# The economics of architecture: A synthesis

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# Context

- **Distinctive architectural design**
  - **Aesthetic features** that provide utility beyond that the mere use of the building
  - Similar to **consumption value of arts**
- **Internal value** to residents of a distinctive building
  - Reflected in rents to **owner of distinctive building**
- **External value** to neighbors (in addition to society as a whole)
  - Mostly reflected in rents to **owners of other buildings**
- **Coordination problem**
  - Private cost vs shared benefit incentivizes **freeriding**
- Scope for **welfare-improving planning policies**
  - Subsidies to owners implementing distinctive design
  - Zoning (distinctive districts, FAR incentives)

# This paper

- **Develop a quantitative model** for the analysis of design policies
  - Downward-sloping demand for distinctive design meets constant marginal cost
  - Design spillover shifts location-specific amenity
- **Review evidence** to guide quantification of the model
  - Internal design premium: 15%;
  - External design premium: 9%
- **Survey** to understand design preferences
  - Buildings rated highly by Starchitect are valued higher by respondents
  - Dispersion of tastes for architecture similar to location preferences: $\epsilon = 4$
- **Simulate design policies**
  - Optimal Subsidy (9% of construction cost) improves welfare
  - Design districts can generate small improvements when they are small
  - FAR incentives require strong constraints that depreciate welfare

# Related literature

- **Design premiums**
  - e.g. Hough and Kratz (1983); Vandell and Lane (1989); Ahlfeldt and Holman (2018); Koster et al. (2016); Lindenthal and Johnson (2021); Füß et al. (2025)
    - Our quantitative survey covers 68 estimates of premiums from **41 studies**
    - Our quantitative survey covers 33 estimates of external premiums from **28 studies**
- **Quantitative urban models**
  - e.g. Ahlfeldt et al. (2015); Heblich et al. (2020); Tsivanidis (2025); Redding (2025)
    - We focus on choices among buildings of different design within a neighborhood
- **Welfare effects of planning**
  - e.g. Glaeser et al. (2005); Brueckner and Rossi-Hansberg (2010); Sridhar (2012); Cheshire and Dericks (2020); Ahlfeldt and Barr (2022)
    - Design choice by the developer is endogenous in our model

# Model

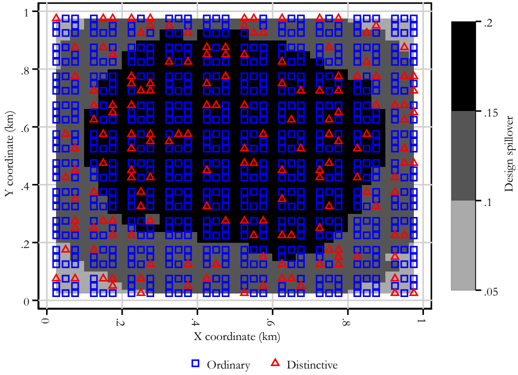
- **Geography:** Neighbourhood with $J$ parcels and one developer per parcel
  - Each parcel has developable land $\bar{K}_i$, can be develoed by one building
  - Embedded in wider city
- **Residents:** Choose a parcel in the neighbourhood or the rest of the city
  - Standard Cobb-Douglas preferences for housing and floor space
  - Amenity $B_i$ includes exogenous component and design spillovers $D_i$
    - Take the standard market potential form (normalized to range between 0 and 1)
  - Idiosyncratic preferences (Fréchet) for submarkets
    - Downward-sloping demand within submarkets: Distinctive, ordinary, rest of city
- **Developers:** Choose building height $h_i$ and design $d$
  - Face design-specific construction cost and height elasticity of cost $\theta$
    - Heterogeneity in design cost generates upward-sloping aggregate supply
  - May receive subsidy $t_i^d$ and face design regulation $G_i$

# Primitives and endogenous outcomes

- **Equilibrium:**
  - Utility equalizes within neighbourhood
  - Zero profits in floor space production
  - Floor space markets clears
- **Primitives:**
  - Calibrated/estimated parameters, neighbourhood wage, utility in rest of city
  - Parcel-specific fundamental amenity, design subsidy, height limit, design restriction
  - City population, parcel land
- **Endogenous outcomes:**
  - Submarket population, expected city utility, developer profits
  - Parcel rent, height, floor space consumption, distinctive design status & spillover
- **Mapping from primitives to endogenous outcomes**, solved numerically

Workers Developers Welfare Equilibrium

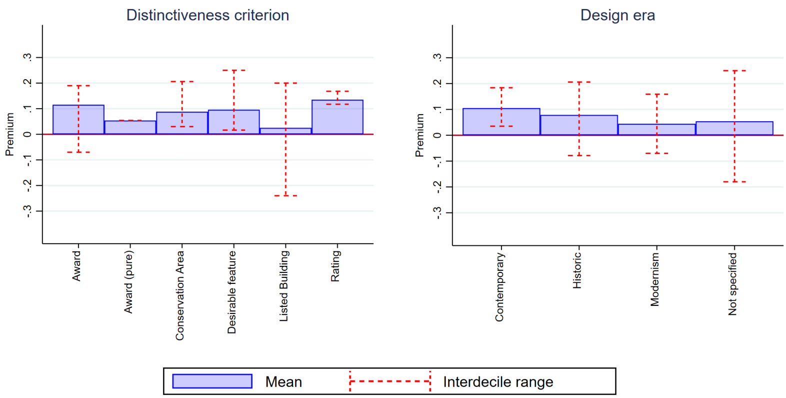
# Intuition and quantification




- Developers develop distinctive buildings **where distinctive design has the greatest payoff**
- **Marginal parcel** is where the return to distinctive design falls below the cost
- Exposure to distinctive design **spillover translates into higher prices**
- **Need moments to calibrate the model**
  - Internal design premium
  - External design premium
  - Taste dispersion

# Internal design premium

- Literature search reveals 68 estimates from 41 studies



# Internal design premium

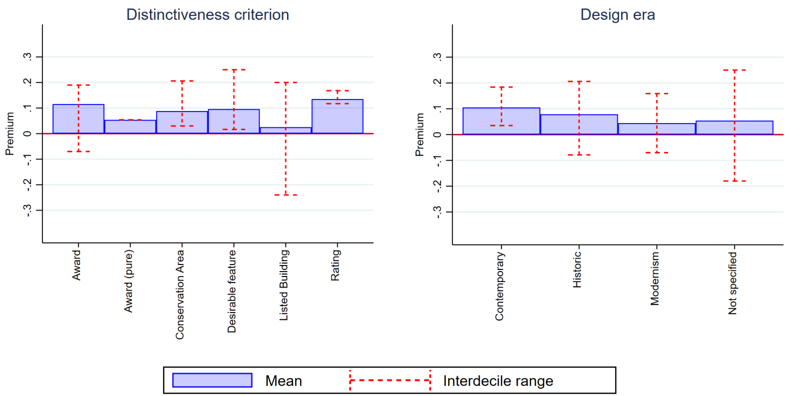
| | (1) Premium | | (2) Premium | | (3) Premium | |
|---|---|---|---|---|---|---|
| Commercial | 0.095*** | (0.02) | 0.101*** | (0.02) | 0.146*** | (0.02) |
| Residential | 0.077*** | (0.02) | 0.099** | (0.04) | 0.164*** | (0.04) |
| Conservation Area | | | -0.02 | (0.03) | | |
| Listed Building | | | -0.08* | (0.05) | | |
| Award (pure) | | | -0.05 | (0.04) | | |
| Historic Style | | | 0.010 | (0.05) | | |
| Weighted | No | | No | | Yes | |
| Sample | All | | All | | Cohort control | |
| r2 | 0.4 | | 0.4 | | 0.7 | |
| N | 68 | | 68 | | 17 | |

Notes: Standard errors in parentheses. Each observation is an estimate of the effect of distinctive design on property price or rent from the literature in log points. All explanatory variables are dummy variables. Baseline distinctiveness measure is listed building. Modern covers the style groups contemporary, modernism, and transitional from Figure 12 (right panel). Quality weights are proportionate to Google citation counts, regression adjusted for publication years. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Regression-based average
  - We weight observation by publication-year adjusted citation count
  - Most credible estimates are from studies that identify the distinctiveness effect within cohorts
  - **Interal design premium $\approx$ 15 %**

# External design premium

- Literature search reveals 33 estimates from 28 studies: **Average ≈ 9%**



# Design preferences

- **Internet survey** asking respondents to rate 10 buildings on a 0-100 scale
  - Also obtained ratings by "Starchitect" Stefano Boeri (Bosco Verticale, Milan)
- Structural estimation of Fréchet shift and share parameters using GMM: $\epsilon = 4$
  - Buildings rated highly by Starchitect also appreciated by respondents

| Group | Mean rating | Variance | Shift $A_b$ | Shape $\varepsilon$ |
|---|---|---|---|---|
| All respondents, all buildings | 52.72 | 480.88 | 42.73 | 4.04 |
| People similar to Starchitect | 51.34 | 416.81 | 39.53 | 4.06 |
| People different from Starchitect | 52.99 | 586.57 | 42.16 | 3.79 |
| Buildings ranked high by Starchitect | 65.63 | 486.86 | 55.89 | 4.69 |
| Buildings ranked low by Starchitect | 39.80 | 474.90 | 32.39 | 3.40 |

Notes: This table reports GMM estimates based on matching the first and second moments of the building-level rating distributions to those implied by a Fréchet model. The shape parameter $\varepsilon$ governs preference heterogeneity, while $A_b$ reflects the building-specific location shift. Groups are defined based on respondent-level or Starchitect-level ranking similarity.

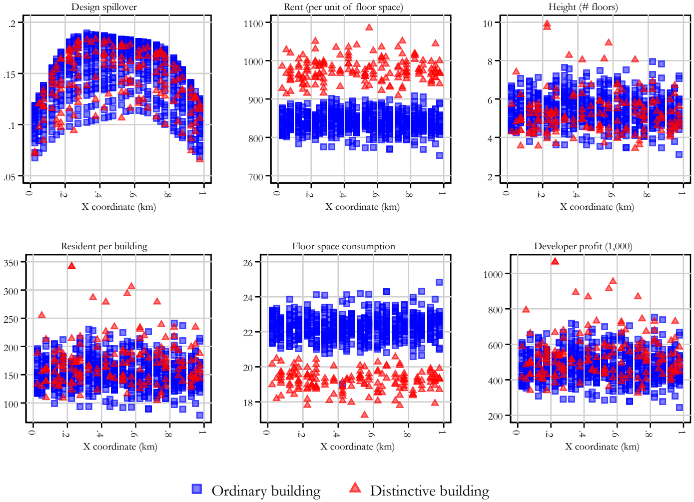
Example GMM

# Quantification

- **Borrow caonical parameters** from literature
  - Housing expenditure ($1-\alpha=0.33$), spillover decay ($\tau=5$), height elasticity of construction cost ($\theta=0.2$)
- **Estimate taste dispersion** using survey data
  - $\epsilon=4$
- **Structural interpretation** of external design premium (for given $1-\alpha$)
  - Normalize design spillover so that 1 reflects a fully distinctive neighbourhood
- Use **SMM** to estimate the average taste for and cost of distinctive design
  - The internal design premium via Frechet scale parameter
  - The average cost of distinctive design via target share of distinctive buildings (20%)
- This approach **works for real-world neighbourhoods**, too!

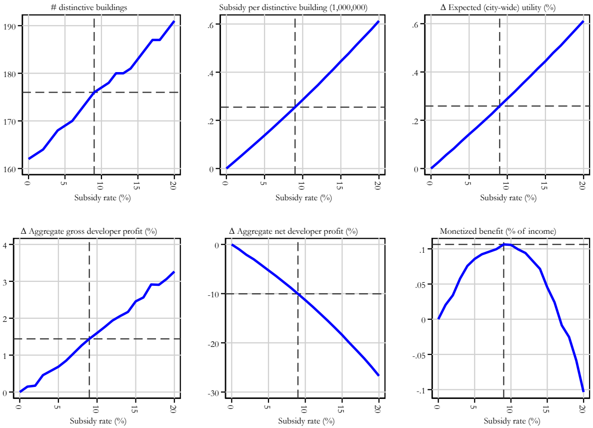
SMM

# Neighbourhood structure




- Distinctive design premium
  - Matched to data
- Affects floorspace consumption
  - Higher price $\Rightarrow$ lower consumption
- Design spillover is greatest in the centre
  - Affects prices (effect barely visible)

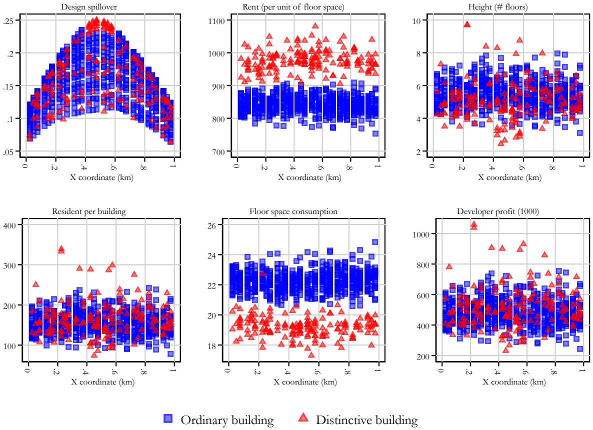
# Pigovian subsidy




- Increases
  - # distinctive buildings
  - Expected utility
  - Developer gross profits
- Reduces net profits after taxes
  - Convex shape
- Hump-shaped welfare effect
  - Monetized utility effect, developer profits, and tax cost
  - Concave as diminishing marginal returns ⇒ downward-sloping demand
- **Optional subsidy**: 9% of construction cost

Subsidy gradients

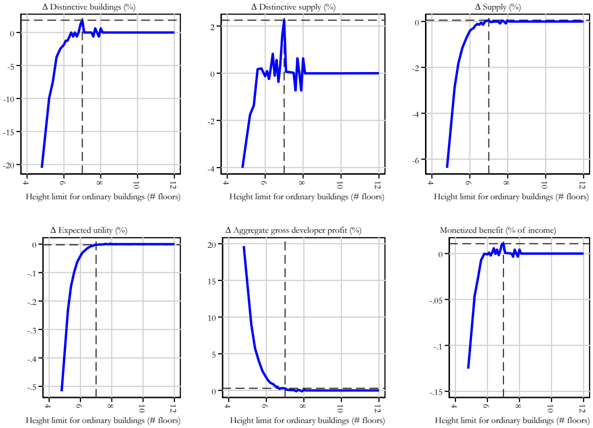
# Mandatory distinctive design district




- Can **force developers** to solve the coordination problem
  - All buildings in a district must be distinctive
  - Related policy: Conservation areas
- Can generate **benefits when the distinctive district is small**
  - Distinctive buildings +4.3%
  - Expected utility +0.001% (city-wide)
  - Developer profits +0.091%
- If it is too large, the effect is negative due to diminishing returns

Map Large district

# FAR incentives




- **FAR incentives** only work under **constraints** for ordinary buildings
  - Introduce height limit for ordinary buildings
  - No limit for distinctive buildings
- Generally, binding **height limits depreciate welfare**
  - Non-binding height limits do not affect distinctive supply
- **Knife-edge welfare gain**
  - At 7-foor height limit
    - hard to hit in practice
  - Tighter constraints depreciate aggregate welfare and transfare welfare from workers to landowners

# Conclusion

- Distinctive architectural design generates substantial **positive externalities**
  - Under-internalized in laissez-faire markets
  - Market fails to deliver optimal design levels
- **Net social benefit** of additional distinctive design justifies **policy intervention**
  - **Most efficient:** Construction cost subsidy targeted at distinctive buildings
  - **Design standards** in moderate districts can leverage spillovers
  - **FAR bonuses** offer marginal gains and risk inefficiencies if miscalibrated
    - **Should not introduce supply constraints** to enable policy
    - However, in an already **supply-constrained city, FAR incentives make sense**

# Appendix

# Workers

- Workers choose among submarkets: $\mathbf{C} = \{distinctive, ordinary, outside\}$
  - Preferences modeled via Fréchet distribution with shape $\varepsilon$ and scale $A^d$
  - Utility: $U(v) = \tilde{U}^d a^d(v)$
  - Within-neighbourhood utility: Cobb-Douglas over non-housing good $g$ and housing $f$
- Housing demand:
  - $f_i^d = (1-\alpha)\frac{\bar{w}}{Q_i^d}$
- Choice probabilities:
  - $\mu^d = \frac{(\tilde{V}^d)^\varepsilon}{\sum_{u \in \mathbf{C}} (\tilde{V}^u)^\varepsilon}$
  - Outside option: fixed utility $\tilde{U}^{outside} = \bar{U}$
- Local amenity:
  - $B_i = b_i^d \cdot \exp[\beta D_i]$
  - $D_i$ is spillover from nearby distinctive buildings

Back to Model

# Developers

- One developer per parcel $i$, chooses:
  - Submarket $d \in \{distinctive, ordinary\}$
  - Height $h_i$ and thus floor space supply $H_i^d$
- Profit function:
  - $\pi_i^d = \left[ Q_i^d h_i^d - \bar{C}(h_i^d)^{1+\theta} e^{\delta_i^d - t_i^d} \right] \bar{K}_i$
- Height decision:
  - $h_i^{d^*} = \left( \frac{Q_i^d}{(1+\theta)\bar{C} e^{\delta_i^d - t_i^d}} \right)^{1/\theta}$
  - Subject to height limit: $\tilde{h}_i^d = \min(h_i^{d^*}, \bar{h}_i^d)$
- Design decision:
  - If regulated ($G_i = \text{distinctive}$): forced to build distinctive
  - Else: choose $d$ that maximizes profit

Back to Model

# Welfare

- Two components:
  - Worker utility: $\mathbb{E}[U]\bar{N}$
  - Developer profits: $\Pi = \sum_{i,d} \pi_i^d \mathbb{1}(\tilde{d}_i = d) + \bar{\pi}^{outside}$
- Expected utility (logit structure):
  - $\mathbb{E}[U] = \Gamma\left(\frac{\varepsilon-1}{\varepsilon}\right)\left(\sum_{u\in\mathbf{C}}(\tilde{V}^u)^\varepsilon\right)^{1/\varepsilon}$
- Policy evaluation:
  - Change in welfare: $\Delta W = \frac{\mathbb{E}[U]^1 - \mathbb{E}[U]^0}{\mathbb{E}[U]^0}\bar{w}\bar{N} + \Delta\Pi$
- Subsidy cost:
  - $S = \sum_{i,d} \mathbb{1}(\tilde{d}_i = d)\bar{C}(h_i^d)^{1+\theta}\bar{K}_i[e^{\delta_i^d} - e^{\delta_i^d - t_i^d}]$

Back to Model

# Equilibrium

- Equilibrium vector: $\mathbf{V} = \{\tilde{d}_i, Q_i^d, \tilde{V}^{distinctive}, \tilde{V}^{ordinary}\}$
- Key conditions:
  - Market clearing: $f_i^d N_i^d = H_i^d$
  - Population: $N_i^d = \nVdash(\tilde{d}_i = d) \cdot \frac{H_i^d}{f_i^d}$
  - Share: $\mu^d = \frac{1}{\bar{N}} \sum_i N_i^d = \frac{(\tilde{V}^d)^\varepsilon}{\sum_{u \in \mathbf{C}} (\tilde{V}^u)^\varepsilon}$
- Solving equilibrium:
  - Bid rent and design choice form a fixed-point system
  - Externalities generate circular causality (via $B_i$ and $D_i$)
  - Numerical solution required; uniqueness shown via heterogeneous fundamentals

Back to Model

# Survey Example

- Example building rating distribution
  - Respondents scored on a 0–100 scale
  - Compare average scores with expert (Starchitect) ratings

Back to Preferences

# GMM Estimation

- Structural estimation of taste parameters
  - Logit model with Fréchet taste heterogeneity
  - GMM used to identify $\varepsilon = 4$
- Key result:
  - Buildings highly rated by Starchitect also appreciated by survey respondents
  - Supports validity of expert-based preference shifters

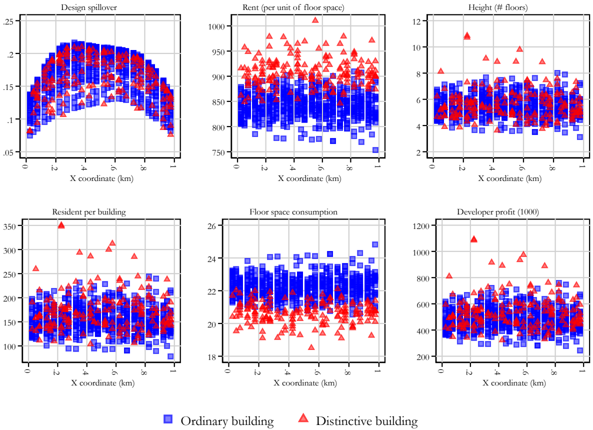
Back to Preferences

# Simulated Method of Moments (SMM)

- Calibration target:
  - Internal design premium from regression evidence and real-world distinctive share
- Estimation:
  - Simulate model given $(\alpha, \tau, \theta, \varepsilon, \sigma)$
  - Adjust average taste parameter and average distinctive cost until simulated premium matches empirical premium and share
- Interpretation:
  - Maps observed internal premium into structural preference for distinctive design
  - Maps real-world share of distinctive buildings into cost of distinctive design
  - Provides a quantitative foundation for policy counterfactuals

Back to Quantification

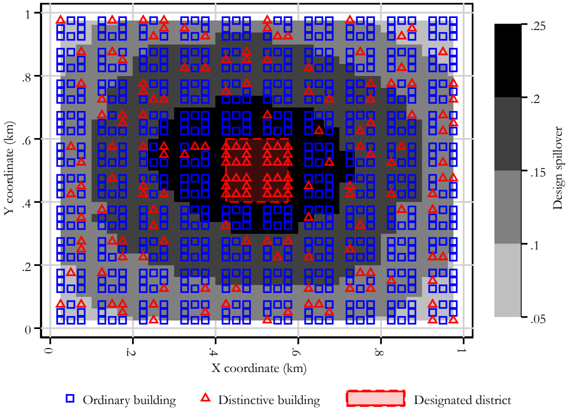
# Subsidy Gradients




- Effects across subsidy levels:
  - Distinctive building share rises smoothly
  - Rents increase, but at diminishing rate
- Margins of adjustment:
  - Utility gain from spillovers
  - Developer profits vs. tax burden
- Welfare profile:
  - Concave, consistent with downward-sloping demand
  - Peak defines Pigovian optimum

Back to Pigovian subsidy

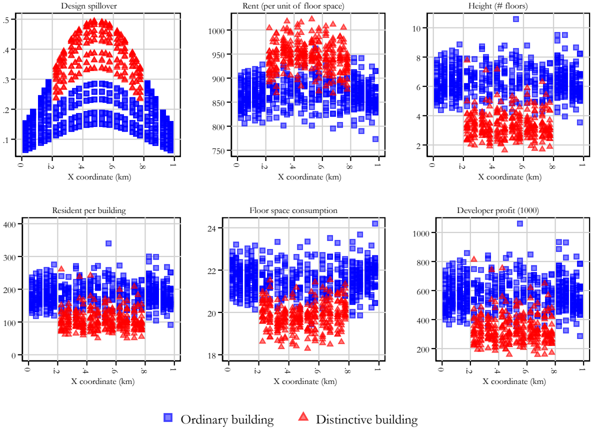
# Mandatory District Map




- Visualizes the location of the mandatory design district
- Shows spatial clustering of distinctive buildings
- Useful for interpreting spillover and coordination effects

Back to Mandatory District

# Mandatory District: Large-Scale Scenario




- When the mandatory district is large:
  - Distinctive share saturates
  - Returns diminish, congestion effects rise
- Welfare impact turns negative
  - Utility and profits decline
- Policy trade-off:
  - Small districts solve coordination
  - Large ones impose inefficiency

Back to Mandatory District