Public housing in Aarhus

- Problem: It's hard to get a proper overview of what matters in public housing rent by just looking at listings.

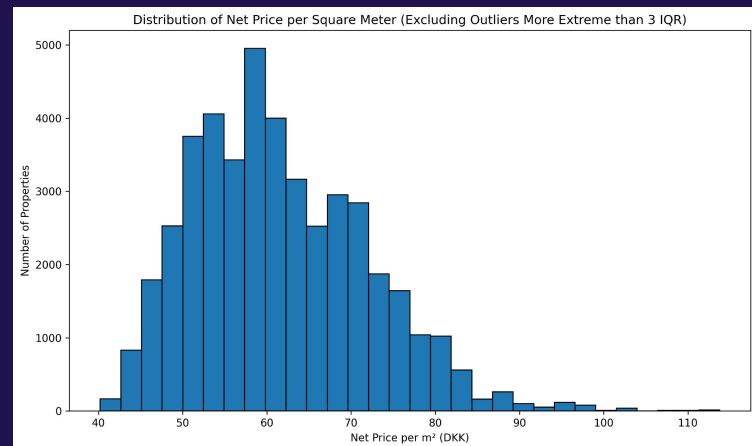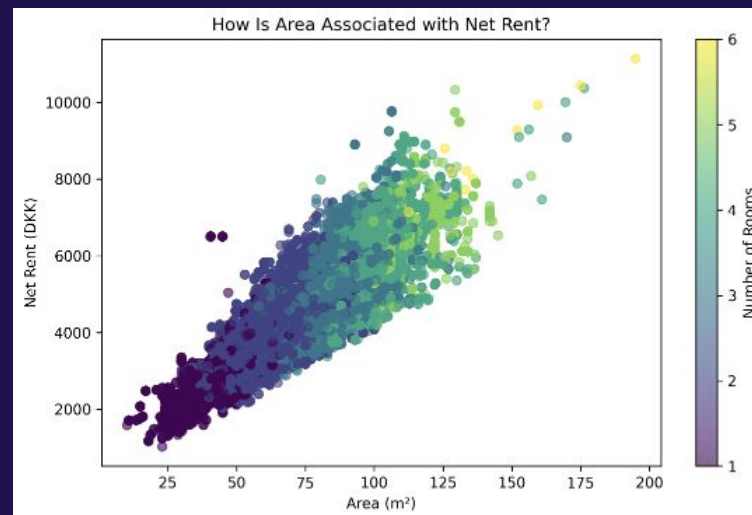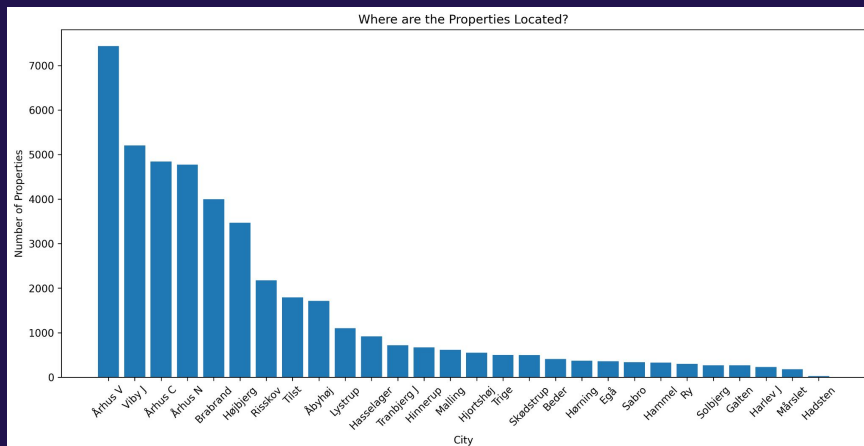- Question: What factors determine the price per square meter in public housing in Aarhus

What is known?
- Housing prices are influenced by both structural characteristics (e.g., area and number of rooms) and locational factors (e.g., proximity to amenities or urban centers) (Sirmans et al., 2020).

- Smaller apartments tend to have a higher price per square meter due to greater demand for compact & urban-friendly housing (European Commission, 2022)

- Location is one of the most significant predictors of housing prices. Proximity to central business districts and desirable neighborhoods is driving up prices (Melecky & Paksi, 2024).

Methods & Data

- Data source:
  - Aarhus Kommune, 2024
  - All public housing in Aarhus: 44090 data points
  - Data cleaning and transformation

- Descriptive Analytics
- Linear Models (linear regression and Bayesian)
  - Outcome variable: price pr. sqm
  - Predictors: Area, rooms, deposit, city

How Is Area Associated with Net Rent?

Where are the Properties Located?

Distribution of Net Price per Square Meter (Excluding Outliers More Extreme than 3 IQR)

Slide: Jacob Lillelund

Results

- Smaller properties - higher price pr. sqm
- Area and rooms correlate
- Area and number of rooms is associated with some variance in data
- Deposit have no effect
- Postal code is associated with price/sqm

Bayesian Generalized LM

```
prior = c(
set_prior("normal(100, 30)", class = "Intercept"),
set_prior("normal(0, 4)", class = "b", coef = "area"),
set_prior("normal(0, 4)", class = "b", coef = "deposit")
```
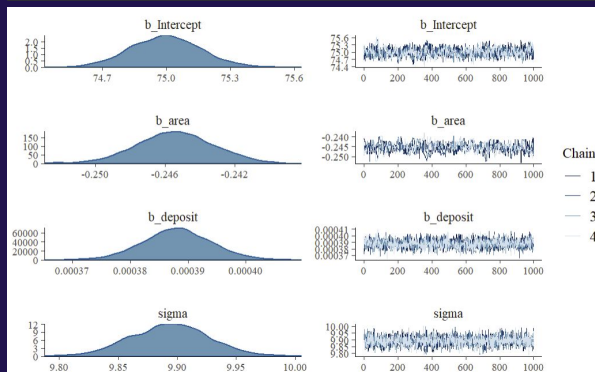
```
 Family: gaussian
  Links: mu = identity; sigma = identity
Formula: net_price_per_sqm ~ area + deposit
   Data: d (Number of observations: 44090)
  Draws: 4 chains, each with iter = 2000; warmup = 1000; thin = 1;
         total post-warmup draws = 4000

Population-Level Effects:
          Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
Intercept    75.01      0.16    74.71    75.33 1.01      580     1140
area         -0.25      0.00    -0.25    -0.24 1.01      412      492
deposit       0.00      0.00     0.00     0.00 1.00     1632     1912

Family Specific Parameters:
      Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
sigma     9.89      0.03     9.83     9.96 1.00     2670     2107
```


Linear Regression Model

```
Call:
lm(formula = net_price_per_sqm ~ rooms + area + deposit + city,
    data = d)

Residuals:
    Min      1Q  Median      3Q     Max
-51.533  -5.548  -0.601   4.618  84.507

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)    7.075e+01  2.566e-01 275.762  < 2e-16 ***
rooms         -1.774e-01  9.837e-02  -1.803   0.0713 .
area          -2.462e-01  4.381e-03 -56.190  < 2e-16 ***
deposit        3.577e-04  5.561e-06  64.329  < 2e-16 ***
cityÅrhus C    1.203e+00  2.546e-01   4.724 2.31e-06 ***
cityÅrhus N    2.266e+00  2.556e-01   8.867  < 2e-16 ***
cityHarlev J   2.130e+01  6.318e-01  33.712  < 2e-16 ***
```

Slide: Jonathan Laursen

Discussion

The typical market dynamics are restricted in public housing schemes

Imbalanced data with regards to postal code - careful interpretation
-    E.g.: Harlev J - high prices, but only recently built apartments are listed

Handling of identical or near identical listings

Interesting variables for future work:

-    Year build/latest renovation
-    Distance from city centre
-    Amenities in area (child care, groceries, parks etc.)
-    Other structural characteristics
-    Length of waiting lists for each apartment complex