The microgeography of housing supply in England

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Introduction

- Sustained house price rises over past half-century across developed economies
  - Major policy concern in UK
- Raises number of issues:
  1. Affordability / quality of housing
  2. Implications for who can live where (and what opportunities they can access)
  3. And drag on productivity
- How house building responds to *local* demand is essential to understanding these issues
- But little evidence on local housing supply elasticities and their impacts on location choices

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- But little evidence on local housing supply elasticities and their impacts on location choices

This paper

- Characterise differences in housing supply growth in response to house price changes across 6,788 census tract areas in England
  - Over two periods of house price growth, 1996-2006, 2011-2021
  - Measuring the importance of policy and natural constraints
  - Measure the importance of different constraints for local housing mix
- Quantify effects of housing supply on location choices [to come!]

Preview of findings

- Weak local supply response to price changes
  - Elasticity of 0.17 for 1996-2006 and 0 for 2011-2021
  - Comparable estimates from the US 0.30 (Baum-snow and Han, 2022)
- Lower responses in areas with more uneven topography, less land available for development and higher historical housing density
- Housing density and land available for development do more to constrain construction of larger properties than one/two bed properties
- Planning approval less important at small area level

Housing in England

- Only 9% of land is built on
  - Conservation areas (national parks, AONB and SSSI) together cover around one quarter of land
  - Further 13% is covered by green belt, rings around major cities that largely prohibits new building Green belt
- For what's left, house building decisions taken by 393 Local Planning Authorities
  - Strong incentives to be conservative
  - Local spending determined centrally and weakly related to local tax takes
  - Planning permission slow, expensive PQ trend

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Empirical approach

Housing supply equation

$$\Delta \log Q_i = \gamma(Z_i) \Delta \log P_i + \Delta u_i$$

- u_i local productivity shock
- Elasticities $\gamma(Z_i)$ vary according to vector of local constraints Z_i:
- P_i local house price
- ... u_i and P_i correlated ($\Longrightarrow$ downward bias to OLS)

Identification

- Use shift-share (shifts in labour demand) to get exogenous variation in prices
- Geographic areas are small $\implies$ using only local employment shares $\implies$ weak instrument
- Also account for employment growth in potential commute destinations using changes in **'residential market access'** (Baum-Snow and Han, 2022)

Residential Market Access (BH, 2022)

- Derived from spatial equilibrium model
- Workers choose locations based on expected wage, housing costs and amenities, then commute destinations
- Productivity in each potential destination are draws from Fréchet, with shape parameter ϵ
  - ϵ determines how specific worker-location match is
- Wages in different destinations discounted according to commute time and disutility of commuting (κ)
- Model $\implies$ gravity model for commute flows
- Fewer commuters from *i* to *j* implies $\uparrow \kappa\epsilon$

Calculating Residential Market Access

- Solve simultaneous equations:

$$RMA_i = \sum_j \frac{L_j e^{-\epsilon\kappa\tau_{ij}}}{FMA_j}$$

$$FMA_j = \sum_i \frac{\pi_i e^{-\epsilon\kappa\tau_{ij}}}{RMA_i}$$

- RMA_i 'residential market access'
- FMA_j 'firm market access'
- π_i of residents
- L_i of workers
- τ_{ij} commute time
- κ, ϵ parameters from gravity model

Predicted $RMA_{i,t}$

Solve for

$$\widetilde{RMA}_{i,t} = \sum_j \frac{\tilde{L}_{j,t} e^{-\epsilon\kappa\tau_{ij}}}{\widetilde{FMA}_{j,t}} \tag{1}$$

and

$$\widetilde{FMA}_{j,t} = \sum_i \frac{\pi_{i,t_0} e^{-\epsilon\kappa\tau_{ij}}}{\widetilde{RMA}_{i,t}} \tag{2}$$

π_{i,t_0} residents shifted by population growth

$\tilde{L}_{j,t}$ shift-share predicted employment

Control function specification

- 2SLS with many interactions not feasilbe
- Instead use control function
- Estimate:

$$\Delta \ln Q_i = \gamma(Z_i)\Delta \ln P_i + \zeta \hat{v}_i + \omega_i \tag{3}$$

- $\hat{v}_i$ residual from a regression of $\Delta \ln P_i$ on $\Delta \ln \widetilde{RMA}_i$
- Assumes $(\Delta u_i, \hat{v}_i) \perp Z_i$ and $\Delta \ln \widetilde{RMA}_i$

Data

Data I

Housing data

- Number of housing units from the Valuation Office Agency
- House prices and characteristics from UK Land Registry (universe of transactions)
  - Quality adjust using house type, freehold vs leasehold and month of sale

Constraints

- Historical housing density
- Share of land available for development

  $\rightarrow$ derived using satellite data on land cover (water bodies, cliffs, built up areas) and locations of green belt, national parks and SSSIs
- Geographical constraints, including max - min elevation, landslide risk, and radon
- Historic refusal rates for major projects (1975-1990) from Hilber and Vermeulen (2016)

Data II

Commuting data

- Travel times from National Travel Survey

Employment and population

- Annual Employment Survey and Annual Business Inquiry for employment and industry classification (two digit SIC 1992 measured in 1991)
- Labour Force Survey and Annual Population Survey for resident populations
- Construct 10 metro regions (larger than commuting zones/TTWAs)

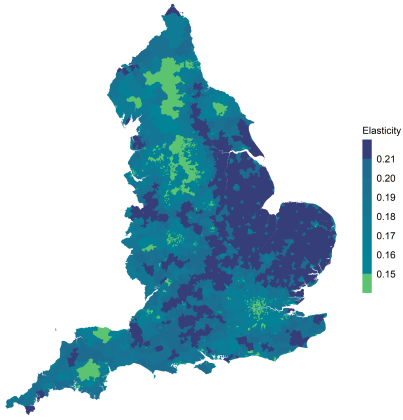
Results

Supply elasticities 1996 - 2006

	OLS	+controls	+interactions	+control func.	lasso
Δ log P	0.031	0.096***	0.112***	0.166*	0.167
	[-0.003,0.065]	[0.066,0.127]	[0.083,0.141]	[0.001,0.332]	[-0.005,0.323]
Radon * Δ log P			-0.001	-0.001	
			[-0.003,0.002]	[-0.001,0.003]	
Elevation * Δ log P			-0.012***	-0.012***	-0.012***
			[-0.016,-0.009]	[-0.016,-0.009]	[-0.015,-0.008]
Landslides * Δ log P			0.000	0.000*	
			[-0.001,0.001]	[0.000,0.002]	
Housing density * Δ log P			-0.018***	-0.018***	-0.018***
			[-0.024,-0.013]	[-0.023,-0.012]	[-0.022,-0.012]
Sh. unconstrained * Δ log P			0.009***	0.009***	0.009***
			[0.006,0.013]	[0.005,0.012]	[0.005,0.012]
Refusal rate * Δ log P			0.000	0.000	
			[-0.003,0.004]	[-0.005,0.002]	
$\hat{v}_i$				-0.054*	-0.056
				[-0.335,-0.001]	[-0.329,0.004]
R2	0.021	0.073	0.113	0.113	0.113
Observations	6,788	6,788	6,788	6,788	6,788
Controls	No	Yes	Yes	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ specification

Elasticities map, 1996-2006



Supply elasticities 2011 - 2021

	OLS	+controls	+interactions	+control func.	lasso
Δ log P	0.044**	0.064***	0.067***	0.030	0.030
	[0.014,0.075]	[0.031,0.096]	[0.037,0.096]	[-0.183,0.175]	[-0.183,0.175]
Radon * Δ log P			-0.009	-0.009	-0.009
			[-0.021,0.003]	[-0.023,0.003]	[-0.023,0.003]
Elevation * Δ log P			-0.047***	-0.047***	-0.047***
			[-0.062,-0.032]	[-0.051,-0.021]	[-0.051,-0.021]
Landslides * Δ log P			0.000	0.000	
			[-0.006,0.006]	[-0.006,0.005]	
Housing density * Δ log P			-0.061***	-0.061***	-0.061***
			[-0.082,-0.040]	[-0.064,-0.023]	[-0.064,-0.023]
Sh. unconstrained * Δ log P			0.014	0.014	0.014
			[-0.005,0.032]	[-0.021,0.013]	[-0.021,0.013]
Refusal rate * Δ log P			-0.025***	-0.026***	-0.026***
			[-0.040,-0.011]	[-0.046,-0.019]	[-0.046,-0.019]
$\hat{v}_i$				0.037	0.037
				[-0.181,0.180]	[-0.181,0.180]
R2	0.023	0.045	0.075	0.075	0.075
Observations	6,788	6,788	6,788	6,788	6,788
Controls	No	Yes	Yes	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Intensive margin

Supply elasticities 2011 - 2021: by property size

	1/2 bed	3+ bed	Ratio 1/2 vs 3+ bed
Δ log P	0.170	-0.156	0.223*
	[-0.119,0.357]	[-0.608,0.223]	[0.022,0.460]
Radon * Δ log P	-0.008	-0.005	-0.003
	[-0.026,0.012]	[-0.035,0.015]	[-0.006,0.009]
Elevation * Δ log P	-0.080***	-0.043*	-0.017
	[-0.081,-0.035]	[-0.049,-0.006]	[-0.016,0.007]
Landslides * Δ log P	-0.001	-0.003	-0.001
	[-0.007,0.003]	[-0.010,0.005]	[-0.003,0.004]
Housing density * Δ log P	-0.090***	-0.058*	0.028*
	[-0.111,-0.040]	[-0.052,-0.004]	[0.004,0.032]
Sh. unconstrained * Δ log P	-0.045***	0.057***	-0.041***
	[-0.082,-0.029]	[0.014,0.056]	[-0.046,-0.022]
Refusal rate * Δ log P	-0.018**	-0.010	0.017
	[-0.055,-0.016]	[-0.036,0.005]	[-0.003,0.021]
$\hat{v}_i$	-0.048	0.218	-0.186*
	[-0.374,0.104]	[-0.231,0.610]	[-0.463,-0.037]
Constant	0.111	0.201	-0.022
	[-0.026,0.211]	[-0.031,0.354]	[-0.127,0.074]
R2	0.125	0.055	0.162
Observations	6,788	6,785	6,788

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Summary and conclusions

- Elasticities are low: ≈ 0.17 1996-2006; ≈ 0 2011 - 2021

  $\Longrightarrow$ demand-side home ownership policies likely to push up prices

- Differences in elasticities mainly driven by available land and existing housing density

  $\Longrightarrow$ less role for planning decisions at local levels

- Share of land available/urban density mean marginal units are smaller (fewer bedrooms)

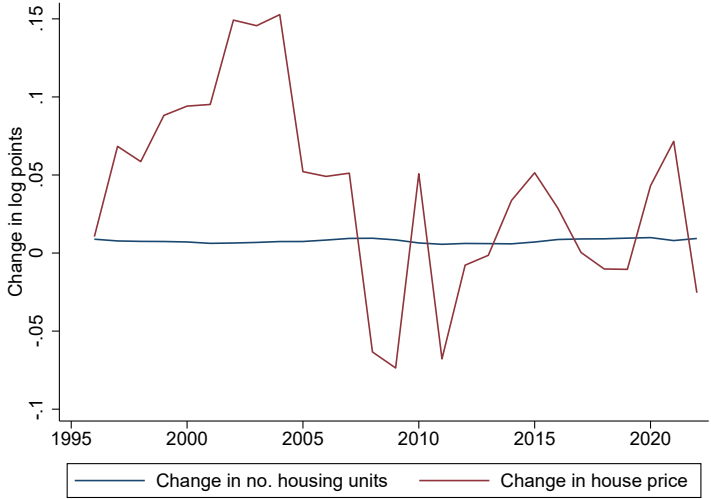
  $\Longrightarrow$ Potential implications for resident composition e.g. families

- Next steps:
  - Measure impact of elasticities on growth in local workforce/resident families
  - Consider effects of policies (limited release of green belt land)

Thank you!

Extras

Supply looks unresponsive



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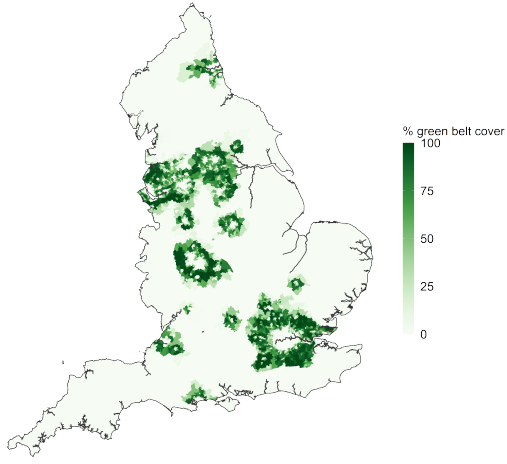

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Housing supply regressions

- Control variables:
  - Initial price, elderly share, higher educated share, initial employment rate, metro-region FE and quadratic distance to CBD
- Weight by initial number of housing units
- For control function use wild-cluster bootstrap
  - Recommended for IV when clustering in Roodman et al. (2019)
  - Use method in MacKinnon (2014) to obtain CIs
  - Cluster at LA level (defn of RMA)
- Standardise all Z variables
  - Coefficient on price is elasticity in location with mean characteristics
  - Coefficients are effect of changing constraints by 1 s.d.

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Supply elasticities 2011 - 2021: no. bedrooms

	OLS	+controls	+interactions	+control func.	lasso
Δ log P	0.010	0.064***	0.044**	-0.007	-0.007
	[-0.017,0.038]	[0.031,0.096]	[0.016,0.071]	[-0.221,0.140]	[-0.222,0.139]
Radon * Δ log P			-0.009	-0.009	-0.009
			[-0.020,0.002]	[-0.023,0.000]	[-0.023,0.000]
Elevation * Δ log P			-0.039***	-0.040***	-0.040***
			[-0.053,-0.025]	[-0.044,-0.017]	[-0.044,-0.018]
Landslides * Δ log P			-0.000	-0.000	
			[-0.006,0.006]	[-0.007,0.005]	
Housing density * Δ log P			-0.059***	-0.059***	-0.059***
			[-0.077,-0.042]	[-0.056,-0.023]	[-0.056,-0.023]
Sh. unconstrained * Δ log P			0.032***	0.032	0.032
			[0.016,0.048]	[-0.003,0.027]	[-0.003,0.027]
Refusal rate * Δ log P			-0.024***	-0.024***	-0.024***
			[-0.037,-0.011]	[-0.041,-0.017]	[-0.041,-0.017]
$\hat{v}_i$				0.051	0.051
				[-0.136,0.220]	[-0.136,0.220]
R2	0.011	0.045	0.078	0.078	0.078
Observations	6,788	6,788	6,788	6,788	6,788

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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Variance decomposition

Share of variance in elasticities explained by

	Owen-Shapely (%)
Housing density	46
Share unconstrained	39
Elevation	12
Refusal rate	3
Landslides	0
Radon	0