The effect of NO2 emission on rental prices in Dresden

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1 Introduction

This study explores how NO2 emissions correlate with rental prices in urban apartments in Dresden. Specifically, it examines whether there is a relationship, either correlational or causal, between NO2 pollution levels and rental prices. Additionally, it investigates how proximity to the main train station influences rental prices and identifies other factors, such as apartment size, that may mediate the effect of air pollution on rental prices.

1.1 Hypothesis

- **Null Hypothesis (H0):** There is no significant relationship between NO2 emissions and housing prices in Dresden due to low emission levels.
- **Alternative Hypothesis (H1):** There is a significant negative relationship between the distance to the city center and rental prices.

2 Data

After cleaning the data, I filtered it to only include Dresden and the year 2015. Here is the descriptive statistics of the final data:

- **Kaltmiete:** Rent prices
- **Postleitze:** Postal code
- **Wohnflaech:** Size of space
- **Zimmer:** Number of rooms
- **Etage:** Floor position
- **X2015_final_1km:** NO2 emission

Statistic	N	Mean	St. Dev.	Min	Max
V1	7,160	4.138	2.172	0.198	14.880
ScoutID	7,160	80,523,019.000	4,588,390.000	31,847,701	83,609,002
Postleitza	7,160	1,195.564	82.943	1,067	1,809
Kaltmiete	7,160	415.856	231.804	100.000	2,585.000
Wohnflaech	7,160	58.662	25.584	15.600	300.000
Zimmer	7,160	2.197	0.919	1.000	7.000
Etage	7,160	2.722	2.255	0	17
Add_	7,160	1,195.564	82.943	1,067	1,809
Typ	7,160	4.270	4.266	0	9
X2015_final_1km	7,160	10.646	1.694	5.729	16.846

Figure 1: Descriptive statistics

2.0.1 Distribution of Apartment Rent Prices

You can see almost 55% of apartment prices are located in the 300-500 euro range.

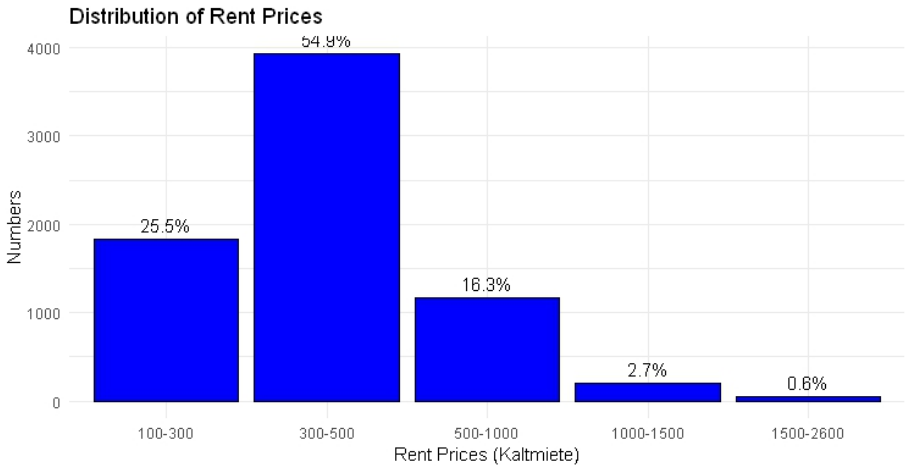

Figure 2: Apartment Rent Prices

In **figure 3** there is map of distribution of apartments in Dresden.

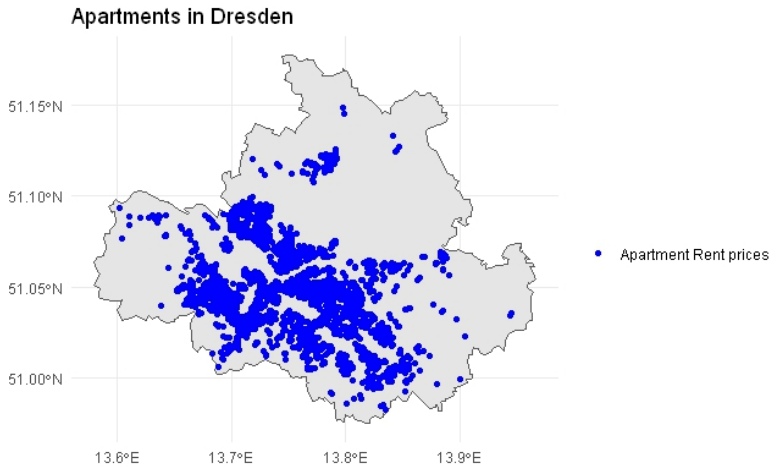

Figure 3:

3 Raster Data

You can see the level of emissions in Dresden is very low, according to the literature, with low levels ranging from 0 to 40.

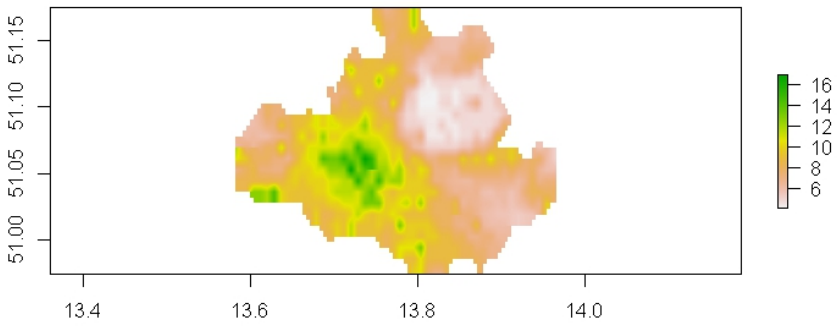

Figure 4: NO2 emissions

3.1 Emission Levels and Apartments in Dresden

I calculated the distance between the HBF (main station) and every apartment, adding it to my apartment data as a column. For this, I used the `hbf <-`

`tibble::tribble` code for adding the address of HBF. Here the plot of map:

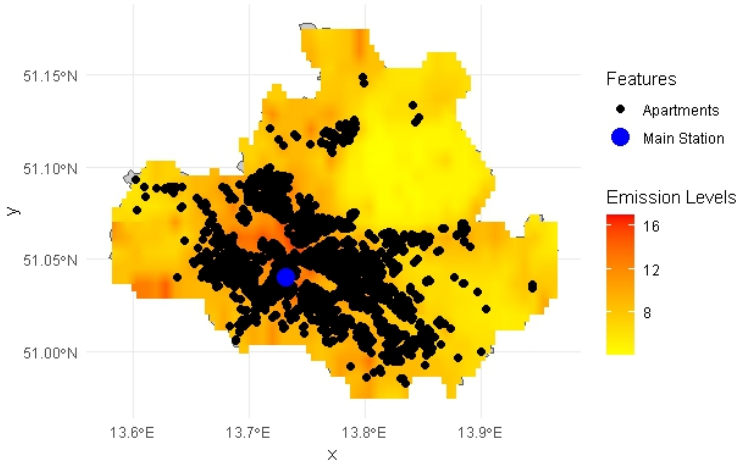

Figure 5: Apartments, HBF and NO2

4 Method

4.1 1st Model

In the 1st model I icluded all important variables to my OLS model, specially emission vaules as number:

log(Rent prices) = $\beta_0 + \beta_1 \log(\text{distance to city center}) + \beta_2 \log(\text{size of living space})$
$+ \beta_3(\text{pre-equipped with a kitchen}) + \beta_4(room) + \beta_5(floor)$
$+ \beta_6(Garden) + \beta_7(Barrierefr) + \beta_8(basement)$
$+ \beta_9(Balkon) + \beta_{10}(Elevator) + \beta_{11} \log(NO_2 emission) + \epsilon$

4.2 2nd Model

In the 2nd model I did same model but changed the emissions from number to level. I splited the emissions according fo the mean of NO2 column and divided it 2 level **low** and **high**.

log(Rent prices) = $\beta_0 + \beta_1 \log(\text{distance to city center}) + \beta_2 \log(\text{size of living space})$
$+ \beta_3(\text{pre-equipped with a kitchen}) + \beta_4(room) + \beta_5(floor)$
$+ \beta_6(Garden) + \beta_7(Barrierefr) + \beta_8(basement)$
$+ \beta_9(Balkon) + \beta_{10}(Elevator) + \beta_{11}(NO_2 category) + \epsilon$

5 Results

Here is the results of both methods:

	log(Kaltmiete)	
	(1)	(2)
log(V1)	−0.084***	−0.054***
	(0.005)	(0.005)
log(Wohnflaech)	0.960***	0.957***
	(0.011)	(0.011)
EBKja	0.113***	0.114***
	(0.006)	(0.006)
Zimmer	−0.011**	−0.010**
	(0.005)	(0.005)
Etage	−0.019***	−0.019***
	(0.001)	(0.001)
Gartenja	0.033***	0.035***
	(0.006)	(0.006)
Barrierefrja	0.214***	0.212***
	(0.011)	(0.011)
Kellerja	0.060***	0.059***
	(0.005)	(0.005)
BalkonTerrja	0.008	0.013***
	(0.005)	(0.005)
Aufzugja	0.075***	0.075***
	(0.005)	(0.005)
log(X2015_final_1km)	−0.120***	
	(0.020)	
NO2_categoryNO2_High		0.013**
		(0.006)
Constant	2.456***	2.133***
	(0.063)	(0.035)
Observations	7,160	7,160
R^2	0.830	0.830
Adjusted R^2	0.830	0.829
Residual Std. Error (df = 7148)	0.184	0.184
F Statistic (df = 11; 7148)	3,178.538***	3,162.684***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Figure 6: Coefficient results

My initial findings indicate that several independent variables, notably NO2, significantly influence housing prices. The main impacts on rent prices are the

availability of barrier-free access, apartment size, built-in kitchen, and NO2 emissions. In the second model, which categorizes emissions, most independent variables are statistically significant and impact rental prices, but the impact of NO2 groups is very small.

One plausible explanation for these findings is that emission levels in Dresden are generally low, so as a group, they have minimal influence on rental prices. However, as a number, NO2 has a strong impact on apartment rent prices.

References

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