes it as a serious obstacle going forward. Even municipalities on track with their targets see it as a constraint, suggesting the more problematic channel may be uncertainty rather than direct capacity failure.

While only 10.6% of municipalities cited land scarcity, agricultural land is the strongest positive predictor in the model. Most municipalities that mention it frame it as a legacy of past policy decisions rather than a physical shortage. Hollands Kroon and Noordenveld, both completing under half their targets, cite a lack of municipal land positions as a serious obstacle, with the latter tracing the problem to the post-2008 period when municipalities sold land assets to cover budget shortfalls. This reframes land scarcity as a policy choice rather than a spatial constraint and reinforces the limitation of the agricultural land variable discussed in 5.2.3.

Local objection is the most cited factor at 28.3%. Most responses describe formal legal appeals and lengthy Council of State procedures as the primary cause of delays, while a minority mention local NIMBY resistance. In this study, the insignificance of the homeownership variable which was included as a proxy for local opposition may reflect that the relevant mechanism is administrative obstruction, which remains unmeasured in the analysis.

5.2 Discussion of findings

5.2.1 Nitrogen constraints

The nitrogen buffer exposure variable is negatively associated with completion rates, situating the empirical results between two conflicting studies. Rouwendal (2023) finds no measurable national decline in permit issuance following the 2019 nitrogen ruling (p. 571), while IPO (2025) identifies nitrogen as the single biggest obstacle to housing construction (p. 15). The results here align more closely with IPO. However, the two findings may not actually contradict each other: Rouwendal analyses the period 2012-2022, which includes years before the most restrictive permitting regime, while this study begins when the construction exemption (bouwvrijstelling) was annulled in November 2022 (DutchNews.nl, 2022), capturing the effect of the tightest nitrogen regulations to date.

The selection of the 5km donut buffer as the best performing validates the policy threshold used by IPO (2025), who identify the 5km zone as critical, noting that over 50% of Dutch housing construction lies within it (p.15). The 5km buffer that excludes the protected area outperforms buffers that include it, which makes intuitive sense: land within a protected area cannot be developed regardless of nitrogen policy, so the constraint operates in the surrounding zone rather than inside it. One way to interpret this is that municipalities already account for the share of their area occupied by protected zones when setting targets, which would also explain the insignificance of the protected nature areas variable in the model.

The insignificance of livestock density across all specifications points to a potential policy failure. If nitrogen policy was fully binding, actual emission sources would constrain housing delivery, yet the data suggests that proximity to sensitive areas matters while the intensity of local farming does not. The regulatory burden therefore appears to fall on municipalities based on where sensitive nature areas happen to be located, rather than on those emitting the most nitrogen. Beyond the direct permitting mechanism, proximity to nitrogen-sensitive areas may also constrain delivery through investor uncertainty. Similarly to what IPO (2025) discussed surrounding investor uncertainty regarding grid congestion, the unstable regulatory landscape, tightening and relaxing permitting conditions, can discourage developers from committing capital to projects within the buffer zone before even trying.

5.2.2 Grid congestion

Severe grid congestion is negatively associated with completion rates and is the second most cited spatial factor overall, consistent with IPO (2025), which identifies it as a widespread structural problem affecting more than 30% of housing construction nationally (pp. 20–21). Notably, the broader severe congestion threshold (scores 2-3) outperforms the full congestion only specification (score 3), suggesting that the constraint does not require complete capacity failure to affect delivery. This confirms municipal citations and IPO (2025) that constraint appears to operate partly through investor behaviour and that the prospect of congestion already causes developers to abandon projects before capacity constraints are actually reached (IPO, 2025, p. 22). Given that TenneT announced that high-voltage network expansion in Flevoland, Gelderland and Utrecht will not be completed before 2033, this problem is likely to intensify over the coming decade rather than resolve (IPO, 2025, p. 21).

5.2.3 Agricultural land

The positive association between agricultural land share and completion rates makes intuitive sense: municipalities with more land available for conversion have more opportunity to build. However, the picture becomes blurry when considering how targets are set. If municipalities calibrated targets bottom-up according to their land potential, completion rates would not systematically differ by land availability, as both targets and delivery would follow the same constraint. The more likely explanation is that targets are not perfectly calibrated to land potential, shaped partly top-down through provincial and national frameworks. Claassens et al. (2020) describe this as a hybrid system in which municipal autonomy in target-setting coexists with provincial frameworks and national housing agreements, such as the designation of 21 large-scale national housing areas in 2023 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2025). Municipalities with limited land may therefore have had targets set above what they could realistically deliver, which would explain the positive coefficient.

5.3 Limitations

The model explains only 22% of variation in completion rates, suggesting substantial omitted variable bias. In several cases, variables capture the physical dimension of a constraint but miss the administrative side of it. Agricultural land measures physical stock but not municipal control over it; homeownership proxies for NIMBY resistance but misses the formal legal procedure dimension; and the protected areas variable captures formal designation but not the broader reach of flora and fauna legislation present outside designated boundaries. Beyond these partial measurements, some relevant constraints are absent entirely. Construction sector capacity, appeal and objection procedures (the most cited factor in the NOS survey at 28.3%), and spray zones around pesticide-sprayed agricultural land all remain unmeasured. The latter receives relatively little attention in the literature but reportedly affects a third of housing projects in Drenthe and Limburg (NOS, 2026b). Together, these absences suggest the spatial constraints measured here are best understood as one component of a broader delivery failure rather than its primary cause.

Two methodological issues also apply. First, the mathematical coupling between ambition level and completion rate cannot be fully resolved within the current research design despite the robustness check. Second, the weak but significant spatial autocorrelation in residuals (Moran's I = 0.084) means OLS standard errors may be slightly underestimated.

The dependent variable carries its own limitations. Non-response to the NOS survey is unlikely to be random: municipalities that underperformed may have had less incentive to report, biasing the sample toward better performers and meaning the mean completion rate of 73.6% likely overestimates national reality. T-tests comparing responding and non-responding municipalities found that non-responding municipalities have significantly more protected nature areas ($p = 0.037$) and are slightly smaller ($p = 0.026$) than respondents, likely reflecting greater administrative constraints for such municipalities. For the remaining variables, no statistically significant differences were found between responding and non-responding municipalities ($p > 0.05$), suggesting that while the sample is not fully representative, the selection bias is unlikely to substantially affect the main findings.

6 Conclusion

This study set out to explain variation in housing under-delivery across Dutch municipalities by examining the role of spatial constraints. The strongest findings make clear that in order to counter the housing crisis in the Netherlands, much more than just targets need to be organised. Without fixing the housing delivery system of today, the structural constraints identified in this study, notably grid congestion and the nitrogen permitting system, will make those targets a false promise.

First, municipalities need to have a clear strategy for urban densification, as such areas are the least affected by nitrogen-sensitive nature, protected nature areas and grid congestion. Second, these structural constraints need to be addressed at their source: stabilising the nitrogen regulatory landscape, expanding grid capacity and reducing electricity consumption. However, a large part of the constraints that hinder municipalities from reaching their targets lie in administrative burden, itself often compounded by the structural issues listed above. As Jonkman et al. (2022) note, the accumulation of qualitative objectives around affordable and sustainable housing alongside quantitative delivery targets is already too much for many municipalities to handle, particularly smaller ones. A new approach to target-setting that accounts for local delivery capacity therefore deserves serious research attention, alongside a deeper understanding of how non-spatial factors shape outcomes.

It would also be valuable to understand to what extent the variables identified in this study directly impact housing completion rates, and how much of their effect operates through the intermediary of investor uncertainty and project deferral. More broadly, with two thirds of the world population projected to live in cities by 2050 (United Nations, 2025), similar tensions between housing supply and spatial constraints are likely to emerge in other contexts, and replicating this framework in other countries would be a natural and worthwhile next step. Ultimately, this study demonstrates that housing under-delivery in the Netherlands is a spatially uneven problem shaped by structural constraints that vary across municipalities and that national housing policy has yet to fully account for.

Appendix

Original Land-use class	Aggregated Land-use class	Development Process
Railways	Infrastructure	Greyfield
Main roads	Infrastructure	Greyfield
Airport	Infrastructure	Greyfield
Residential	Residential	Residential
Retail and hospitality/catering	Other built-up	Greyfield
Public facilities	Other built-up	Greyfield
Social-cultural facilities	Other built-up	Greyfield
Industrial grounds	Other built-up	Greyfield
Dumping grounds	Other built-up	Greyfield
Wreck storage facilities	Other built-up	Greyfield
Cemetery	Other built-up	Greyfield
Mining	Other built-up	Greyfield
Construction sites	Construction	Greyfield
Semi-paved terrain	Other built-up	Greyfield
Parks	Urban Green	Green
Sports facilities	Urban Green	Green
Allotment gardens	Urban Green	Green
Day trip locations	Other built-up	Greyfield
Accommodations	Other built-up	Greyfield
Greenhouses	Agriculture	Green
Other agricultural	Agriculture	Green
Forest	Nature	Green
Dry natural area	Nature	Green
Wetlands	Nature	Green
IJsselmeer/Markermeer	Water	Green
Closed estuary	Water	Green
Rhine and Meuse	Water	Green
Randmeer	Water	Green
Reservoir	Water	Green
Water with recreational function	Water	Green
Water with extraction function	Water	Green
Mud depot	Other built-up	Greyfield
Other inland water	Water	Green
Waddenzee, Eems, Dollard	Exterior water	Green
Eastern Schelde estuary	Water	Green
Western Schelde estuary	Water	Green
North Sea	Exterior water	Green
Foreign country	Outside Study Area	-

Table A1: Land use reclassification table. Source : adapted from Claasens et al. (2020)

Hoofdgroep	Code	Categorie	Ondergrenzen	
			Areaal	Breedte
1 - Verkeersterrein	10	Spoorterrein	0,1 ha	2 m
	11	Hoofdweg	0,1 ha	2 m
	12	Vliegveld	1 ha	5 m
	13	Metro en sneltram	0,1 ha	2 m
2 - Bebouwd terrein	20	Woonterrein	1 ha	10 m
	21	Detailhandel en horeca	1 ha	10 m
	22	Openbare voorziening	1 ha	10 m
	23	Sociaal-culturele voorziening	1 ha	10 m
	24	Bedrijfsterrein	1 ha	10 m
3 - Semi-bebouwd terrein	30	Stortplaats	1 ha	10 m
	32	Begraafplaats	0,1 ha	10 m
	33	Delfstofwinplaats	0,5 ha	10 m
	34	Bouwterrein	1 ha	geen
	35	Semi-verhard overig terrein	1 ha	5 m
	36	Zonnepark	1 ha	10 m
4 - Recreatief terrein	40	Stedelijk groen	1 ha	5 m
	41	Sportterrein	0,5 ha	10 m
	42	Volkstuin	0,1 ha	5 m
	43	Dagrecreatief terrein	1 ha	10 m
	44	Verblijfsrecreatief terrein	1 ha	10 m
5 - Agrarisch terrein	50	Glastuinbouw	0,5 ha	10 m
	51	Overig agrarisch terrein	1 ha	10 m
	52	Akker en meerjarige teelt	1 ha	10 m
	53	Agrarisch grasland	1 ha	10 m
6 - Natuurlijk terrein	60	Bos	1 ha	25 m
	61	Open droog natuurlijk terrein	1 ha	10 m
	62	Open nat natuurlijk terrein	1 ha	10 m
7 - Binnenwater	70	IJsselmeer en Markermeer	geen	6 m
	71	Afgesloten zeearm	geen	6 m
	72	Rijn en Maas	geen	6 m
	73	Randmeer	geen	6 m
	74	Spaarbekken	1 ha	6 m
	75	Recreatief binnenwater	1 ha	6 m
	76	Binnenwater voor delfstofwinning	1 ha	6 m
	77	Vloei- en slibveld	1 ha	6 m
	78	Overig binnenwater	1 ha	6 m
8 - Buitenwater	80	Waddenzee, Eems en Dollard	geen	6 m
	81	Oosterschelde	geen	6 m
	82	Westerschelde	geen	6 m
	83	Noordzee	geen	6 m
9 - Buitenland	90	Buitenland	geen	geen

Table A2: NBBG 2022 Land use classification table. Source: CBS

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