The Incidence of Local Public Spending Under Imperfect Mobility: Evidence from London

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November 2026

Abstract

The level of local public spending is a key input in local services, the quality of which can be capitalised into local house prices. If residents are fully mobile, this value should be captured by landlords, but under imperfect mobility the effect is not clear. I study London, where 33 local councils provide local services inside a common housing and labour market. Almost a quarter of households are beneficiaries of welfare or council support which cannot be transferred across boroughs, making them de facto immobile. Using the 2010 cuts to borough funding, I compare quality-adjusted house-price changes for homes near the same borough boundary but exposed to different spending cuts. I find that a 10 percent increase in council spending raises house prices by 0.9 percent. I use this estimate in a quantitative spatial model of the city, and show that when a council cuts services, private rents in the borough fall, offsetting part of the loss to private renters. Immobile residents are unable to re-sort, so more of the effect of a spending change falls on them, and all of it falls on social tenants, whose rents do not change. The funding cuts were deepest in boroughs with a higher share of immobile residents, so they bore a disproportionately large share of the welfare losses.

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1 Introduction

Local governments provide services that are important drivers of where households decide to live. If households were able to move freely within a city, areas with better local government services would have higher house prices, such that the value of these services would accrue to housing owners (Oates, 1969; Roback, 1982; Rosen, 1974). From this perspective, local government cuts would decrease land values but would not affect the welfare of local households since any costs of the cuts would be passed onto housing owners (Glaeser & Gottlieb, 2008; Kline & Moretti, 2014).

This changes when some households cannot move. Consider a neighbourhood in the city whose funding, and therefore public service provision, falls. As a result, the attractiveness of the location falls and so does the demand for living there. Prices and rents will decrease in this neighbourhood such that freely mobile renters are made whole, and the costs are ultimately borne by landlords. If households cannot move however, they bear some of the effect of the cut. In my context, the UK, many households rely on local welfare and council support that they would lose if they relocated. Tenants in social and rent-regulated housing are one such group (Diamond et al., 2019; Hughes & McCormick, 1981), and others depend on benefits or care that cannot be transferred across local governments. The incidence of spending cuts therefore depends on where immobile households live and how spending cuts are allocated across local authorities. This motivates the research question of this paper: what is the incidence of local spending cuts when some residents are immobile?

I study this question in the context of the 2010 funding cuts to London's local governments. London offers an ideal setting to answer this question, as its 33 local authorities (boroughs) provide services separately within one housing and labour market, and the spending cuts that followed the 2010 Spending Review varied widely across them. The cuts were deepest in the boroughs where social tenants live. I estimate house-price differentials across local-authority borders to identify the implicit price of local government spending. House prices increase by 0.9 percent with a 10 percent increase in spending. I then use this estimate in a spatial equilibrium model of the city that includes both immobile households and households that can choose where in the city to locate. I find that households that live in social housing took 31 percent of the total costs of spending cuts in the local authorities with above-average cuts, despite representing only 24 percent of total housing value in London.

The 32 London boroughs and the City of London provide refuse collection, street-cleaning, local roads and libraries, but housing markets are integrated across local-authority borders

and many households commute to work in other local authorities. London also has the largest share of households living in social housing (23.1 percent) out of all English and Welsh regions.

Neighbouring homes on either side of a local-authority border share their neighbourhood but not their council, and I use this to estimate the implicit price of local government spending. Following an approach developed in the context of valuing school quality (Bayer et al., 2007; Gibbons et al., 2013), I compare quality-adjusted house-price changes before and after spending cuts for properties within 500 metres on either side of a local-authority border. My identifying assumption is that, in the absence of differential spending cuts, quality-adjusted house prices would have evolved similarly on either side of a local-authority border. Quality-adjusted house prices did evolve similarly on either side of a border prior to the spending cuts but diverged as the spending cuts were implemented. My identification strategy is unaffected by any correlation between the size of the spending cuts and the prevalence of immobile households since I conduct my analysis within each local-authority border segment. I estimate an elasticity of quality-adjusted house-price changes with respect to changes in spending of 0.092. Given that the housing stock and floor area per household are unchanged over this period, I interpret this effect as capturing the full willingness of households to pay for local government spending.

This willingness-to-pay effect measures the total value of the lost services, but not who ends up paying for them. Once immobile households remain and mobile households optimise floor area, part of the incidence falls on private renters, since the reduction in floor-area rents will be less than the implicit value of local spending. More of it falls on other immobile households, and all of it falls on social tenants, whose rents do not change.

To measure this incidence, I build a model of London's local authorities in the tradition of Ahlfeldt et al. (2015) in which households optimise where they live and work and offices and shops optimise the floor area they demand. Social tenants and a share of other households that rely on council support are modelled as immobile. Spending cuts enter the model as a reduction in residential amenities and are parameterised using the implicit price of local government spending estimated above. I use this model to examine the incidence of London local-authority spending cuts once all general-equilibrium effects have played out.

The 2010 cuts fell where immobile households live. The change in spending relative to the London average exhibits a correlation of -0.67 with the share of households living in social housing. At the willingness-to-pay effect estimated above, the value of lost services in present-value terms in the 14 above-average spending-cut local authorities totals £7.7bn. If interpreted as a capitalised effect, all of these losses would fall on owners of housing stock.

Instead, social tenants incur 31 percent of the losses, which is greater than the 24 percent they would incur on average under allocations of the spending cut unrelated to where social tenants live. Once mobile households optimise floor area, owners of housing stock incur 18 percent of the losses, down from 69 percent when floor area is fixed, and about half of losses are redistributed to other households in London, while social tenants continue to incur 31 percent of the losses.

Holding the total saving fixed, the allocation of the spending cut across local authorities determines its incidence. Consider instead a uniform spending cut of £75 per resident per annum in all local authorities, which yields the same total saving. Such a cut would imply that social tenants incur 16 percent of losses and would give social tenants a net-present-value gain of £0.7bn. Since a cut of £75 per resident is a small fraction of spending in local authorities with large per-resident budgets, and per-resident spending was positively correlated with the share of social tenants, this counterfactual implies a gain to social tenants.

This paper contributes to the literature on the incidence of local shocks in settings in which some households are immobile for institutional reasons. Busso et al. (2013), Kline and Moretti (2014), and Suárez Serrato and Zidar (2016) study how the incidence of local shocks is split between workers, landowners and firm owners when idiosyncratic preferences limit mobility. In their settings, the households that incur part of the loss remain due to their preferences over locations. Notowidigdo (2020) shows that low-skill households in declining localities are partially compensated by falling housing prices. In my setting, households are immobile for institutional rather than preference-based reasons and can be characterised by their type of tenure: while private renters receive some compensation via falling floor-area rents, social tenants do not since they do not face a change in floor-area rents. My paper is also related to research documenting that rent regulation allows tenants to remain in housing (Diamond et al., 2019) and impacts prices on neighbouring units (Autor et al., 2014). In my setting, rent regulation implies that the full incidence of local spending cuts falls on social tenants.

This paper also contributes to the literature that uses housing prices to estimate the implicit value of local public goods provision (Cellini et al., 2010; Oates, 1969). Hilber et al. (2011) document that grants received by local authorities in England are largely capitalised into house prices, implying that such grants accrue primarily to owners of housing stock. However, capitalisation effects may not correspond to willingness-to-pay effects once households re-sort and optimise floor area (Kuminoff et al., 2013; Sieg et al., 2004). My approach is also related to quantitative models of cities in which amenities are backed out as a residual (Ahlfeldt et al., 2015) or modelled endogenously (Almagro & Domínguez-Iino, 2025). I instead estimate the

implicit value of amenities that vary at the border of the local government that provides them and parameterise a quantitative model with these estimates. Finally, my paper emphasises that when some households are immobile relative to their local government, the incidence of local shocks depends not only on the magnitude of those shocks but also on how those shocks are allocated across local governments.

The rest of this paper is organised as follows. Section 2 provides background on local-authority-provided amenities, the 2010 spending cuts, and which households are immobile. Section 3 estimates the implicit value of local-authority-provided amenities using variation at local-authority borders. Section 4 derives analytical expressions for the incidence of shocks to local-authority-provided amenities. Section 5 calibrates a quantitative model of London. Section 6 applies the quantitative model to the 2010 spending cuts. Section 7 concludes.

2 Council services, immobile residents and the 2010 cuts

Local authorities in London provide street services. They also provide or organise housing services, local welfare support and social care, and they commission schools. Transport, fire and police services in London are provided at a citywide level by the Greater London Authority and so are outside the scope of this paper. These services are funded through council tax, central government grants and, for some services, a proportion of locally collected business rates.

I measure council spending by the per capita expenditure of local authorities on street services, which I define as central services and administration, planning and development, environmental and regulatory services, cultural and related services, and highways and transport from revenue outturn data (Ministry of Housing, Communities and Local Government, 2026b). These services are used by all residents of a street and were more discretionary for local authorities to cut back on than other spending. Spending on adult and children's social care, schools, housing benefit and other benefits or transfers to households, and public health is excluded. Data on expenditure and other variables used in the empirical model are described in Appendix A.

Social renters are the largest group of immobile residents in London. In the 2021 Census, 23.1 percent of households in London rent social housing, the highest proportion of any region in England and Wales (Office for National Statistics, 2023b, 2023c). Valuing homes at 2009 prices, social renting accounts for 24 percent of the value of London's housing stock. Housing allocation rules make social renters immobile. Social homes are allocated using points-based

or priority-band systems which typically include local-connection criteria (Department for Communities and Local Government, 2012), and tenancies are rarely transferred between local authorities. Losing a below-market social rent and having to re-enter the housing queue in a new local authority deters moves. This is consistent with the association between council housing and lower mobility found in previous research in the UK context (Gibbons et al., 2020; Hughes & McCormick, 1981). Gibbons et al. (2020) find little evidence of additional moves after the 2013 benefit reform which restricted housing benefit for social renters with a spare bedroom (the so-called bedroom tax). Moreover, since social rents are set according to a nationwide rent formula that determines the change in rents each year, they respond little to local labour and housing market conditions (Ministry of Housing, Communities and Local Government, 2019).

Some market renters are immobile too. Council Tax Reduction, local welfare support and adult social care are provided by the local council and cannot be carried to another local authority, as discussed in Appendix A. I refer to these households as immobile market renters.

2.1 The 2010 funding cuts

Since deprived local authorities relied more on central government grants, the 2010 cuts to these grants affected deprived areas more than affluent areas (Amin-Smith & Phillips, 2019). Pre-reform house price growth is not associated with the treatment intensity (see Appendix Table 7). I measure treatment intensity as the change in council spending between 2009-10 and 2013-14 relative to the mean change in council spending over this period, with boroughs weighted by the value of their housing. The value-weighted mean of the borough changes, which I subtract to form this measure, is a fall of 29.2 log points. The London-wide component of the cuts is common to all boroughs, and residents in each borough bear it in full, which is equivalent to treating London as a closed city (see Appendix F).

Figure 1 shows that relative spending cuts were largest in local authorities with larger proportions of immobile residents. Expenditure changes relative to London correlate -0.67 with the proportion of social renting and -0.51 with the predicted proportion of immobile residents. Westminster, Islington and Barking and Dagenham had the largest relative cuts, while Havering and Croydon had the smallest (excluding the City of London).

In the next section, I use revealed preferences at the margin to estimate the value of street services. Since 14 local authorities saw relatively larger decreases in spending than the London average, I refer to the value of the implied decrease in services in these local authorities relative

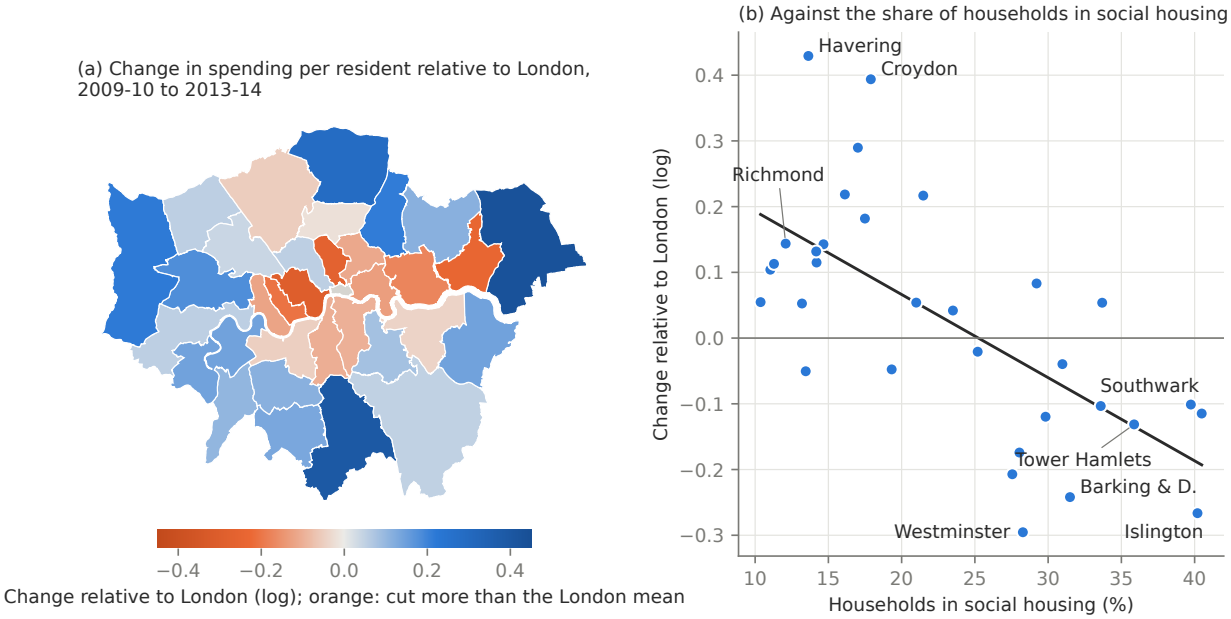


Figure 1: Where the 2010 cuts fell

Notes: Panel a maps the change in spending per resident on council services from 2009-10 to 2013-14 relative to the London mean, in logs. Panel b plots it against the share of households in social housing.

to the London average as losses.

3 Estimating the value of council services at borough boundaries

My empirical strategy exploits variation in spending cuts at borough boundaries. Properties on either side of local authority boundaries are similar in unobserved characteristics but are provided services by different local authorities that experienced different changes in grants and hence council spending after the 2010 reform. I exploit this variation to estimate the association between changes in quality-adjusted property prices and changes in council spending on street services around local authority boundaries (similar to Black, 1999; Gibbons et al., 2013; Grembi et al., 2016; Keele & Titiunik, 2015).

I compare quality-adjusted house prices, using house price data from HM Land Registry matched with property characteristics from energy performance certificates (Chi et al., 2021a, 2021b). Using hedonic regressions (see HM Land Registry (2026) and Appendix B for details), I estimate quality-adjusted house price indices $\hat{\pi}_{jr}$ for each local authority r and one-kilometre local-authority-boundary segment j for pre- and post-reform periods. I then estimate the association between changes in council spending G_r per capita on street services and changes

in quality-adjusted house prices around local authority boundaries:

$$\Delta\hat{\pi}_{jr} = \lambda_j + \beta\,\Delta \log G_r + \nu_{jr}, \tag{1}$$

using observations from 2008-09 and 2013-14 for quality-adjusted house prices and 2009-10 and 2013-14 for council spending. λ_j are boundary segment fixed effects ensuring that estimation uses variation within one-kilometre stretches of local authority boundaries (and therefore is not picking up correlations between treatment intensity and deprivation or tenure type across local authorities). My preferred specification includes properties within 500 metres of boundaries excluding those within 50 metres (donut specification), where uncertainty around postcode delimitation is highest. Inference is based on standard errors clustered at the boundary segment level. Appendix Figure 6 maps the boundary segments used for estimation and Figure 2 illustrates the comparison.

The identifying assumption behind this strategy is that in the absence of differential spending cuts quality-adjusted house prices would have evolved similarly on either side of local authority boundaries. Including boundary segment fixed effects controls for time-invariant differences in characteristics of neighbourhoods and housing stock as well as compositional effects stemming from residential sorting around local authority boundaries (see Bayer et al., 2007).

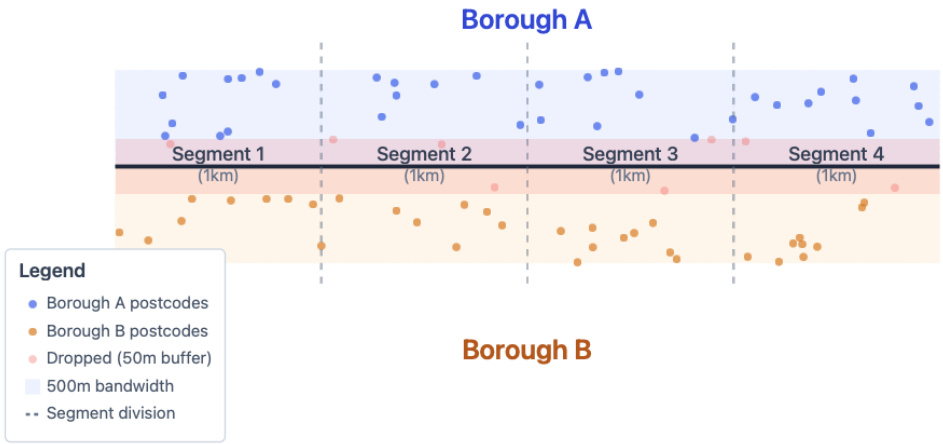


Figure 2: The border comparison

Notes: Homes close to the same borough border but served by different councils.

3.1 Estimate

In my preferred specification (Table 1, column 1), quality-adjusted house prices increase by 0.9 percent when spending increases by 10 percent ($\beta = 0.092$, standard error 0.042). This is the equivalent of £4,542 at the average transaction price of £516,274 and average spending in the estimation sample around local authority boundaries, where 10 percent equates to £39 per capita per annum.

Figure 3 shows that quality-adjusted house prices evolved similarly on either side of local authority boundaries in the sample without the donut prior to the reform (the joint significance p-value of the pre-reform coefficients is 0.70) and diverged during its roll-out. Appendix Figure 8 shows a similar pattern for my preferred specification. Table 1 reports results when also including properties within 50 metres of the boundaries (column 2) and using alternative bandwidths around local authority boundaries of 800 (column 3) and 300 metres (column 4).

Given that the housing stock and space per household are held constant, this estimate can be interpreted as the total willingness to pay for changes in street services from 2010 to 2014. I will return to how this total benefit accrues to households given the possibility of re-sorting in Section 4.

Table 1: House prices and council spending at borough borders

	(1)	(2)	(3)	(4)
Log change in council spending	0.092**	0.089**	0.095**	0.117**
	(0.042)	(0.040)	(0.039)	(0.049)
Segment fixed effects	Yes	Yes	Yes	Yes
Bandwidth	500m	500m	800m	300m
Donut	50m	No	50m	50m
Segment-borough cells	806	830	877	705

Notes: The dependent variable is the change in the quality-adjusted price index between 2008-09 and 2013-14. All columns include one-kilometre segment fixed effects. Standard errors in parentheses, clustered at the segment level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

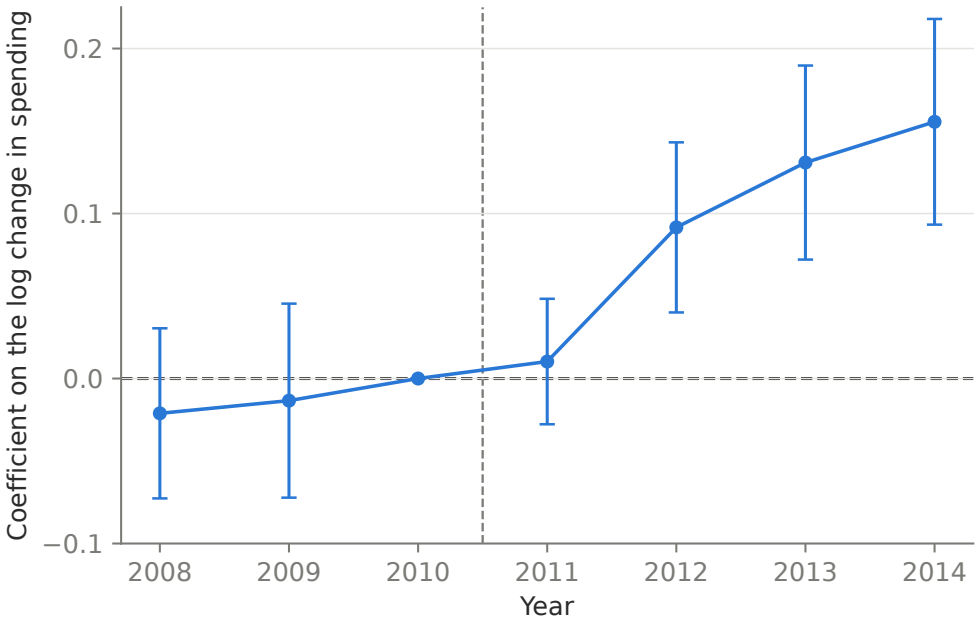


Figure 3: House prices around the 2010 reform

Notes: 95 percent confidence intervals, clustered at the segment level.

4 Incidence of a permanent spending change

Borough r is one of London's 33 local authorities, $\hat{g}_r$ is the change in its spending per resident relative to London, in logs, and V_r is the value of housing in r. Changes $\hat{g}_r$ sum to zero in values of housing, $\sum_r V_r \hat{g}_r = 0$. Some housing stock is regulated (in London, social housing), with rents not set by the market, and some is market housing with market-determined rents. Let ω_r be the share of the value of housing that is regulated in r. Market housing is part of the market for floor space along with shops and offices. Let Q_r be the price of floor space in the market segment.

Whether a household can move determines how much of a change in $\hat{g}_r$ it keeps. Tenants in the regulated sector cannot move their housing contract to another borough, so I take all social housing tenants as immobile. All other London households (owner-occupiers and private renters) pay market prices for housing, and I call them market renters. Assume a fraction t_r of households in market housing are immobile market renters and the rest are mobile, free to live in any London borough.

Households value changes in local public services relative to their spending on housing, just as buyers at the border do. Thus households of type $s \in \{H, L\}$ (high- and low-skill) get a utility benefit of $(1 - \alpha_s)\beta\hat{g}_r$ in log utility from a change in spending, with $1 - \alpha_s$ the share

of income spent on housing. Market renters get this benefit net of changes in the price of housing, $(1-\alpha_s)[\beta\hat{g}_r - \hat{Q}_r]$, where $\hat{Q}_r$ is the change in the relative price of market floor space. In the case of a permanent change this latter term can be written as $\beta\hat{g}_r - \hat{Q}_r$ multiplied by the (present) value of the household's home, regardless of who owns it (see Appendix D). Summing across households and assuming they all live in the average home in r gives the implied incidence of the total value of the spending change across households in r:

$$\beta\hat{g}_r V_r = \underbrace{\hat{Q}_r\,(1-\omega_r)V_r}_{\text{owners}} + \underbrace{\big(\beta\hat{g}_r - \hat{Q}_r\big)(1-\omega_r)V_r}_{\text{market renters}} + \underbrace{\beta\hat{g}_r\,\omega_r V_r}_{\text{social tenants}}\,. \tag{2}$$

Because regulated housing rents do not adjust, the full value of changes on this stock accrues to its occupants.

4.1 Sorting elasticity and closure

Two elasticities govern this incidence. The sorting elasticity ε describes the strength of household responses in terms of sorting across space to changes in the relative attractiveness of living in different places. Separately, let e be the elasticity, in absolute value, of floor space used per user (by firms or households) with respect to the price of floor space, holding the built stock fixed. Then $e = 0$ corresponds to completely inelastic (fixed) space demands, implying that the number of households in each borough is fixed. In contrast, $e = 1$ corresponds to households and firms adjusting space elastically such that each user spends a fixed share of its budget on floor space.

With these assumptions and the stock of market floor space fixed, market clearing requires

$$0 \;=\; S_r\left[\beta\hat{g}_r - \hat{Q}_r\right] \;-\; e\,\hat{Q}_r \qquad \Longrightarrow \qquad \hat{Q}_r \;=\; \frac{S_r}{S_r + e}\,\beta\hat{g}_r, \tag{3}$$

where S_r is the elasticity of demand for market floor space with respect to the net gain from living in r. The first term of (3) is the increase in floor space demanded by mobile households due to sorting into r, and the second term reflects reductions in floor space demanded by all users due to price increases. If $e = 0$ no mobile households can enter (or exit) r, implying that $\hat{Q}_r = \beta\hat{g}_r$. Allowing for reductions in floor space demanded allows mobile households to enter (exit) r and means that $\hat{Q}_r < \beta\hat{g}_r$ for a rise in spending. S_r is increasing in ε and in the share of total spending on floor space in r accounted for by mobile households, and decreasing in the presence of shops, offices and immobile market renters, who do not adjust their presence in response to $\hat{Q}_r$ (see Appendix D).

The model implies the following expression for S_r (Appendix D):

$$S_r \;=\; \varepsilon \sum_s (1-\alpha_s)\, m_{rs}\, (1-\pi_{rs}), \tag{4}$$

where π_{rs} is the fraction of type s mobile households residing in local authority r and m_{rs} is the fraction of spending on floor space in the market in local authority r by type s mobile households. The term $1-\pi_{rs}$ captures the fact that the pool of potential in-migrants is smaller the larger is the fraction of type s mobile households already residing in local authority r. The term m_{rs} captures the effect of in-migration on total demand for floor space relative to the effect on demand for housing and is smaller the larger is the fraction of floor space in local authority r devoted to offices and shops.

Proposition 1. *For any $\varepsilon > 0$ and $e \geq 0$, the value of the change $\beta \hat{g}_r V_r$ accrues to the three groups in the shares*

$$\underbrace{(1-\omega_r)\frac{S_r}{S_r+e}}_{owners} \;+\; \underbrace{(1-\omega_r)\frac{e}{S_r+e}}_{market\ renters} \;+\; \underbrace{\omega_r}_{social\ tenants} \;=\; 1.$$

With $e = 0$, $\hat{Q}_r = \beta \hat{g}_r$, so $1-\omega_r$ accrues to owners, ω_r to social tenants, and market renters have their gain or loss offset by their housing cost. The share of owners falls with e and rises with S_r. The net change accruing to social tenants across London is

$$\beta \sum_r \omega_r V_r\, \hat{g}_r \;=\; \beta\, V\, \mathrm{Cov}_V(\omega_r, \hat{g}_r), \tag{5}$$

where V is the value of all London housing and Cov_V the covariance across boroughs weighted by housing value. It depends on neither e nor ε.

Proposition 1 shows that when space is fixed or mobile households are infinitely elastic in their sorting behaviour, changes in $\hat{g}_r$ are fully capitalised in the value of market housing; otherwise market renters get $e/(S_r+e)$. When $e = 0$, floor space per household is fixed and so I recover the standard result that an amenity is capitalised one-for-one (Roback, 1982). This looks like a standard incidence formula with e playing the role of the supply elasticity (cf., e.g., Kline & Moretti, 2014). Immobile market renters get t_r of the return to market renters and mobile households get the residual.

With $e = 0$ there is no re-sorting, so changes in $\hat{g}_r$ only redistribute value across owners and social housing tenants. Owners as a group get $-\beta V \,\mathrm{Cov}_V(\omega_r, \hat{g}_r)$ and social housing tenants

the opposite. Thus social housing tenants as a group lose from changes only if spending is cut back more in boroughs in which they are disproportionately likely to live.

Immobile market renters bear the share $e/(S_r + e)$ of the fall in council services if their local authority is affected, where this loss is net of their fall in rent. Since the rent of social tenants does not fall, they bear all of the loss in council services in affected local authorities.

5 Quantitative application

I compute the values of S_r, and the welfare changes for different households, using a quantitative equilibrium model of London. My model builds on Ahlfeldt et al. (2015) and Redding and Rossi-Hansberg (2017) and includes commuting and location decisions. Households, which belong to one of two skill types, choose where to live and work in one of London's 33 local authorities. Council services enter the model through the residential amenity B_r^s:

$$B_r^s = b_r^s \, G_r^{\eta_s}, \qquad \eta_s = (1 - \alpha_s) \, \beta. \tag{6}$$

where β is common across all boroughs r and household types s. This is the only place where β shows up in the model. Since β measures the value households place on council services, I use the estimate from Section 3.

Some fraction of low-skill households are unable to move to another local authority; I allow these households to choose only where to work. Firms produce using labour of both types as well as floor space, and compete for floor space with households. Since the supply of floor space is fixed in each borough, the equilibrium price of floor space clears the market for floor space in each borough. Owners of floor space collect this rent and so the value of their asset depends on this equilibrium rent.

5.1 Household location and employment decisions

Each household chooses a borough in which to live and a borough in which to work. I use the subscript r to denote the local authority of residence and l to denote that of work. I divide households into two skill groups $s \in \{H, L\}$ that differ in income and in their marginal budget share spent on housing $1 - \alpha_s$. All households in London supply one unit of inelastic labour to a local authority l and receive a wage w_l^s. They spend a fraction $1 - \alpha_s$ of their income on floor space in their local authority of residence r and face a price Q_r. I let

$d_{rl} = T_{rl}^{\delta}$ denote commuting costs, with T_{rl} travel time between local authorities r and l and δ a parameter. Households also enjoy local residential amenities B_r^s given in equation (6). Finally, each household has tastes z for each local authority pair (r, l) distributed Fréchet with shape parameter ε. The indirect utility of households of type s living in r and working in l is therefore

$$U_{rl}^s = z \frac{B_r^s \, w_l^s}{d_{rl} \, Q_r^{1-\alpha_s}}. \tag{7}$$

Households maximise this expression choosing r and l. Since low-skill households spend a larger fraction of their income on housing ($\alpha_L < \alpha_H$), their utility is more sensitive to the price of floor space Q_r.

Aggregating over destinations l, the attractiveness of local authority r to households of type s is

$$\Phi_r^s = \left(B_r^s \, Q_r^{-(1-\alpha_s)}\right)^{\varepsilon} \Psi_r^s, \qquad \Psi_r^s = \sum_l \left(\frac{w_l^s}{d_{rl}}\right)^{\varepsilon}, \tag{8}$$

The term Ψ_r^s summarises commuting opportunities and is a function of the wages accessible to a household of type s in r net of commuting costs. ε is the elasticity of sorting of households across boroughs. Mobile households of type s will choose to live in r with probability $\Phi_r^s / \sum_k \Phi_k^s$. Thus, the fraction of type s households that live in r will increase with $(B_r^s / Q_r^{1-\alpha_s})^{\varepsilon}$ and the set of jobs available to them net of commuting costs.

5.2 Immobile residents

I assume all high-skill households are mobile. In the closed city, they thus number L^H:

$$R_r^H = L^H \frac{\Phi_r^H}{\sum_k \Phi_k^H}. \tag{9}$$

For each local authority r, I divide low-skill households into three groups:

$$R_r^L = \underbrace{\mu_r \, R_r^{L,0}}_{\text{regulated rent}} + \underbrace{\tau \, (1 - \mu_r) \, R_r^{L,0}}_{\text{immobile, market rent}} + \underbrace{R_r^{L,M}}_{\text{mobile}}. \tag{10}$$

The first group are social housing tenants who I assume for simplicity are only of the low-skill type and do not make any endogenous decisions except for where they work. The second group are immobile market renters who make all decisions endogenously except for where they live. The third group are those that are able to make all residential and labour market decisions endogenously.

The fraction of low-skill households in local authority r in social housing is μ_r and the fraction τ of low-skill households that are not in social housing are immobile. Both of these fractions are set as described in Appendix A. Market renters that are immobile make up a fraction t_r of households that consume market housing in local authority r. The value of housing for social tenants is equal to the average value of housing in their local authority. The total number of low-skill households that can make residential location decisions endogenously is $M^L = (1-\tau)\sum_k (1-\mu_k) R_k^{L,0}$.

I hold the number of immobile households at its baseline value. Mobile households choose their local authority of residence r according to

$$R_r^L = \mu_r R_r^{L,0} + \tau(1-\mu_r) R_r^{L,0} + M^L \frac{\Phi_r^L}{\sum_k \Phi_k^L}, \tag{11}$$

The only component of this expression that is a function of wages, housing prices, and council services is the last term.

5.3 Production and floor space

Production in l uses high-skill and low-skill labour and floor space according to

$$Y_l = A_l \, N_l^{\gamma/\rho} \, F_l^{1-\gamma}, \qquad N_l = (L_l^H)^\rho + \phi \, (L_l^L)^\rho, \tag{12}$$

where I assume $\gamma = 0.6$, $\rho = 1/2$ corresponding to an elasticity of substitution between high-skill and low-skill labour of 2, and $\phi = 1$. Wages are equal to marginal products (see equation (16) in Appendix C). TFP, A_l, is always kept at its calibrated value when doing counterfactuals.

Total spending on market floor space in r, E_r, includes spending by firms and households that do not live in social housing. Firms spend a fixed share, $\kappa = 0.4$, of their total wage bill on floor space. This corresponds to firms accounting on average for 47 percent of spending on market floor space in the model, which is similar to the share of commercial floor space in F_r.

Social housing tenants keep using the same amount of floor space as in the status quo, $H_r^{\text{reg}} = (1-\alpha_L) \, \bar{y}_r^{L,0} \, \mu_r R_r^{L,0} / Q_r^0$, where Q_r^0 is the aggregate amount spent on floor space in r before normalising prices divided by total floor space in r, F_r. This floor space is not part of the market. All other demanders of floor space, both firms and households, have the same elasticity of floor space with respect to its price, e, as introduced in Section 4. When $e > 0$,

the equilibrium price of floor space solves

$$\left(\frac{Q_r}{Q_r^0}\right)^e = \frac{E_r}{E_r^0}, \qquad E_r^0 = Q_r^0\big(F_r - H_r^{\text{reg}}\big), \tag{13}$$

where E_r^0 is status quo spending on market floor space. The first equation implies that when spending on floor space in r goes up by 1 percent, the price goes up by $1/e$ percent. The case where $e = 1$ corresponds to the housing demand implied by the utility function (7), which assumes a constant expenditure share on housing. When $e = 0$, all demanders keep their status quo demand and the population in each borough is equal to its status quo level. The price of floor space then absorbs any changes in amenities.

5.4 Equilibrium

For given total factor productivity, commuting times, amenities, housing floor space, and government spending across London's boroughs, an equilibrium consists of employment, wages, floor space prices, and the distribution of households across boroughs that solves equations (8), (9), (11) and (13), as well as the commuting probabilities (15) and the equations for wages (16). The total numbers of high- and low-skill households in London are fixed. For each value of ε and e I solve for an equilibrium assuming no change in council services, which I refer to as the status quo. To solve for a counterfactual equilibrium, I multiply residential amenities for households of skill type s living in borough r, B_r^s, by $\exp(\eta_s \hat{g}_r)$. See Appendix C.8 for how I calculate welfare for each type of household.

5.5 Calibration and fit

The calibration matches where Londoners of each skill lived and worked in 2011. To back out amenities and productivity levels, I assume that commuting costs are as estimated using 2011 commuting flows and the elasticity of sorting of households across boroughs, ε, is 3.53, chosen to match the variance of log workplace wages as in Ahlfeldt et al. (2015) (see Table 2 for a summary of estimates). I assume that London is closed and calculate welfare as an equivalent variation relative to London as a whole as a percent of consumption. I set τ equal to 0.2. In London, 23 percent of residents live in social housing. Given this value of τ, 6 percent live in unsubsidised immobile rental housing and 71 percent are free to make all decisions endogenously.

There are two parameters in the model that I estimate. First, I estimate the value Londoners

place on council services, β, using the discontinuity in house price changes at local authority borders. My estimate for this parameter is $\beta = 0.092$. Second, I estimate the product of the elasticity of sorting and the elasticity of commuting costs with respect to travel times, $\varepsilon\delta$, using a Poisson regression of commuting flows on travel times (Appendix Table 11). My estimate of this parameter is $\varepsilon\delta = 2.854$. Dividing by my benchmark value of ε gives $\delta = 0.81$.

Table 2: Parameters

Parameter	Value	Source
β, value of council services	0.092	Section 3
$\varepsilon\delta$, commuting costs	2.854	Commuting flows
ε, sorting elasticity	3.53	Log wage variance
$1-\alpha_H$, $1-\alpha_L$, housing shares	0.30, 0.40	Housing surveys
η_H, η_L	0.028, 0.037	$(1-\alpha_s)\beta$
μ_r, social tenants	by borough	Census
τ, immobile market renters	0.2	
e, space	0 to 1.5	Literature

Notes: The gravity regression is in Appendix Table 11. ε matches the variance of log workplace wages, following Ahlfeldt et al. (2015). Housing shares follow Ministry of Housing, Communities and Local Government (2025a) and Office for National Statistics (2025); the range of e follows Davis and Ortalo-Magné (2011) and Albouy et al. (2016).

The model matches untargeted wages and prices across boroughs well. Appendix Table 12 shows that log wages predicted by the model, which are not targeted (only their variance sets ε), have a correlation of 0.82 with log ASHE wages, and log prices of floor space have a correlation of 0.77 with log house prices.

Outside evidence puts e between two thirds and one. I use the finding of Davis and Ortalo-Magné (2011) that housing expenditure shares are relatively constant across time and space to set $e = 1$, and the estimate of Albouy et al. (2016) of a housing demand elasticity of two thirds to motivate $e = 0.67$, and report results for e between 0 and 1.5. Finally, with space fixed the model's price response equals β exactly, and as space adjusts it stays close to that of the sharing rule in Proposition 1 (see Appendix E).

Three sets of parameters enter into the sharing rule from Proposition 1. The first is β, the value Londoners place on council services, which multiplies changes in welfare and in pounds. The second set of parameters determines S_r, the response of demand for market floor space in borough r to the net gain from living there. S_r is determined by ε, the housing expenditure shares by skill, the fraction of firm expenditure spent on floor space and the share of immobile market renters. The final parameter is e, which determines the fraction of a change that is absorbed by floor space prices.

Sorting moves demand for floor space far less than ε alone would suggest. I compute S_r to average 0.56 across London's boroughs. This is around a sixth of the elasticity of sorting, because on average households spend only part of their income on housing and offices and shops account for a large fraction of total expenditure on space in most boroughs.

6 The 2010 cuts

6.1 Incidence by group

Social tenants bore 31 percent of the losses in the 14 boroughs that were cut deeper than the London mean (£7.7bn in present value), even though social housing makes up only 24 percent of London's housing value (Table 3). This 31 percent is the social share of housing value in the cut boroughs, weighted by the size of each borough's loss.

Table 3: Incidence of the 2010 cuts by group

	Share of London's	Share of the losses (%)		Welfare range (% of consumption)	
	housing value (%)	Space fixed	Space adjusts ($e = 1$)	Space fixed	Space adjusts ($e = 1$)
Owners	76	69	18	–	–
Social tenants	24	31	31	−1.1 to +1.6	−1.1 to +1.5
Immobile market renters		0	1	0	−1.0 to +0.9
Mobile households		0	50	–	–

Notes: $\varepsilon = 3.53$. Welfare is in percent of consumption relative to London.

Social housing was concentrated where the cuts were deeper. It made up 29 percent of the value of housing in above-average cut local authorities and 18 percent in below-average cut local authorities. As a result, social tenants bore 31 percent of the losses from spending cuts but only 17 percent of the gains.

The net loss of social tenants is given by the covariance term in the net-change equation (5). In 2010, this is a net loss of £1.1bn for social tenants ($0.092 \times £1,163\text{bn} \times (-0.010)$; Appendix F), and housing owners as a group gain this amount when space is fixed.

6.2 Incidence when space adjusts

Prices respond less when households can adjust their space. The price response to a change relative to London falls from 0.092 with space fixed to 0.028 with $e = 1$. In the cut boroughs,

market rents fall by less than the value of the lost services, so lower rents partially compensate market renters for the loss from the cut.

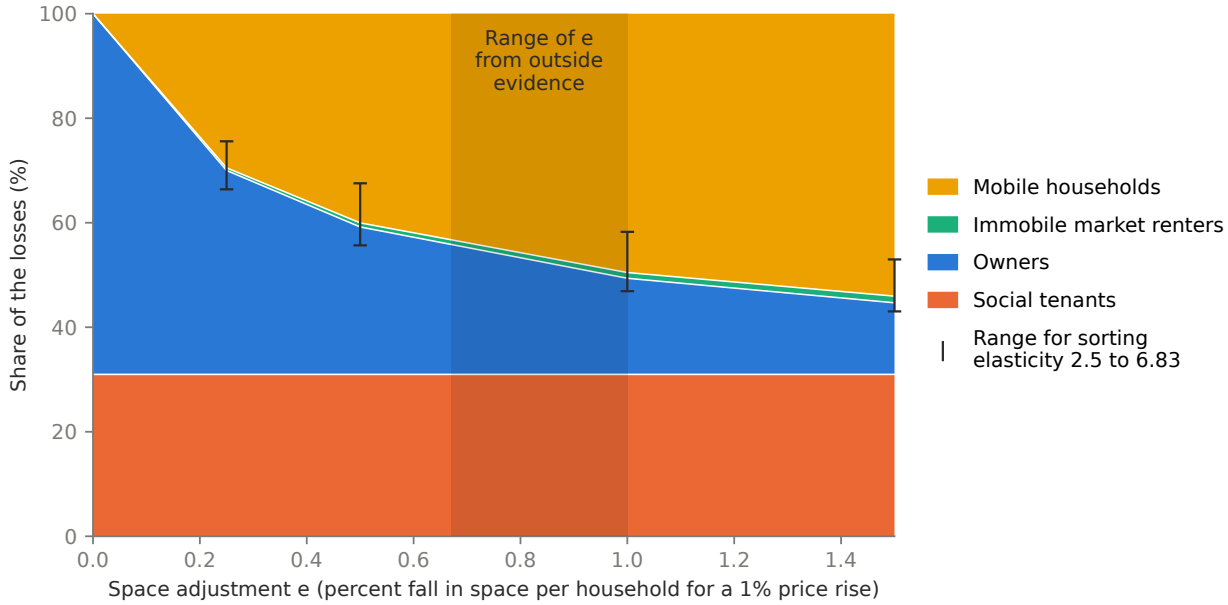


Figure 4: Incidence of the 2010 cuts as space adjusts

Notes: The shaded region is the range of e from outside studies. Whiskers show the share of mobile households at $\varepsilon = 2.5$ and 6.83.

As e rises, the losses move from owners to mobile households (Figure 4). The share of social tenants remains at 31 percent for all e, since their rents did not fall. The share of owners falls from 69 percent when space is fixed to 18 percent when $e = 1$, so that for $e = 1$, social tenants incur a higher share of the losses than owners for all values of the sorting elasticity I consider (Appendix E).

With $e = 1$, around half of the losses fall on mobile households.

6.3 A uniform per-resident cut

A uniform per-resident cut would have turned the net loss of social tenants into a net gain. In this thought experiment, each London borough makes the same saving, £75 per resident per year, with the same total saving. Per-resident budgets were higher in boroughs with more social tenants, so a fixed saving implies a deeper cut relative to London in boroughs with fewer social tenants. In this scenario, social tenants would incur 16 percent of the losses (Table 4) and would make a net gain of £0.7bn.

A uniform cut of £75 per resident would also narrow the range of welfare changes for social

tenants across boroughs (panel b of Figure 5). Under this counterfactual, the predicted welfare change for social tenants is between −0.63 and +0.45 percent of consumption, compared to between −1.1 and +1.6 percent under the actual distribution of spending cuts.

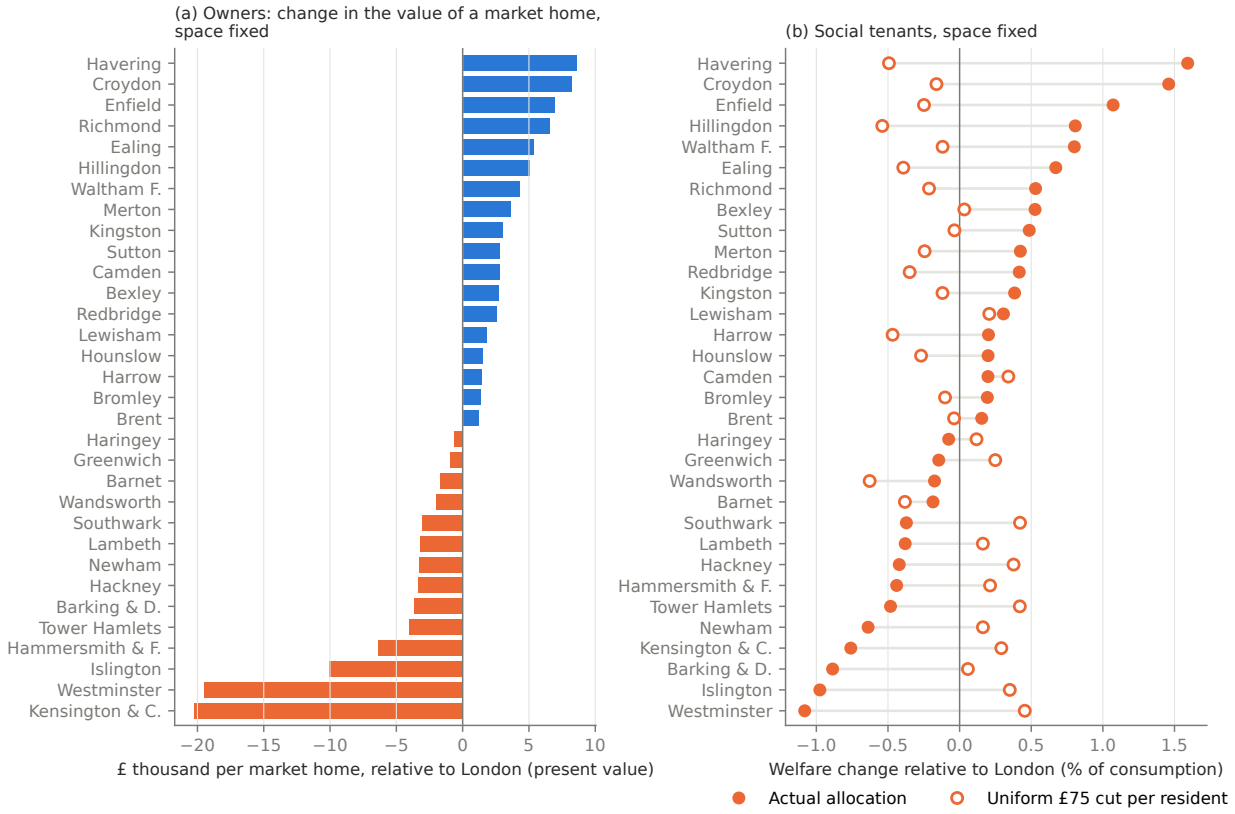


Figure 5: Owners and social tenants by borough, 2010

Notes: Panel a: change in the present value of a market home relative to London, in thousand pounds. Panel b: welfare of social tenants relative to London, in percent of consumption, under the actual allocation and a uniform cut of £75 per resident. Space fixed.

Table 4: Two allocations of the same saving

	Actual	Uniform cut	Uncorrelated with tenure
Change in London spending (log points)	−25.4	−25.4	—
SD across boroughs	0.18	0.09	—
Correlation with social renting	−0.67	+0.83	0
Social tenant share of losses (%)	31	16	24
Social tenant share of housing value (%)	24	24	24
Net change for social tenants (£bn)	−1.1	+0.7	0
Welfare of social tenants in levels (% of consumption)	−1.11	−0.94	—
SD across boroughs (pp)	0.66	0.31	—

Notes: Space fixed. The change in London spending uses 2014 population in both years.

7 Conclusion

The 2010 local spending cuts hit immobile households harder than others, because the cuts were deepest where immobile households live and immobile households cannot move away from them. I provide evidence of this using the 2010 local spending cuts in London's 33 local authorities (boroughs), which all provide similar services within one integrated housing and labour market. Households residing in social housing are immobile, as they would lose their tenancy if they moved, and their regulated rent does not adjust to housing market changes. Using a quantitative spatial model with housing capitalisation, I show that these immobile households suffered disproportionately from the 2010 cuts.

The cuts varied substantially across London's boroughs and were on average larger where the share of households in social housing was higher (social housing share and relative spending cuts have a correlation of −0.67). In boroughs that were cut deeper than the London average, immobile households in social housing suffer 31 percent of the losses in my model but only account for 24 percent of housing value in London. In total, net of gains elsewhere, immobile households in social housing lose £1.1bn (present value) from the 2010 cuts. This is because the cuts were deepest where they live and immobile households in social housing cannot benefit from falling market rents. Had the same amount of total spending been cut uniformly per resident (£75 per resident), immobile households in social housing would have incurred 16 percent of the losses and would have gained £0.7bn (present value), as on average they resided in boroughs with above-average per-resident spending prior to the cuts.

Capitalisation of local spending cuts in house prices cushions mobile households against local spending cuts. In my quantitative spatial model, with space fixed, falling market rents fully cushion mobile renters from local spending cuts. With a fixed supply of floor space, capitalisation of local spending cuts in house prices translates into losses for homeowners. I

estimate that a 10 percent increase in local (council) spending increases house prices by 0.9 percent at London borough borders. Using this elasticity, homeowners bear 69 percent of the losses from the 2010 local spending cuts in the short run, with space fixed, in my model.

In the long run, when space adjusts, households can relocate, and households and firms can adjust the amount of space they use. As a result of these extensive and intensive margin adjustments, market rents fall by less than the value of local spending cuts and cushion mobile renters incompletely. The share of homeowners falls to 18 percent in the long run, and about half of the losses fall on mobile households. In contrast, immobile households in social housing suffer 31 percent of the losses in both the short and long run, as they are unable to benefit from falling market rents.

My analysis has implications beyond the 2010 local spending cuts in London. In many countries, central governments fund local governments according to some funding formula. In big cities, multiple formula-funded local governments provide local services within one integrated housing and labour market, and there may be immobile households that receive some form of rent regulation. More generally, there may be households that are less able to relocate in response to local spending cuts.

Using my framework, it is possible to compute ex ante the share of losses that immobile households will suffer from local spending cuts. All that is required is an estimate of the capitalisation of local spending in house prices and knowledge about the proposed allocation of local spending cuts as well as where immobile households reside. For example, using the allocation of funding under the Fair Funding Review, I find that immobile households in social housing in London would suffer 27 percent of the losses from this reallocation (Appendix G). This illustrates that central governments that care about immobile households also need to consider the allocation of local spending cuts across local governments, not just their overall magnitude.

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A Setting and data

A.1 Council funding

Councils in England are funded by a combination of local and national taxes. Local taxes include council tax and a share of business rates that councils collect on behalf of the government. Nationally, the government provides grants to councils according to a formula that accounts for need and the cost of provision (Amin-Smith & Phillips, 2019). Council tax is based on property values as of 1991 and grouped into property bands. Since 2012, increases beyond a nationally determined cap have required a local referendum.

A.2 Council spending

I use the net current spending of councils, in current pounds, in five areas reported in each council's revenue outturn summary sent to the Ministry of Housing, Communities and Local Government (Ministry of Housing, Communities and Local Government, 2026b): 1) highways and transport, 2) cultural and related services, 3) environmental and regulatory services, 4) planning and development, and 5) central services. All English councils use the same categorisation of services, the Service Reporting Code of Practice of CIPFA (Chartered Institute of Public Finance and Accountancy, 2013), so, for example, spending on planning is reported on the same line item in every council. English councils substantially reduced their spending in these areas during the 2010s: by more than 40 percent in transport and culture and by more than 50 percent in planning (though less in other areas, such as adult social care) (Amin-Smith & Phillips, 2019). Mean spending in these areas is £392 per resident per year in my sample of bordering local authorities in Section 3.

My preferred measure of spending excludes areas such as education, children's and adult social care, public health, and housing that were less discretionary for councils or that are not public goods. Education receives ring-fenced grants and thus does not follow the same logic as other areas of council spending. Transfers to households, such as housing benefit, are meant to supplement the incomes of specific households and are thus different from street-level public goods. Policing, fire and transport in London are provided by the Greater London Authority and thus are not included in borough reports. To calculate per capita spending, I divide spending in these areas by the population of the local authority, using the ONS mid-year population estimates for 2010 (for 2009-10) or 2014 (for 2013-14). I report the change in per capita spending in these areas before the reform, from 2007-08, using the same five

line items, in Figure 7.

A.3 Immobile residents

I measure the share of households in social renting in Census 2021 Table TS054 (Office for National Statistics, 2023c), summing council renting and other social renting, as the table recommends. I use Table TS067 to measure the share of high-skill residents, operationalised as individuals with Level 4 or above qualifications (Office for National Statistics, 2023a), with all other individuals as low-skill.

Eligibility for some services is contingent on residence. For instance, if an individual in a social tenancy moves across local authority boundaries, she surrenders her current tenancy and must apply for housing on the waiting list of the new council. Councils set priorities for the waiting list according to local connection rules, time on the waiting list, and priority bands (Department for Communities and Local Government, 2012).

Even households renting in the private market could see changes in their access to benefits provided by the local council. For instance, after an individual moves to a new local authority, she needs to make a new application for support that is determined by the council, such as Council Tax Reduction (determined according to each council's scheme since April 2013 (HM Government, 2026)), Discretionary Housing Payments and other local welfare assistance (House of Commons Library, 2022), and adult social care, contingent on an assessment by the local authority in which the individual is ordinarily resident (Department of Health and Social Care, 2025). (From April 2026, the Housing Payment element of the Crisis and Resilience Fund replaced Discretionary Housing Payments in England (Department for Work and Pensions, 2026).)

Model implications. Let $R_r^{L,0}$ denote the number of low-skill individuals residing in r at baseline. Let μ_r denote the share of low-skill individuals in r that live in social tenancy. I set μ_r to match the share of households renting from a social landlord in each area, imposing that all social tenants are low-skill, with a cap of 0.95:

$$\mu_r = \min\left\{0.95,\ \frac{\text{social-rented share of households}_r}{\text{low-skill share of residents}_r}\right\}.$$

The cap binds for Hackney, Islington, and the City of London.

Among low-skill individuals in r not living in social tenancy, a fraction τ are immobile and

rent housing in the market. I set $\tau = 0.2$ in all areas, and explore the implications of varying τ between 0 and 0.5 in Appendix E. Thus, the distribution of the $R_r^{L,0}$ low-skill individuals in r across the immobile in regulated housing, the immobile in market housing and the mobile is given by $\mu_r R_r^{L,0}$, $\tau(1-\mu_r)R_r^{L,0}$, and $(1-\tau)(1-\mu_r)R_r^{L,0}$, respectively (equation (10)). Across London, 23 percent of individuals are immobile in regulated housing, 6 percent are immobile in market housing, and 71 percent are mobile.

The share of immobile market renters among market renters in r is given by

$$t_r = \frac{\tau(1-\mu_r)R_r^{L,0}}{R_r^{H,0} + R_r^{L,0} - \mu_r R_r^{L,0}},$$

where the denominator is the number of all individuals residing in r at baseline who do not reside in social housing.

Housing values. Let V_r denote the value of housing stock in r, which I measure as the product of the average transaction price in 2009 (P_r) and the number of households (h_r) in Census 2021. Let h_r^{soc} denote the number of households in social renting in r. Under the maintained assumption that housing is homogeneous within a local authority, the share of housing value in social renting is simply given by $\omega_r = P_r h_r^{\text{soc}}/(P_r h_r) = h_r^{\text{soc}}/h_r$, which is the share of households in social renting. In London as a whole, housing under regulation accounts for 24 percent of housing value.

A.4 Transactions and model data

The data sources are as follows. House prices are from house sales data from HM Land Registry (HM Land Registry, 2026). Fixed effects are at the level of one-kilometre segments of the boundary. I use postcodes on house sales to merge them to these border segments. Spending per resident is revenue expenditure (referred to as the revenue outturn in the data) divided by population (obtained from mid-year population estimates by the ONS). Information about skills, commuting and housing tenure comes from the 2011 and 2021 Censuses (Office for National Statistics, 2014, 2021, 2023a, 2023c). Wages at the workplace come from the Annual Survey of Hours and Earnings (Office for National Statistics, 2026). Information about travel times by public transportation comes from Transport for London (Transport for London, 2026). Commercial space is obtained from the Valuation Office Agency (Valuation Office Agency, 2026). The rest of this appendix provides more detailed information about data and variable construction, and Table 5 follows the sample from linked transactions down

to the final sample of 806 segment-borough cells. This paper contains HM Land Registry data © Crown copyright and database right 2026, licensed under the Open Government Licence v3.0.

I combine data on property characteristics from energy performance certificates and transaction data from HM Land Registry (Chi et al., 2021a; HM Land Registry, 2026). The latter reports the transaction price and date, property type, and whether a property is a new build; the former reports floor area, number of habitable rooms, and energy efficiency rating. For the hedonic price regression in Section 3, I use properties transacted in 2008-09 and 2013-14 located within 500 metres but further than 50 metres from the boundary with complete data on property characteristics. I drop segment-borough cells observed in only one of the two time periods, as well as segments for which differencing leaves only one local authority in the final regression.

I calibrate the model to match the distribution of residents by skill type and employment by skill type in each area in 2011. I use data from the Valuation Office Agency (Valuation Office Agency, 2026) on commercial floor space, which I add to the floor area of residences to construct the measure of floor space in each area. I do not calibrate the model to match area-level average wages (constructed using data from the Annual Survey of Hours and Earnings, Office for National Statistics (2026)) or house prices, and instead use these to check the fit of the model (see Table 12).

A.5 The City of London

The City of London is one of the 33 local authorities in my setting, and I include its residents, workplaces, and floor space in computing each equilibrium, and include it when constructing the London average when measuring changes relative to London or imposing the restriction $\sum_r V_r \hat{g}_r = 0$. However, I exclude it when computing summary statistics reported in the paper (means, standard deviations, shares of the losses, correlations, etc.). This is because (i) it has very few residents (around 6,000 in 2014, whereas other local authorities all have more than 150,000), and (ii) it has by far the largest increase in per-capita spending between 2009-10 and 2013-14.

Table 5: Construction of the border sample

	Sales	Cells
London sales, 2007–15	778,643	
Within 1 km of a borough border	452,177	
Sold in 2008–09 or 2013–14	184,221	
Within 500 metres of a border	107,881	
More than 50 metres from a border	97,293	
With all property characteristics	85,803	
Segment-borough-period cells		1,927
Observed before and after the reform		1,906
Differenced		960
Final sample		806

Notes: HM Land Registry sales, linked to property characteristics by Chi et al. (2021a, 2021b).

B Border design

B.1 The sample

I obtain price indices using a standard hedonic equation estimated by regression. I index sales i, segments of the borough boundary j, local authorities r, and time periods before and after the reform p. The hedonic equation I estimate on various samples of sales is given by

$$\log P_{ijrp} = X_i'\delta + \pi_{jrp} + u_{ijrp}, \tag{14}$$

where P_{ijrp} is the price of the sale and X_i includes controls for log floor area, property type, energy efficiency rating, whether the home is a new build, and the number of habitable rooms. The fixed effect π_{jrp} is interpreted as the log price of a home with particular characteristics in period p on the side of segment j served by local authority r. My estimates of these fixed effects $\hat{\pi}_{jr}$ provide the price indices. I use the evolution of these indices in equation (1) to estimate the impact of local spending on housing prices.

Figure 6 shows the sample.

The exact effect on prices of a 10 percent rise in spending is $1.1^{\beta} - 1$, or 0.88 percent.

B.2 The comparison

For each stretch of border, I track houses on either side of the border around the reform and relate the difference in changes in (quality-adjusted) house prices to the difference in

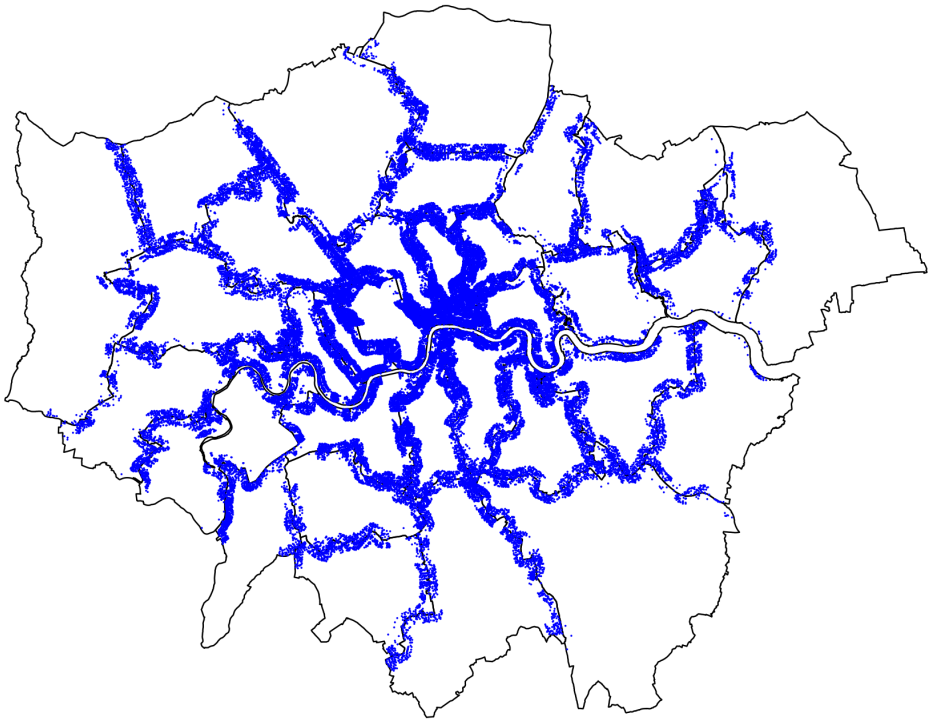


Figure 6: The border sample

changes in spending by the two local councils (Figure 2). Within a stretch of border, λ_j in equation (1) controls for everything that is common to the two sides of the border, so only the difference in changes in spending matters for identification.

B.3 Balance

Pre-reform characteristics are balanced across the two sides of each border. To check balance in pre-determined characteristics across segment-borough cells, I standardise each characteristic and then run a regression of each standardised characteristic on the change in spending by the local council (scaled such that a coefficient of one corresponds to a change of 0.10 log points) within each border segment. In Table 6, I report the coefficient on the change in spending from each of these nine regressions. Eight of the nine coefficients are statistically insignificant at the 10 percent level and none of the coefficients is larger than 0.04 standard deviations in absolute value.

Table 6: Pre-reform attributes and the spending change at borough borders

	Mean	Coefficient	Standard error
Log price	12.646	−0.017	(0.014)
Log floor area	4.303	−0.013	(0.016)
Rooms	3.769	−0.005	(0.012)
New build	0.141	−0.033	(0.029)
Flat	0.628	−0.013	(0.014)
Terraced	0.254	0.003	(0.015)
Detached or semi-detached	0.118	0.015	(0.010)
EPC rating A–C	0.424	−0.037*	(0.019)
Distance to border (metres)	263.698	−0.029	(0.019)

Notes: Standard errors in parentheses, clustered at the segment level; * $p < 0.10$.

B.4 The spending change across boroughs

Because changes in spending are driven by grant formulas that account for need, across local authorities changes in spending are correlated with pre-determined characteristics. In Table 7, I report a regression of the change in spending per resident on the 2007 Index of Multiple Deprivation (negative correlation), population, pre-reform spending, and house price growth between 2007 and 2009 (insignificant) for each local authority. In Figure 7, I plot pre- and post-reform spending changes against deprivation. These cross-sectional differences are controlled for in my design using segment fixed effects since I compare outcomes on either side of the same border. Note that the share of households renting from social landlords is highly correlated with the Index of Multiple Deprivation (correlation of 0.82).

B.5 Pre-reform trends and robustness

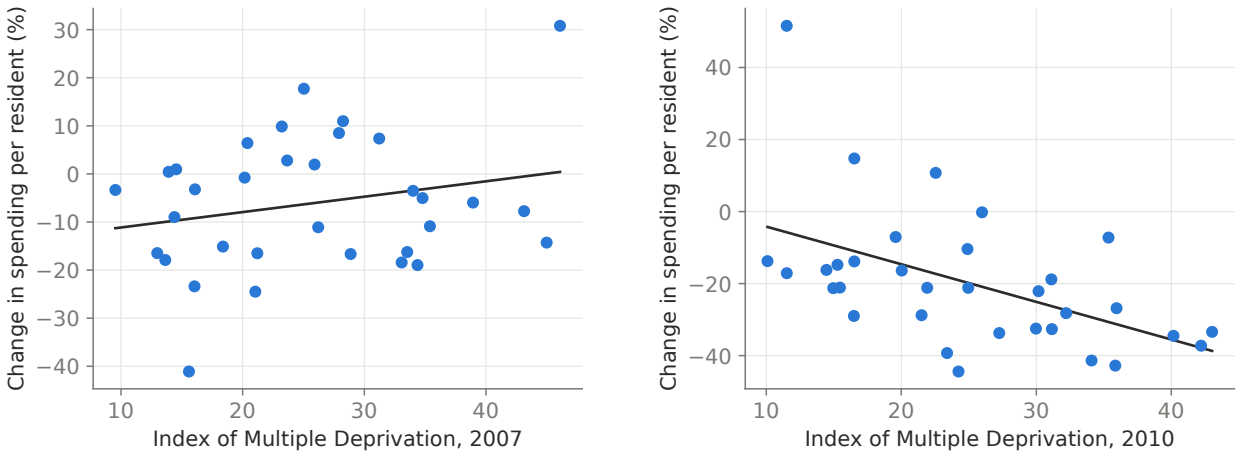
Prices on either side of a border moved together before the reform and diverged as spending was cut (Figure 3). In 2008 and 2009, the estimates are respectively −0.021 and −0.013 relative to 2010, suggesting that there are no differential trends in prices on either side of the border, regardless of which side will suffer greater spending cuts. From 2011 onwards, the gap between the evolution of prices on either side of the border opens up and then increases further: the estimates are 0.010 in 2011, 0.092 in 2012, 0.131 in 2013, and 0.156 in 2014. This evolution takes place over exactly the time period in which spending was cut.

The border estimate passes three further checks (Table 10). In column 1, I implement a placebo exercise where I pretend that the reform took place in 2008, and the estimate is 0.006. In column 2, I remove from the sample sales near borders with parks or the river

Table 7: Borough characteristics and the 2010 spending change

	(1)	(2)	(3)
Deprivation index, 2007	−0.011**		−0.013**
	(0.005)		(0.005)
Log population, 2008	−0.069		0.027
	(0.190)		(0.188)
Log spending per resident, 2009–10	0.040		0.134
	(0.190)		(0.185)
House price growth, 2007–09		−0.868	−0.850
		(0.788)	(0.657)
R-squared	0.423	0.054	0.466
F-statistic	12.83	1.214	9.100
Observations	33	33	33

Notes: Robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.



(a) 2007-08 to 2009-10

(b) 2009-10 to 2013-14

Figure 7: Spending changes and deprivation

Notes: Panel a uses the 2007 Index of Multiple Deprivation and panel b the 2010 index.

Thames, where the two sides of the border might not belong to the same neighbourhood, and reduce the bandwidth to 300 metres. The estimate increases to 0.122 (standard error 0.061, $N = 476$) relative to my preferred estimate. In column 3, I interact changes in spending with an indicator for local authorities with above-median spending on street services in 2009-10. The estimate on the interaction is close to zero, suggesting that the effect of spending cuts is not different for local authorities with high initial spending relative to those with low spending. This provides further support for assuming a single elasticity for all local authorities in the model in Section 5.

My estimate does not rely on any single local authority or border. The estimates range from 0.055 to 0.116 when I drop one local authority at a time, and from 0.053 to 0.109 when I drop one of the 76 local-authority-pair borders at a time. I finally compute standard errors that allow for arbitrary correlation across residuals of geographically close segments (Conley, 1999). The resulting standard errors range from 0.035 to 0.050 as I vary the distance cutoff at which correlation is allowed from 1 to 10 kilometres, bracketing the standard error when clustering at the segment level of 0.042.

B.6 Inference

Spending varies across only 33 local authorities, and the estimate stays statistically significant at the 5 percent level when inference allows for this. The estimation sample consists of 806 segment-borough cells on 335 segments, along 76 borders between pairs of local authorities. In Table 8, I report alternative measures of the precision of the preferred estimate. The standard error is 0.041 (0.042) when clustering by local authority (segment). With only 33 clusters, I also conduct a wild cluster bootstrap (Cameron et al., 2008; Roodman et al., 2019) at the local authority level, using Webb weights, imposing the null and using 9,999 replications; the resulting p-value is 0.04. Finally, I conduct randomisation inference, reassigning changes in spending across local authorities 999 times and re-estimating equation (1) each time; the resulting two-sided p-value is 0.001. In Table 8, I also report Conley (1999) spatial standard errors (demeaning to account for the segment fixed effects and using a uniform kernel) computed at the level of the same segment-borough cells using cutoffs of 1, 2, 5 and 10 kilometres.

Table 8: Inference on the border estimate

	Standard error	p-value	Clusters
Clustered by segment	0.042	0.029	335
Clustered by borough	0.041	0.031	33
Two-way clustered	0.042	0.037	335 / 33
Wild cluster bootstrap		0.044	33
Randomisation inference		0.001	
Conley standard errors			
1 km	0.050		
2 km	0.035		
5 km	0.035		
10 km	0.046		

Notes: Wild cluster bootstrap with Webb weights and 9,999 replications; randomisation inference with 999 draws.

B.7 Event study on the preferred sample

The event study on the preferred sample shows the same pattern. In Figure 8 and Table 9, I conduct the event study of Figure 3 using only houses that are more than 50 metres away from the border, consistent with the preferred specification. The coefficients on 2008 and 2009 are -0.030 and -0.039 and are jointly insignificant (p-value $= 0.26$), and the path after the reform is similar to that of Figure 3.

Table 9: Event study coefficients, preferred sample

Year	Coefficient	Standard error
2008	-0.030	(0.026)
2009	-0.039	(0.030)
2010	0	–
2011	0.003	(0.020)
2012	0.086^{***}	(0.027)
2013	0.129^{***}	(0.031)
2014	0.163^{***}	(0.034)
Segment fixed effects	Yes	
Bandwidth	500m	
Donut	50m	
Pre-trend p-value	0.26	

Notes: Standard errors in parentheses, clustered at the segment level; *** $p < 0.01$.

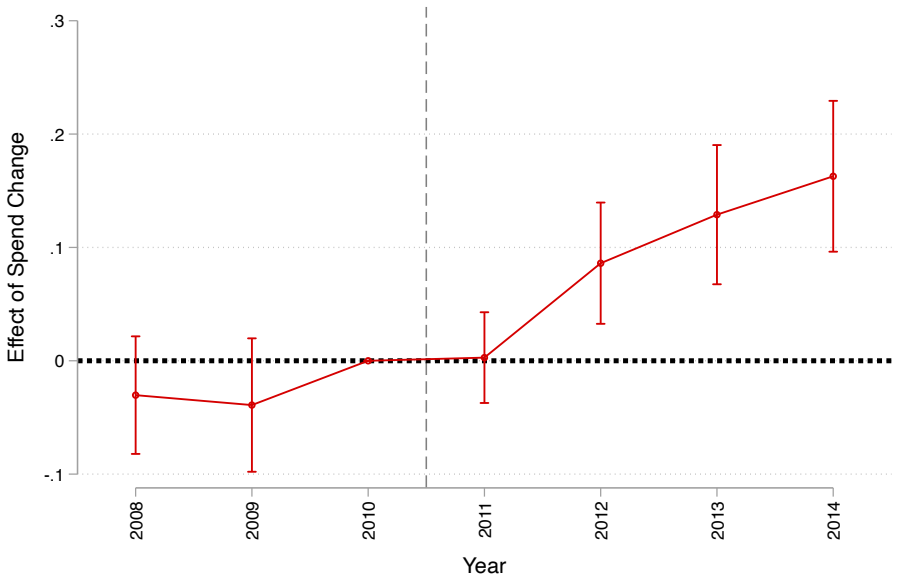


Figure 8: House prices around the 2010 reform, preferred sample
Notes: 95 percent confidence intervals, clustered at the segment level.

C The model

Section 5 describes my model, its equilibrium and its calibration. In this appendix, I describe in more detail the commuting probabilities, the wage equations, the closure with space fixed, the normalisations for the closed city and the open city, the commuting regression and the recovery of amenities on the grid of ε values. I also describe the details of the numerical solver and present welfare changes for different groups.

C.1 Commuting

Aggregating further, the fraction of residents of local authority r (whether mobile or not) that work in l is given by

$$\lambda_{l|r}^{s} = \frac{(w_l^s / d_{rl})^{\varepsilon}}{\Psi_r^s}, \tag{15}$$

and does not depend on local amenities or floor space prices in r. Per-capita income of type-s residents in local authority r is thus $\bar{y}_r^s = \sum_l \lambda_{l|r}^s w_l^s$. Given the population of type-s residents R_r^s, I can also back out the number of type-s workers in local authority l, $L_l^s = \sum_r \lambda_{l|r}^s R_r^s$.

Table 10: Further checks on the border estimate

	(1) Placebo 2008	(2) No parks or river	(3) High spending
Log change in council spending	0.006	0.122**	0.084*
	(0.026)	(0.061)	(0.049)
× high spending			−0.001
			(0.083)
Segment fixed effects	Yes	Yes	Yes
Bandwidth	500m	300m	500m
Donut	50m	50m	50m
Segment-borough cells	790	476	806

Notes: Column 1 dates the reform to 2008. Column 2 drops segments next to a park or the river and uses a 300 metre bandwidth. Column 3 interacts the treatment with above-median spending in 2009-10. Standard errors in parentheses, clustered at the segment level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.2 Wages, spending on floor space and fixed space

Wages in l are given by the marginal products of the production function (12) and solve

$$w_l^H = \gamma\, Y_l\, \frac{(L_l^H)^{\rho-1}}{N_l}, \qquad w_l^L = \gamma\, Y_l\, \frac{\phi\,(L_l^L)^{\rho-1}}{N_l}. \tag{16}$$

In production, floor area is a fixed input. As more people commute to work in a borough, wages in that borough fall, leading employment to be more evenly spread across London.

Spending on the market for floor space in r is given by

$$E_r = (1-\alpha_H)\,\bar{y}_r^H R_r^H + (1-\alpha_L)\,\bar{y}_r^L\big(R_r^L - \mu_r R_r^{L,0}\big) + \kappa\big(w_r^H L_r^H + w_r^L L_r^L\big). \tag{17}$$

where households in social housing do not spend on the market for floor space. The first two terms are spending on floor space by mobile and immobile market renting households who live in r, the final term is spending by firms in r, and I set $\kappa = 0.4$, equal to $1-\gamma$. Note that since I model floor area as a fixed input in production, κ will only impact demand for floor space by firms in the market for floor space. In Table 14 I report results where I instead calibrate κ to 2009 commercial rateable values and results where I instead use the implied payment for floor space given the Cobb-Douglas assumption, $(1-\gamma)/\gamma$.

With $e = 0$ the equation for floor space (13) is replaced by

$$R_r^H + R_r^L = R_r^{H,0} + R_r^{L,0} \qquad \text{for every } r, \tag{18}$$

where I solve for floor space prices such that the number of residents in each borough matches the baseline data. With $e = 0$ no additional mobile households can enter or exit a borough. Thus, the price of floor space in each borough fully absorbs the change in the level of public services.

C.3 Normalisations and the closed city

In the closed city L^H and L^L are fixed. I normalise wages and prices by dividing wages of each type by the geometric mean wage across the 33 local authorities and dividing prices by the geometric mean across the 33 local authorities. Since I normalise wages separately for each skill level, this means that spending on floor space in (17) does not include the skill premia in wages. If I include skill premia of 1.3 and 0.8, the average level of S_r across boroughs remains at 0.56 but the share of the losses falling on mobile households (for $e = 1$) falls from 50 to 49 percent. I report percentage changes in prices relative to the value-weighted price index for London; see Appendix E for more detail.

To calculate welfare changes in levels I include the effect of the change in $\bar{G}$, which is not passed into the model when solving for the closed city. I multiply one plus percentage changes relative to London by $\exp(\eta_s \bar{G})$ to obtain percentage changes in levels, i.e. $100[(1 + w/100)\exp(\eta_s \bar{G}) - 1]$ where w is the percentage change relative to London.

C.4 Open city

For the open city I do not normalise wages or prices, so changes in $\bar{G}$ will impact levels of wages and prices. The population of type s in London is given by

$$L^s = L^{s,0}\left(\frac{W^s}{W^{s,0}}\right)^{\theta}, \qquad W^s = \Big(\sum_k \Phi_k^s\Big)^{1/\varepsilon}, \tag{19}$$

where I report results for $\theta \in \{1, 3.53, 10\}$. I report results for $e = 0$ and $e = 1$ and include social renting households and mobile households but do not include immobile market renting households. I pass the full change in $\hat{G}_r$ into the model. For these exercises the share of the loss falling on owners is given by $\sum_r \hat{Q}_r V_r^{\text{mkt}} \big/ \sum_r \beta \hat{G}_r V_r$, where the sums are over the 32

London boroughs and V_r^{mkt} is the value of market housing as defined in Appendix C.8. I scale amenities for mobile low-skill workers by $[(1-\mu_r)/\overline{(1-\mu)}]^{1/\varepsilon}$, where the mean is over local authorities, so that shares residing in each authority change in proportion to $1-\mu_r$.

C.5 Commuting gravity

Table 11 reports the results from estimating the gravity equation used to set $\varepsilon\delta = 2.854$ in Section 5. The dependent variable is the probability of commuting between local authorities in 2011 and the independent variable of interest is log travel time. I include origin and destination local authority fixed effects and a dummy for living and working in the same local authority. Data are from Office for National Statistics (2014) and Transport for London (2026). The table reports the results from estimating the gravity equation using least squares (column 1) and the Poisson estimator of Santos Silva and Tenreyro (2006) (column 2). I use the Poisson estimate in the model. There are 1,089 origin-destination pairs of local authorities in the sample.

C.6 Amenities on the grid of ε

When I vary ε between 2.5 and 6.83, I hold TFPs fixed at the values I back out when $\varepsilon = 3.53$, let δ vary with ε such that $\varepsilon\delta$ is always equal to 2.854, and back out amenities again. The share of income households spend on housing is 0.30 for high-skilled households and 0.40 for low-skilled households, which implies $\eta_H = 0.028$ and $\eta_L = 0.037$. The wage premium of high-skilled workers is taken as given.

For each value of ε on the grid reported in Appendix E, I back out residential amenities given baseline residents, wages and prices using

$$B_r^s = \left[\frac{R_r^{s,0}}{\sum_l \left(w_l^{s,0} \Big/ \left(d_{rl} \left(Q_r^0 \right)^{1-\alpha_s} \right) \right)^{\varepsilon}} \right]^{1/\varepsilon}, \tag{20}$$

where for mobile low-skill workers I replace $R_r^{L,0}$ with $(1-\tau)(1-\mu_r)R_r^{L,0}$.

C.7 Solution

I solve the model using a damped fixed point algorithm over employment, residents and prices. Starting with an initial guess of employment, residents and prices, I iterate the following steps:

1. calculate wages using (16),
2. calculate commuting using (15),
3. calculate employment,
4. calculate residents using (9) and (11),
5. calculate prices using (13), and
6. renormalise wages and prices.

For $e = 0$ I instead calculate residents using (9) and (11) and then multiply prices by $\left[(R_r^H + R_r^L)/(R_r^{H,0} + R_r^{L,0})\right]^{1/(0.35\varepsilon)}$, where $R_r^H + R_r^L$ is the population implied by (9) and (11). This term is equal to one when (18) holds.

I damp employment, residents and prices by moving 15 percent of the way to the new value in each iteration (7.5 percent for $0 < e < 0.5$). I terminate the algorithm when employment, residents and prices change by less than 10^{-7} in relative terms. All reported exercises converge.

Table 11: Commuting gravity

	(1)	(2)
Log travel time	−4.320***	−2.854***
	(0.132)	(0.117)
Estimator	Least squares	Poisson
Origin fixed effects	Yes	Yes
Destination fixed effects	Yes	Yes
Same authority	Yes	Yes
Pairs	1,089	1,089

Notes: Robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Fit of the baseline

	Correlation
Log wages	0.82
Log prices	0.77

Notes: Correlations between the baseline model and the data. Wages are ASHE workplace means (Office for National Statistics, 2026).

C.8 Welfare in the model

I measure welfare as expected utility and report the percentage change in terms of consumption. Expected utility for mobile type-s households equals $\Gamma(1-1/\varepsilon)\left(\sum_r \Phi_r^s\right)^{1/\varepsilon}$, where $\Gamma(\cdot)$ is the Gamma function, and for immobile households in r it equals $\Gamma(1-1/\varepsilon)\left(\Phi_r^s\right)^{1/\varepsilon}$. As I only consider ratios of welfare, the constant $\Gamma(1-1/\varepsilon)$ cancels out. Denoting with m_Q the average of the log change in prices of floor space weighted by its value (see Appendix E for an expression), I use the prices found by the solver to write the percentage change in expected utilities as

$$\begin{aligned}
\text{mobile, type } s: &\quad 100\left[\frac{W_1^s}{W_0^s}\,\exp((1-\alpha_s)m_Q)-1\right], \qquad W^s=\Big(\sum_r \Phi_r^s\Big)^{1/\varepsilon},\\
\text{immobile, market rent, in } r: &\quad 100\left[\frac{(\Phi_{r,1}^L)^{1/\varepsilon}}{(\Phi_{r,0}^L)^{1/\varepsilon}}\,\exp((1-\alpha_L)m_Q)-1\right],\\
\text{regulated rent, in } r: &\quad 100\left[\frac{(\tilde{\Phi}_{r,1}^L)^{1/\varepsilon}}{(\Phi_{r,0}^L)^{1/\varepsilon}}-1\right],
\end{aligned} \tag{21}$$

where the subscript 0 refers to the status quo and 1 to the counterfactual and $\tilde{\Phi}_{r,1}^L$ is Φ_r^L evaluated using the counterfactual amenities and wages but the status quo price, $Q_{r,0}$. The term $\exp((1-\alpha_s)m_Q)$ normalises the welfare of households paying the market price for floor space with respect to London's price index on floor space weighted by the value of housing. Denoting with $V_r^{\text{mkt}}=(1-\omega_r)V_r$ the value of market floor space in r, the change in the value of market floor space in r relative to London is $(\hat{Q}_r-m_Q)V_r^{\text{mkt}}$. These expressions are analogous to the expression for welfare changes in Appendix D, equation (24), where I held wages and changes in other boroughs fixed. I keep the status quo expenditure shares on housing when computing welfare for values of e other than one.

Welfare for mobile households is determined by the net benefits available across London, since mobile households can reside in any location. Welfare for immobile households is determined by amenities and prices in their borough of residence and wages across London, since they can commute to any location to work. Since social renters pay baseline rent, the full change in amenities accrues to them.

D The sharing rule

Consider a change in council spending in some location, $\hat{g}_r$. Throughout this appendix hats denote log changes; wages, commuting costs and the price level in London are assumed to be unchanged, and $\eta_s=(1-\alpha_s)\beta$. As before, it is the change relative to the average in London

that matters, so amenities increase by $\hat{B}_r^s = (1-\alpha_s)\beta\hat{g}_r$.

D.1 Location choice and the response S_r

From (8) and assuming commuting costs and wages do not change (so $\hat{\Psi}_r^s = 0$), I have

$$\hat{\Phi}_r^s = \varepsilon\big[\hat{B}_r^s - (1-\alpha_s)\hat{Q}_r\big] = \varepsilon\,\hat{u}_{rs},$$

where $\hat{u}_{rs} = (1-\alpha_s)[\beta\hat{g}_r - \hat{Q}_r]$ is the change in net benefits from living in r for a type s household at the market price. The number of mobile type s households residing in r is given by $N_{rs} = L^s\Phi_r^s/\sum_k \Phi_k^s$, hence

$$\hat{N}_{rs} = \varepsilon\,\hat{u}_{rs} - \varepsilon\sum_k \pi_{ks}\,\hat{u}_{ks}, \qquad \pi_{ks} = \frac{\Phi_k^s}{\sum_j \Phi_j^s} = \frac{N_{ks}}{L^s}.$$

Note that the above sum is over all locations including $k = r$. Holding fixed utilities in locations $k \neq r$, I have

$$\hat{N}_{rs} = \varepsilon\,(1-\pi_{rs})\,\hat{u}_{rs}, \tag{22}$$

so the elasticity of the number of type s households living in r with respect to utility for type s households in r is $\varepsilon(1-\pi_{rs})$. The last term, $-\varepsilon\sum_{k\neq r}\pi_{ks}\hat{u}_{ks}$, is the effect of changes in other locations on the number of residents in r. This term is held fixed in the closed form (3) but is present in the full model in Section 5.

D.2 Market clearing

Consider changes in demand for and supply of space in r. There are four types of users of space in the market for floor space in r,

$$j \in \mathcal{J} = \{H \text{ mobile},\ L \text{ mobile},\ L \text{ immobile at market rent},\ \text{firms}\}.$$

Let N_{rj} denote the number of each type of user and assume they use h_{rj} units of floor space. Let $m_{rj} = N_{rj}h_{rj}/\sum_k N_{rk}h_{rk}$ denote the fraction of floor space in r used by each type, which is also the fraction of spending on floor space since all market users face the same price Q_r. Note that $\sum_j m_{rj} = 1$. Regulated floor space used by social renters, H_r^{reg}, is excluded from

the market. Given a fixed supply of floor space in the market, market clearing implies

$$0 = \sum_{j \in \mathcal{J}} m_{rj} \big(\hat{N}_{rj} + \hat{h}_{rj} \big), \qquad \hat{h}_{rj} = -e \, \hat{Q}_r \;\; \text{for every } j,$$

$$\hat{N}_{rj} = \begin{cases} \varepsilon (1 - \pi_{rj}) \, \hat{u}_{rj}, & j \text{ mobile}, \\ 0, & j \text{ immobile at market rent or firms}. \end{cases}$$

Only mobile households enter or leave, by (22). Immobile market renters do not change in number. In the closed form the number of firms in r and their wage bill are also held fixed. In the model, employment in r, and with it the wage bill of firms and their spending on floor space, moves as residents re-sort, which is part of the gap between the model and the closed form (Appendix E). Hence

$$0 = \sum_s m_{rs} \, \varepsilon (1 - \pi_{rs})(1 - \alpha_s) \big[\beta \hat{g}_r - \hat{Q}_r \big] - e \, \hat{Q}_r = S_r \big[\beta \hat{g}_r - \hat{Q}_r \big] - e \, \hat{Q}_r,$$

where S_r is given by (4).

Solving the above equation for $\hat{Q}_r$, market clearing implies $\hat{Q}_r = \beta \hat{g}_r S_r / (S_r + e)$ provided $S_r + e > 0$. In the model, m_{rs} is equal to the fraction of total spending on market floor space, E_r defined in (17), spent by type s mobile households and π_{rs} is equal to the fraction of type s mobile households residing in r.

D.3 The value of a change in services

The value to a type s household of a change in services relative to the London average in its location is

$$(1 - \alpha_s) \, \beta \, \hat{g}_r \tag{23}$$

in terms of log consumption or, in terms of levels of consumption, equation (6). To convert this into the value in terms of housing used in (2), assume a type s household with income y spends $(1 - \alpha_s) y$ per period on housing and let χ denote the constant ratio of rents to the value of housing, so $(1 - \alpha_s) y = \chi P h$, where Ph is the value of housing. The present value of a permanent change in net benefits of $(1 - \alpha_s)[\beta \hat{g}_r - \hat{Q}_r]$ in terms of log consumption is

$$\frac{(1 - \alpha_s) \, y \, [\beta \hat{g}_r - \hat{Q}_r]}{\chi} = [\beta \hat{g}_r - \hat{Q}_r] \, Ph$$

regardless of household type. For a permanent change in amenities the rent and the price of market housing in r both change by $\hat{Q}_r$, so the gain to owners of housing in the market segment in r is $\hat{Q}_r(1-\omega_r)V_r$ while those residing there gain $(\beta\hat{g}_r-\hat{Q}_r)(1-\omega_r)V_r$. The regulated price does not change, so those residing in that segment gain $\beta\hat{g}_r\,\omega_r V_r$, valued at the average price in r. The sum of these terms is $\beta\hat{g}_r V_r$, as in (2). While the price of floor space used for offices and shops also changes by $\hat{Q}_r$, this merely transfers value between owners and firms, so the total value accruing to owners of floor space does not include floor space devoted to these uses. These uses of floor space are nevertheless important for determining the sharing rule because they lower S_r, as they are uses of floor space that are not very responsive to changes in the quality of local government services.

D.4 Welfare

With wages and commuting costs fixed, I can express the change in log consumption of a household of type s as

$$\begin{aligned} \text{immobile market renter, in } r: &\quad (1-\alpha_L)\big[\beta\hat{g}_r-\hat{Q}_r\big] \;=\; (1-\alpha_L)\,\frac{e}{S_r+e}\,\beta\hat{g}_r, \\ \text{social tenant, in } r: &\quad (1-\alpha_L)\,\beta\hat{g}_r, \\ \text{mobile, type } s: &\quad \textstyle\sum_r \pi_{rs}\,(1-\alpha_s)\big[\beta\hat{g}_r-\hat{Q}_r\big]. \end{aligned} \tag{24}$$

Thus, the log change in consumption of a mobile household type is the average log change in consumption across local authorities weighted by the fraction of households of that type that live there. If $e=0$, then the first and last lines are zero and the only type to see a change in consumption will be social tenants.

To obtain (24), start from (3) and (23). For a mobile type s household expected utility is proportional to $(\sum_r \Phi_r^s)^{1/\varepsilon}$, where the constant of proportionality, the Gamma-function term of the Fréchet distribution, drops out of the change in expected utility (see Appendix C.8). Thus the change in log expected utility for such a type s household is

$$\frac{1}{\varepsilon}\sum_r \frac{\Phi_r^s}{\sum_k \Phi_k^s}\,\hat{\Phi}_r^s = \sum_r \pi_{rs}\,\hat{u}_{rs},$$

which is the last line of (24). An immobile type s household residing in r in the market segment can choose where to work but not where to reside. Her expected utility is proportional to $(\Phi_r^s)^{1/\varepsilon}$ and so the change in log expected utility is $\hat{u}_{rs}=(1-\alpha_s)[\beta\hat{g}_r-\hat{Q}_r]$. Using (3) to replace $\hat{Q}_r$, this can be written $(1-\alpha_s)\beta\hat{g}_r\,e/(S_r+e)$. For a household in the regulated

segment the analogous expression with $\hat{Q}_r = 0$ is $(1 - \alpha_L)\beta\hat{g}_r$.

D.5 Proposition 1 with space fixed

With $S_r > 0$ for every r with any mobile households and $\varepsilon > 0$, it follows from (3) that with $e = 0$, $\hat{Q}_r = \beta\hat{g}_r$ for all r. For any household residing in the market segment it then follows that $\hat{u}_{rs} = 0$; the benefit of higher quality services is just offset by an increase in the cost of housing. The gain accruing to owners of housing in the market segment in r is $\hat{Q}_r(1 - \omega_r)V_r = \beta\hat{g}_r(1 - \omega_r)V_r$ as above. Those residing in the regulated segment in r gain $\beta\hat{g}_r\,\omega_r V_r$. Thus the shares accruing to these two groups are $1 - \omega_r$ and ω_r, respectively.

D.6 Proposition 1

Divide each term in (2) by $\beta\hat{g}_r V_r$ and use (3) to obtain

$$\underbrace{(1 - \omega_r)\frac{S_r}{S_r + e}}_{\text{owners}} + \underbrace{(1 - \omega_r)\frac{e}{S_r + e}}_{\text{market renters}} + \underbrace{\omega_r}_{\text{social tenants}} = 1.$$

Suppose a fraction t_r of households residing in the market segment in r are immobile and suppose each household's housing is valued at the average value in r. Then the second term above, accruing to households residing in the market segment in r, can be further decomposed into a component, $(1-\omega_r)t_r\,e/(S_r+e)$, accruing to immobile households residing in the market segment in r and a component, $(1 - \omega_r)(1 - t_r)\,e/(S_r + e)$, accruing to mobile households. But according to (24) a mobile household's component depends on $\hat{g}_r$ only through its effect on the London average weighted by π_{rs}, so this latter component in fact accrues to mobile households across London. Finally, note that the component accruing to owners of housing has a partial derivative with respect to e of $-(1-\omega_r)S_r/(S_r+e)^2 \leq 0$ and a partial derivative with respect to S_r of $(1 - \omega_r)\,e/(S_r + e)^2 \geq 0$.

D.7 Equation (5)

According to the proposition, those residing in the regulated segment in r gain $\beta\omega_r V_r\hat{g}_r$ for any e and ε. Summing across r and denoting the average regulated share across London,

weighted by housing values, by $\bar{\omega} = \sum_r V_r \omega_r / V$, it follows that

$$\beta \sum_r \omega_r V_r \hat{g}_r = \beta \sum_r (\omega_r - \bar{\omega}) V_r \hat{g}_r + \beta\, \bar{\omega} \sum_r V_r \hat{g}_r = \beta\, V \sum_r \frac{V_r}{V} (\omega_r - \bar{\omega}) \hat{g}_r.$$

The second term is zero because $\sum_r V_r \hat{g}_r = 0$. Since this also implies that the average of $\hat{g}_r$, weighted by V_r, is zero, the last term is the covariance (weighted by V_r) between ω_r and $\hat{g}_r$, denoted $\mathrm{Cov}_V(\omega_r, \hat{g}_r)$, giving (5). With $e = 0$ those owning housing gain $\beta \sum_r (1 - \omega_r) V_r \hat{g}_r = -\beta V \,\mathrm{Cov}_V(\omega_r, \hat{g}_r)$.

E Model robustness and grids

E.1 The change relative to London and the price index

In the model I use $\hat{g}_r = \hat{G}_r - \bar{G}$, where $\hat{G}_r = \ln G_r^{\text{2013-14}} - \ln G_r^{\text{2009-10}}$ and $\bar{G} = \sum_r V_r \hat{G}_r / V$. Here V_r is the 2009 value of housing in the local authority (Appendix A) and V is its sum across London's 33 local authorities. For the 2010 reform, $\bar{G}$ was -29.2 log points, slightly bigger than the change for London as a whole (-25.5 log points), as local authority expenditure fell by more in areas with more expensive housing. Some examples of $\hat{g}_r$: -0.30 for Westminster; -0.27 for Islington; -0.24 for Barking and Dagenham; $+0.43$ for Havering; $+0.39$ for Croydon.

The numerical algorithm is pinned down by setting the geometric mean price across the 33 local authorities to be constant. When reporting results, I use a slightly different normalisation: $m_Q = \sum_r V_r \hat{Q}_r / V$, where $\hat{Q}_r$ is the log change in the price of floor space in local authority r, and I report $\hat{Q}_r - m_Q$. Welfare for a representative mobile household as returned by the numerical algorithm is relative to the price index used by the algorithm. To get welfare relative to m_Q I multiply by $\exp((1 - \alpha_s) m_Q)$ in the welfare equation (21). A similar calculation is needed for immobile market renters. This is not needed for tenants of social housing as their rent does not change.

E.2 Incidence shares

Tables 3 and 13 report the fractions of the total losses for all households living in the 14 local authorities that saw cuts larger than the London average ($\hat{g}_r < 0$, excluding the City of London). The total loss is $\sum_r \beta \hat{g}_r V_r$ over these local authorities. For owners the loss is $\sum_r (\hat{Q}_r - m_Q) V_r^{\text{mkt}}$, for tenants of social housing it is $\sum_r \beta \hat{g}_r\, \omega_r V_r$, and for immobile market

renters it is $\sum_r (\beta \hat{g}_r - \hat{Q}_r + m_Q)\, t_r V_r^{\text{mkt}}$, where t_r is defined in Appendix A; each fraction is the group's loss divided by the total loss. These add up to less than one since some of the losses accrue to mobile households, whose fraction is one minus the sum of these.

To compare the response of prices of floor space in the full model with that from the closed form expression (3) (Figure 9), I use the least squares slope of $\hat{Q}_r$ on $\hat{g}_r$ across the 32 local authorities (excluding the City of London) in the model, and the same slope with $\hat{Q}_r$ replaced by $\beta \hat{g}_r S_r/(S_r+e)$ for the closed form. S_r is solved for using equation (4) at the baseline values.

E.3 The grid of ε and e

In Figure 4 and Table 13 I report results for fifteen calibrations: $e \in \{0, 0.25, 0.5, 1, 1.5\}$ and the elasticity of sorting $\varepsilon \in \{2.5, 3.53, 6.83\}$. The elasticity of commuting costs is $\delta = 2.854/\varepsilon$, productivities are held fixed, and the share $\tau = 0.2$ in all cases. Amenities are backed out using equation (20). The counterfactual is always the change relative to London in 2010, and welfare is relative to the baseline in that calibration (Table 13). When I report results for $e = 0.67$ I linearly interpolate between results for $e = 0.5$ and $e = 1$. As expected, when e is larger the fraction of losses falling on mobile households is higher. For the values of e consistent with outside estimates (0.67 to 1), between 43 and 50 percent of the losses are borne by mobile households.

Table 13: Results on the grid of ε and e

		Price response		Share of the losses (percent)				Mobile welfare (% of consumption)	
ε	e	Model	Closed form	Owners	Social tenants	Immobile market renters	Mobile households	Low skill	High skill
Mean S_r = 0.38									
2.5	0	0.092	0.092	69	31	0	0	0.00	0.00
2.5	0.25	0.050	0.052	35	31	1	34	+0.21	+0.04
2.5	0.5	0.035	0.037	24	31	1	44	+0.28	+0.05
2.5	1	0.022	0.024	15	31	1	53	+0.33	+0.06
2.5	1.5	0.016	0.018	11	31	1	57	+0.36	+0.06
Mean S_r = 0.56									
3.53	0	0.092	0.092	69	31	0	0	0.00	0.00
3.53	0.25	0.056	0.059	39	31	1	30	+0.19	+0.05
3.53	0.5	0.041	0.045	28	31	1	40	+0.26	+0.06
3.53	1	0.028	0.031	18	31	1	50	+0.32	+0.07
3.53	1.5	0.021	0.024	14	31	1	54	+0.35	+0.08
Mean S_r = 1.17									
6.83	0	0.092	0.092	69	31	0	0	0.00	0.00
6.83	0.25	0.064	0.071	44	31	0	24	+0.17	+0.08
6.83	0.5	0.053	0.060	36	31	0	32	+0.23	+0.09
6.83	1	0.040	0.046	27	31	1	42	+0.29	+0.11
6.83	1.5	0.032	0.038	21	31	1	47	+0.32	+0.11

Notes: $\tau = 0.2$ throughout. Shares may not sum to 100 because of rounding.

E.4 The model and the closed form

The closed form tracks the full model closely. Figure 9 compares the response of prices of floor space I compute using the full model with the one implied by the closed form expression for the equilibrium condition for the market for floor space (3) in each borough r using its S_r. With space fixed the two coincide at β. The response I compute using the full model is lower than the one from the closed form expression by 4 to 15 percent for the three values of ε I consider. This is because in the full model wages, commuting and total spending by firms on wages can adjust, and these responses make the price response in the model lower. For example, when $e = 1$ and $\varepsilon = 3.53$ the response in the model is 0.028 while it is 0.031 using the closed form expression. I use S_r in each borough to compute welfare changes implied by the closed form expression (24) for social tenants and immobile market renters. In all boroughs the closed form expression comes within 0.13 percentage points of consumption of the welfare changes computed using the full model.

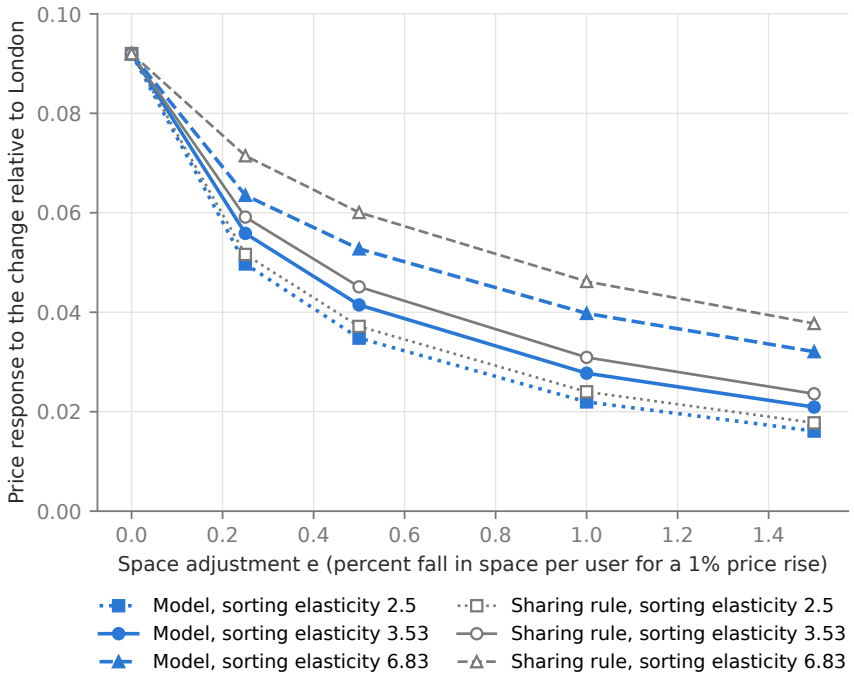


Figure 9: Price response in the model and in the closed form
Notes: Slope of the price change relative to London on the 2010 spending change relative to London.

E.5 Robustness of the incidence shares

When space adjusts, the fraction of the losses from spending cuts borne by owners of market houses and households renting at market prices depends on the elasticity of sorting, the fraction of the demand for floor space accounted for by firms, and the fraction of households renting at market prices that are immobile. The fraction of the losses accounted for by social tenants does not depend on these parameters, as established in Proposition 1.

Tables 13 and 14 report the fractions of the predicted losses in aggregate consumption from the 2010 spending cuts accounted for by each type of household under alternative parameter values. The baseline calibration assumes an elasticity of sorting of 3.53, that firms account for 47 percent of spending on market floor space, and that a share $\tau = 0.2$ of low-skill residents outside social housing are immobile.

Table 13 reports results for alternative values of the elasticity of sorting, and Panel A of Table 14 for alternative values of the share of floor-space spending by firms. I allow the elasticity of sorting to range from 2.5 to 6.83, with $e = 1$. Owners of market houses account for between 15 and 27 percent of the losses, and mobile households renting at market prices account for between 42 and 53 percent of the losses. A higher sorting elasticity raises S_r, so prices respond more and owners incur more of the losses. In Panel A, I calibrate the fraction of the demand for floor space accounted for by firms to alternative statistics. The first alternative statistic matches spending by firms to 2009 commercial rateable values, which implies that firms account for 17 percent of spending on floor space. Valuation Office Agency (2026) reports the commercial rateable values. Under this alternative calibration and $e = 1$, owners of market houses account for 25 percent of the losses and mobile households renting at market prices account for 43 percent of the losses. The second alternative statistic is implied by assuming that firms pay a constant fraction of the wage bill of $(1 - \gamma)/\gamma$ for floor space under a Cobb-Douglas production function. Under this alternative calibration, owners of market houses account for 16 percent of the losses and mobile households renting at market prices account for 52 percent of the losses, compared to 18 and 50 percent, respectively, under the baseline calibration.

Panel B of Table 14 reports results for alternative values of the share of low-skill residents outside of social housing who are immobile, τ, ranging from 0 to 0.5. As τ rises, owners of market houses account for a declining fraction of the losses and households renting at market prices who are immobile account for up to 3 percent of the losses, but mobile households renting at market prices still account for 50 percent of the losses.

Under every alternative calibration reported in Tables 13 and 14, social tenants account for 31 percent of the losses, a larger fraction than that accounted for by owners of market houses when $e = 1$.

Table 14: Floor spending by firms and the immobile share at market rent

	Mobile		Social	Immobile market renters	
	households (%)	Owners (%)	tenants (%)	Share (%)	Welfare range (% of consumption)
A. Floor spending by firms, κ					
0.07, rateable values	42.7	25.3	31.0	1.0	−0.83 to +0.83
0.40, baseline	49.5	18.4	31.0	1.1	−0.98 to +0.93
0.667, Cobb-Douglas	51.8	16.1	31.0	1.2	−0.99 to +0.97
B. Immobile market renters, τ					
0	49.5	19.5	31.0	0.0	–
0.1	49.5	18.9	31.0	0.5	−0.97 to +0.90
0.2, baseline	49.5	18.4	31.0	1.1	−0.98 to +0.93
0.3	49.5	17.8	31.0	1.7	−0.98 to +0.97
0.5	49.5	16.5	31.0	3.0	−0.98 to +1.05

Notes: $\varepsilon = 3.53$ in all runs.

For each run in Table 14, I recompute baseline prices and baseline amenities, so the model continues to match the distribution of residents across skills and local authorities in the baseline.

F Further results on the 2010 cuts

F.1 Net loss of social tenants

Recall that the change for social tenants in local authority r is $\beta \hat{g}_r \, \omega_r V_r$, a loss where spending was cut more than the London mean and a gain elsewhere. To compute the net loss, I use equation (5), and note that the covariance between the change in spending relative to London and the regulated share of housing value, weighted by the value of the housing stock, is -0.010. Thus, in present value, the net welfare loss of social housing tenants across London is

$$\beta \, V \, \mathrm{Cov}_V(\omega_r, \hat{g}_r) \;=\; 0.092 \times £1{,}163\text{bn} \times (-0.010) \;\approx\; -£1.1\text{bn}.$$

Figure 10 plots the gains and losses for different types of immobile households in each borough. For social tenants I hold space fixed, and for immobile market renters I set $e = 1$. For

$e = 1$, changes in welfare of immobile market renters range from -1.0 to $+0.9$ percent of consumption, a similar range to that for social tenants.

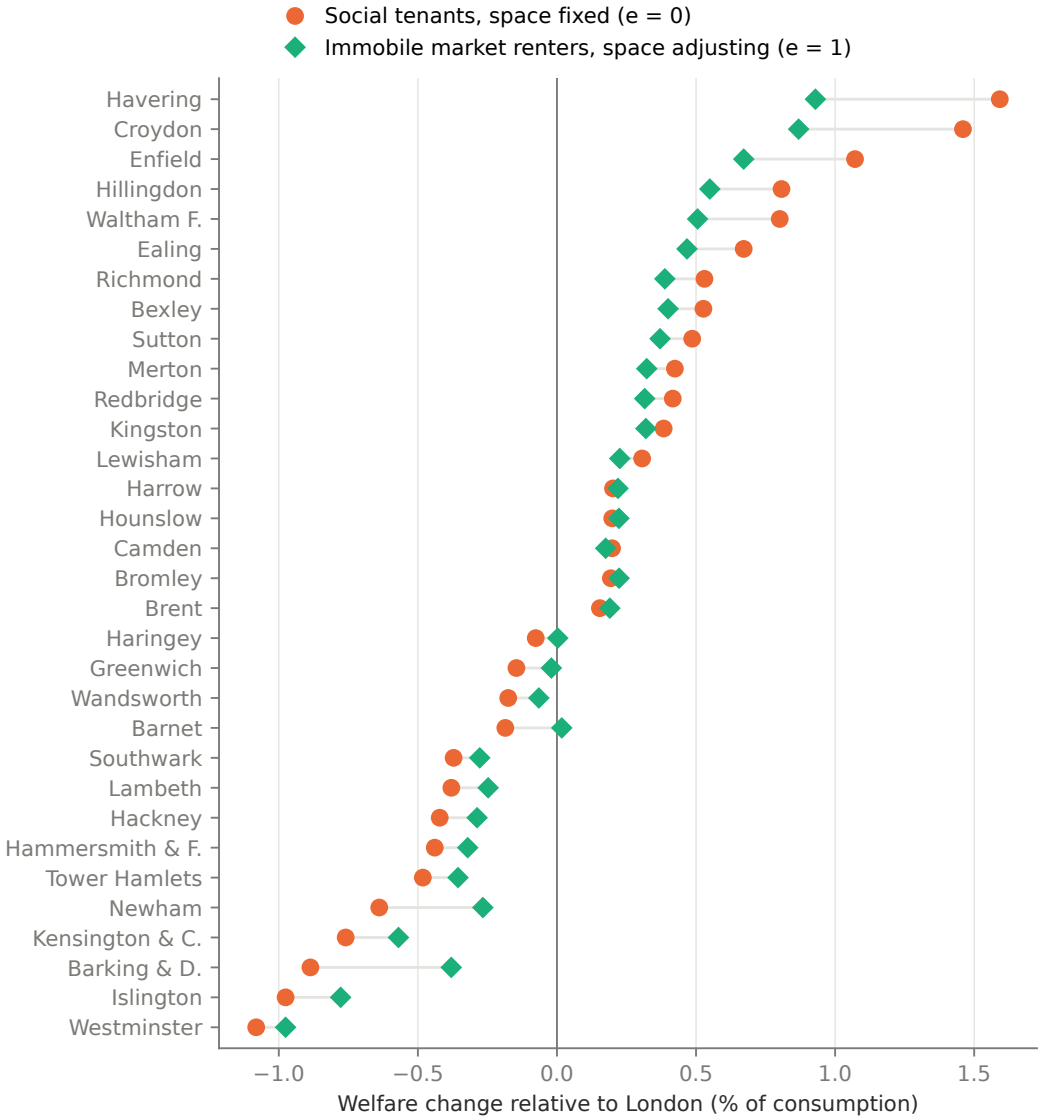


Figure 10: Welfare of immobile residents by borough, 2010

Notes: Relative to London, in percent of consumption, at $\varepsilon = 3.53$. Social tenants with space fixed; immobile market renters with $e = 1$.

F.2 Owners and social tenants by borough

Figure 5 reports the predicted changes in the value of owning a market house and in the welfare of social tenants from the 2010 spending cuts by borough. Panel a shows the predicted change in the value of owning a market house relative to owning one in an average London borough, holding the amount of floor space fixed. The predicted change is given by β times

the change in spending relative to an average London borough times the price of the average market house in the borough. Panel b shows the predicted change in the welfare of social tenants relative to tenants in an average London borough.

Owners lost most in the expensive central boroughs. On average, owners of market houses in Kensington and Chelsea lost £20.3 thousand relative to owners in an average London borough and owners in Westminster lost £19.5 thousand, while owners in Havering gained £8.6 thousand. Owners of market houses in Kensington and Chelsea lost more than owners in Westminster even though Westminster suffered larger spending cuts, because market houses are more expensive in Kensington and Chelsea. Welfare losses for social tenants were largest in Westminster, Islington and Barking and Dagenham, and gains were largest in Croydon and Havering. Social tenants in Barking and Dagenham fared worse than tenants in most other boroughs, even though owners of market houses there lost much less than owners in Westminster, because houses are relatively inexpensive there.

F.3 Two allocations of the same saving

Table 4 compares the actual allocation of spending cuts with an alternative allocation where every local authority makes the same cut per resident. In this alternative scenario, the total spending cut is allocated uniformly per resident, using 2014 population, so that each local authority makes a £75 per resident per year spending cut. This alternative allocation also entails a 25.4 log point cut in per capita spending in London (with 2014 population in both years), just like in reality. The standard deviation of the relative-to-London spending cuts is 0.09 instead of 0.18. The fraction of the costs of austerity borne by tenants of social housing is 16 percent, and their net welfare gain is £0.7bn (in present value). Thus, the actual allocation of the spending cuts and the alternative one where all local authorities make the same cut per resident straddle the prediction of 24 percent when the allocation of the spending cuts has nothing to do with who lives where.

F.4 The London-wide cut and the open city

Up to this point I have focused on the part of the spending cuts that varied by local authority. I next focus on the part of the spending cuts that is common to all local authorities, which I refer to as the London-wide cut. If London is a closed city, so that migration is not possible, this component of the spending cuts is not capitalised into local housing prices. As a result, all London households fully internalise the London-wide cut as residents, and owners of market

houses bear none of it through the value of their homes. If migration is possible, then the London-wide cut is partially capitalised and owners of market houses internalise part of it.

Table 15 reports the fraction of the aggregate welfare loss from the London-wide cut that is predicted to be internalised by owners of market houses under alternative assumptions about migration. The open-city row with $e = 0$ assumes that floor space per household is fixed. In this case, owners of market houses internalise 76 percent of the aggregate loss, which is the market share of London's housing value. The last row allows floor space per household to adjust. I report results for migration elasticities θ of 1, 3.53, and 10 and $e = 1$. When migration is allowed, those households that remain in London use more floor space, which results in smaller declines in prices relative to the case in which floor space is fixed. Nevertheless, even when $\theta = 10$, London households still internalise most of the aggregate welfare loss from the London-wide cut. Owners of market houses internalise between 10 and 20 percent of the £31.3bn London-wide loss.

Table 15: The London-wide part of the 2010 cut

	Share of owners (%)
Closed city	0
Open city, $e = 0$	76
Open city, $e = 1$, $\theta = 1$ / 3.53 / 10	10 / 17 / 20

Notes: Share of the London-wide loss (£31.3bn in present value) falling on owners as a class.

G Fair Funding Review 2.0

Because the predicted net change in the welfare of social tenants depends only on the distribution of the spending change across local authorities, the locations of social tenants, and my border estimate, I can use my empirical strategy to make quantitative predictions about the impact of proposed future reforms to council funding even before these reforms are implemented. As an illustration, I predict the impact on the welfare of social tenants of the changes to council funding formulas resulting from the Fair Funding Review.

The Fair Funding Review took effect in 2026-27 and aims to rebalance funding between councils. It changes the Core Spending Power of councils, the government's measure of the total funding available to each council, between 2025-26 and 2028-29 (Ministry of Housing, Communities and Local Government, 2025b, 2026a). I assume that changes to Core Spending Power translate one for one into changes in per-resident spending by councils on the set of local government services considered in Section 2. Table 16 summarises the predicted changes

in per-resident spending relative to London implied by the Fair Funding Review for each London local authority, which range from -14.7 percent for Kensington and Chelsea to $+29.9$ percent for Enfield. The distribution of the predicted changes in per-resident spending has a correlation of $+0.40$ with the distribution of actual changes in per-resident spending in 2010, and a correlation of -0.27 with the distribution of shares of social tenants across London local authorities. Recall that the correlation between the distribution of actual changes in per-resident spending in 2010 and the distribution of shares of social tenants across London local authorities was -0.67, which contributed to my finding that social tenants internalised a larger share of the welfare losses from the 2010 spending cuts than their share of housing value.

Using the net change in welfare equation (5), I find that the Fair Funding Review would result in a net loss in welfare for social tenants of £0.4bn in present value. Social tenants would be predicted to internalise 27 percent of the total welfare losses experienced by households in local authorities that are predicted to experience larger-than-average spending cuts, which is above their share of London's housing value of 24 percent. Thus, even under the new funding formulas, I predict that social tenants will continue to internalise a larger share of welfare losses from spending cuts than their share of the value of housing, although to a lesser extent than under the 2010 settlement.

I compute the gains and losses implied by these spending changes, assuming population does not change from its current level. I keep space fixed and set $e = 0$. By Proposition 1, this means that prices change by β times the log spending change relative to London, and welfare changes for social tenants by $(1 - \alpha_L)\beta$ times the log spending change relative to London. All log changes are measured relative to the housing-value-weighted average across the 33 local authorities in London (the City of London enters this average but is excluded from the statistics I report).

Holding space fixed, I predict price changes of -1.5 to $+2.4$ percent, and predict welfare changes for social tenants of -0.59 to $+0.96$ percent of consumption. Table 16 reports these calculations by local authority.

Table 16: Fair Funding Review 2.0 by borough

	Core Spending Power (%)	House prices (%)	Welfare of social tenants (% of consumption)
Kensington and Chelsea	−14.7	−1.47	−0.59
Wandsworth	−14.5	−1.44	−0.58
Hammersmith and Fulham	−14.5	−1.44	−0.58
Westminster	−13.8	−1.37	−0.55
Richmond upon Thames	−10.1	−0.98	−0.39
Camden	−9.5	−0.92	−0.37
Islington	−9.1	−0.88	−0.35
Lambeth	−7.7	−0.74	−0.30
Southwark	−7.4	−0.70	−0.28
Merton	−4.8	−0.45	−0.18
Bromley	−4.6	−0.44	−0.17
Sutton	−3.2	−0.30	−0.12
Greenwich	−3.1	−0.29	−0.11
Lewisham	−2.8	−0.26	−0.10
Bexley	+0.1	+0.01	+0.00
Hackney	+2.5	+0.22	+0.09
Haringey	+2.8	+0.26	+0.10
Waltham Forest	+2.9	+0.26	+0.10
Kingston upon Thames	+3.2	+0.29	+0.12
Barnet	+8.5	+0.75	+0.30
Harrow	+9.9	+0.87	+0.35
Brent	+13.1	+1.13	+0.45
Havering	+13.1	+1.13	+0.45
Ealing	+14.1	+1.22	+0.49
Croydon	+14.5	+1.24	+0.50
Redbridge	+16.5	+1.40	+0.56
Tower Hamlets	+17.9	+1.52	+0.61
Barking and Dagenham	+18.5	+1.56	+0.62
Newham	+21.7	+1.81	+0.72
Hillingdon	+22.3	+1.85	+0.74
Hounslow	+23.2	+1.92	+0.77
Enfield	+29.9	+2.40	+0.96

Notes: Change in Core Spending Power from 2025-26 to 2028-29 relative to the London mean, passed through one for one to spending per resident. Space fixed.