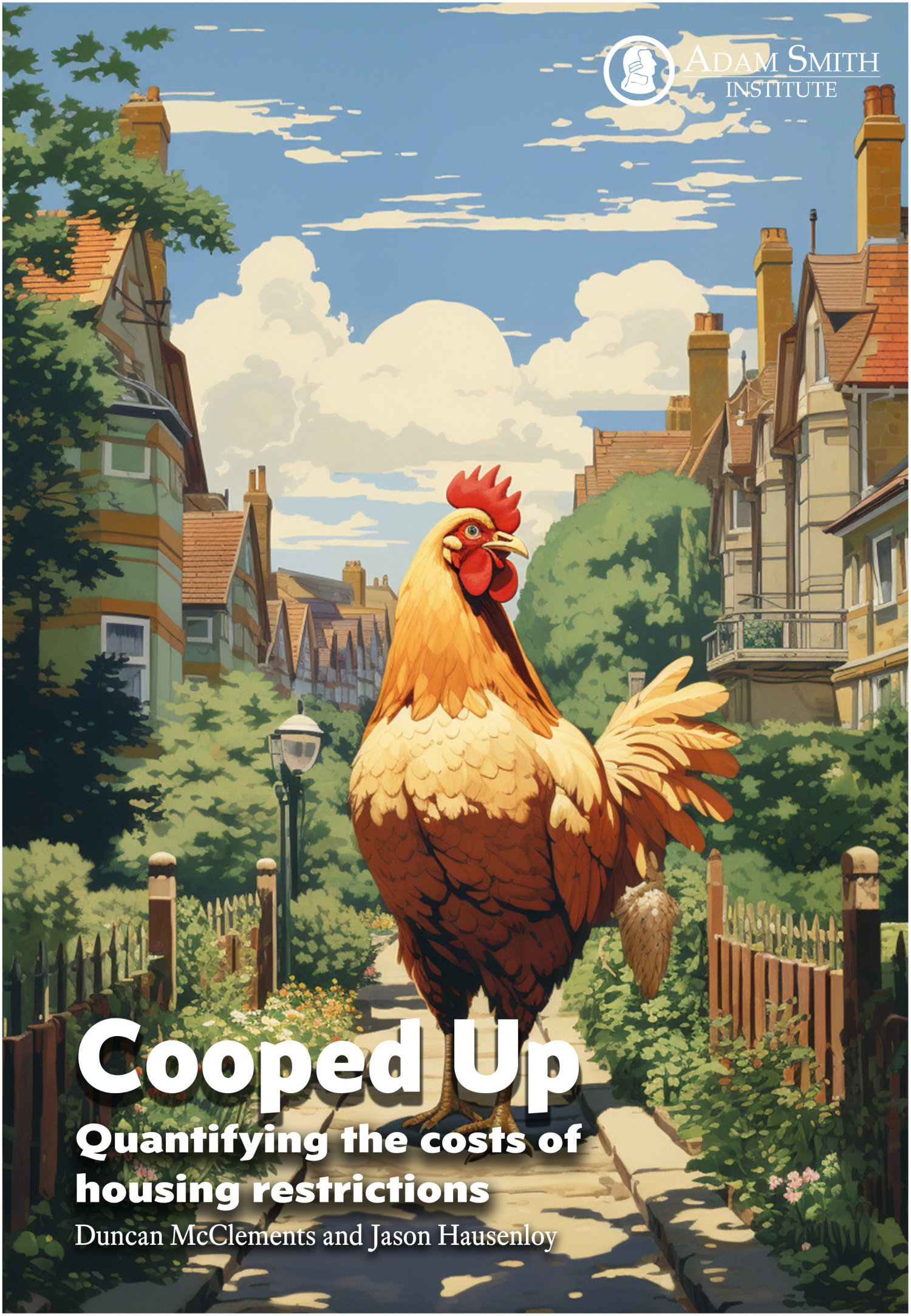
Adam Smith
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Cooped Up
Quantifying the costs of housing restrictions
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Executive Summary

- The cost of housing now makes up on average between 12-27% of annual household income.
- We are not building enough houses for prices to fall. Under our calculations, the construction of a new, average-sized house in London costs £300,000, yet average prices are £685,000, as a result of excessive planning restrictions.
- This paper offers the UK's first calculation of the cost of these restrictions. We find that it is costing the economy at least 6.1% of potential average GDP gains each year, in real terms. In nominal terms, there is a cost of 2.9%.
- We model the effects of a liberalisation of the planning regime through deregulation for height, width, space, and density of the current housing stock.
- The model finds that liberalising restrictions would boost the welfare of every person by 6.5% if limited to London, or by 11.7% if extended to all cities.
- This would correspond to annual nominal and real GDP gains respectively of 3.7% (£83bn) and 2.9% (£66bn) with conservative inputs, and 7.4% (£168bn) and 6.1% (£138.5bn) with liberal inputs.
- Correspondingly, this shows how much the British economy has been losing as a result of the UK's planning restrictions.
- This paper also found that restrictions currently cost the government £15,000 to provide infrastructure to every new person who moves to a city as a result of planning restrictions. This includes the use of education (school places and new teachers), medical (GP slots and pharmacy capacity), transport (parking spaces and demand on buses), and utilities facilities (gas, water, electricity, and signal bandwidth).
- Our findings provide a cost-benefit base for the huge gains to be made from liberalising housing restrictions, and support proposals to deregulate the supply of housing in terms of planning, construction, and in its supply chains.
- This is the first model of its kind for the UK, and based upon modelling from Hsieh and Moretti, 2019. There are limitations to the data inputs given the wide and varied nature of the data analysed, and the public availability of such data.

Introduction

Housing in the UK is too expensive. Today, it makes up between 12-27% of the annual household income, depending on region, with London often exceeding this.[1] Indeed, if the rate of inflation since 1971 had matched the rate of increase of house prices, a chicken today would cost £82.[2] Over 77% believe that there is a national housing crisis, according to a recent ASI poll.[3] This is particularly acute in London, which suffers disproportionately from high prices. As the UK's largest and most productive city, this has an outsized effect on the UK economy.

Today, the construction of a new, average-sized house in London (84m²) costs £300,000, under our calculations, yet average prices are £685,000. This is primarily a result of restrictions on building new homes, with British homes averaging multiple times more in cost than new construction.[4] This is due to fractured supply chains, supply-limiting regulations, and higher labour costs. It is, secondarily, a result of price competition, regulatory costs and obligations.

These extra costs are partly increased by our planning system, which limits where homes can be built, and how tall buildings can be.

First, location. Following the Second World War, to maintain the local character of cities in the UK, a law was passed to create a "Green Belt", a region where building is generally illegal.[5] In London, this Green Belt makes up three times the area of London itself, forming a 35 mile wide belt around the city. Today, the "Green Belt" is also justified by the government as protecting the environment from urban sprawl, even if the environmental merits are poor.

Furthermore, the height of existing houses is restricted. Council planning decisions, a mechanism by which residents' locally elected representatives can reject new development, functionally make any expansion or densification – adding new buildings or increasing the size of existing buildings – extremely difficult. This is because objections by local residents often mean such planning permissions are not granted, as many disgruntled homeowners trying to build a small extension, let alone dramatically increase the capacity of their house, will surely be aware.[6] Beyond concerns for the environment, some residents worry that the quality of local infrastructure and social services would not be able to handle new arrivals of expansion or densification, while others oppose construction in principle because it would substantially increase the profits of wealthy housing developers and landowners.

So far, no detailed quantitative estimates of the cost of these housing restrictions on the UK economy exist. In this paper, we provide what to our knowledge is the first quantitative estimate of the costs of UK housing restrictions, by adapting a well-known model implemented by Hsieh and Moretti in the US. For policymakers, quantifying the large costs of such restrictions provide

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1 "UK Household Expenditure Breakdown 2021, by Decile." *Statista*, www.statista.com/statistics/379934/household-expenditure-categories-uk-by-decile/. Accessed 17 Sept. 2023.

2 "An Englishman's Home." *The Economist*, www.economist.com/leaders/2014/01/09/an-englishmans-home. Accessed 17 Sept. 2023; Statista. "Average House Price in the UK 2007-2019 | *Statista*." Statista, Statista, 2019, www.statista.com/statistics/751605/average-house-price-in-the-uk/. Accessed 17 Sept. 2023.

3 'Rooms for Debate: Polling on the Housing Crisis, Green Belt, and Planning System', Adam Smith Institute, https://static1.squarespace.com/static/56eddde762cd9413e151ac92/t/656289590bbe2574659fc32a/1700956514108/ASI+Polling_+Rooms+for+Debate.pdf

4 Muellbauer, John. "Why we need a green land value tax and how to design it." (2023).

5 Planning on the Doorstep: *The Big Issues* - Green Belt. https://www.local.gov.uk/sites/default/files/documents/green-belt-244.pdf. Accessed 17 Sept. 2023.

6 Vetoes are so common in part because councils do not have any incentive to homeowners to expand their property, as no council additional tax can be collected for more potential residents.

a compelling case for liberalisation to benefit the UK economy.[7]

We operationalise the removal of housing restrictions as allowing owners of existing dwellings to redevelop their properties up to eight stories tall. We therefore do not consider expansion of urban boundaries in our paper. We further propose an adjustable tax to fully fund the additional infrastructure required. Compared to other proposals, this is because of the availability of existing data and political tractability. It substantially decreases the need for any building on greenfield sites, maintains the quality of local infrastructure and enriches homeowners, not housebuilders, while decreasing prices for renters.

Model

Intuition

We seek to answer the following question: what is the effect of housing regulation on house prices?

To answer this, we need to determine the current price of housing, which is readily available. We then find the difference between how much housing would be without regulation, which theoretically should be the cost of building a new house. However, for this paper, as mentioned above, we narrow ourselves to considering the proposals to increase the *density* of existing housing, essentially building more housing units in the same area, rather than expansion outwards. This is because such housing development, for example outside of existing city borders, would require additional time to commute to the centre and the building of additional infrastructure such as road space, rail-lines, reservoirs, all of which are outside the scope of this paper.

For simplicity, we estimate the cost of demolishing a typical two-story house and replacing it with an eight-story housing unit on the same land.[8] When we calculate the difference between this cost and the actual house prices, we find that this would result in a large reduction - see Table 2.

Why does this result in such a large difference? This is because construction costs, even in London, the UK's most expensive region, are £300,000 while the houses themselves cost routinely more than a million pounds.

Lower prices would be better for consumers and the UK economy. Firstly, this is a result of the fact that the nominal value of everything being produced is the same, or, in other words, if the price of a product falls but nominal incomes in the economy stay the same, in real terms, people have become richer. If the price of housing in London decreases while residents' salaries remain unchanged, Londoners would effectively have more purchasing power, allowing them more income to spend on other goods and services. Secondly, house prices would fall the most in the regions that currently have the highest wages.[9] This would allow more people to take advantage of the more productive regions in the UK, raising average wages.

It is reasonable to suspect the difference between raw construction cost and market price can

7 Furthermore, our adaptation allows for policymakers to conduct this analysis across cities in the UK.

8 We also adjust for reduced garden space

9 It is an empirical fact that house prices are highest in regions with the highest productivity. This is likely as a result of the fact that those regions have seen the most growth after housing restrictions were implemented. This means that they also see the largest percentage falls in price as the regulations have had the largest effect there as they have experienced the largest change from those regulations.

come from a variety of factors. To give some intuition, consider other factors that might result in such a gap such as market power amongst developers, efficient taxes to reflect costs on local residents' access to infrastructure or if buyers have limited information about the quantity and quality of available housing. These form a low proportion because of competitive housing markets and high consumer information from browsing and visiting houses.[10] We quantitatively show that housing restrictions make up the majority of difference, around 70% for London and similar figures in other cities. One reason that house prices might not fall, could be a monopoly or cartel of housing developers, however, this is not the case as there are 2566 house building companies in the UK, and many more independent contractors.

We finally consider how housing prices affect GDP. Fundamentally, the reason why the distribution of house prices in the UK matters is because it affects the cities where people live. This is a result of the productivity of workers, which varies dramatically across and within regions in the UK.[11] In fact, if all houses decreased in price by the same percentage of their cost across the UK, and the expenditure share of the economy fell proportionately, this would have no effect on nominal GDP.[12] One way to examine how the distribution of housing prices affects the economy was pioneered by Hsieh and Moretti, which applied a Rosen-Roback econometric model. They concluded that reducing the housing restrictions in the three most productive cities to the median US city would boost GDP by 3.7%.[13] We apply this model to the UK.

Formal Model

Our model is based on Hsieh and Moretti (2019). Please see 'Housing constraints and spatial misallocation' in the American Economic Journal: Macroeconomics for more. [14]

GDP consists of the sum of the value of production of all cities in the economy.[15] In this model, the following function is used to calculate the total production Y_i for city i. Production in a city is given by: $Y_i = A_i L_i^{\alpha} K_i^{\eta} T^{1-\alpha-\eta}$

Constant returns to scale in for labour L_i, capital K_i and land T_i is also assumed, which have elasticities α, for labour, and η, for capital. Housing costs P_i are given by:

10 UK housebuilders are frequently criticised for holding large quantities of land, with this cited as evidence of their market power - but the stock of land they typically hold is roughly equivalent to the time required to get housing approval on new land multiplied by average annual housing construction, so the desire of companies to hold inventory sufficient to cover itself until the inventory can be fully renewed can mostly explain this. If consumer information was a major barrier to house sales, this would be easily rectifiable by house builders packaging insurance on the properties they had constructed with the property sale - so the market does not suffer much from lack of information.

11 A recent IFS study shows that workers wages would grow by 17% by moving the least to most productive area in the UK: Overman, H., Xu, X. (2022), 'Spatial disparities across labour markets', IFS Deaton Review of Inequalities, https://ifs.org.uk/inequality/spatial-disparities-across-labour-markets/

12 Assuming the UK was a closed economy. If falls in house prices increase the demand to immigrate, then this could raise or lower GDP further depending on immigrant productivity spillovers, which a large literature finds to be positive - see Nowrasteh and Powell 2020 for an overview. However, in this model, as the number of cities is fixed, welfare losses would be triggered by the reduction in the marginal product of labour across cities, coupled with a rise in prices from higher population, making the net effect ambiguous. Large falls in house prices caused by permanent changes in the future trajectory of housing prices would likely little affect the path of future speculative activity in the UK housing market. Nowrasteh, Alex, and Benjamin Powell. *Wretched Refuse?*. University of Cambridge ESOL Examinations, 2020.

13 Although they find large changes in the sizes of population flows that historically occurred, of 318% for New York-Newark and 285% for San Francisco, these take place in the context of relatively modest absolute changes that occurred historically - San Francisco's population only grow by 10% between 1964 and 2019, and New York's by 17%, so the population movements involved are comparably large, if slightly less so, to those shown in our paper.

14 Hsieh, Chang-Tai, and Enrico Moretti. "Housing constraints and spatial misallocation." *American Economic Journal: Macroeconomics* 11.2 (2019): 1-39.

15 As our data is based on TTWAs, rural areas are allocated to the city closest to them for the purposes of this production function.

$P_i = \overline{P_i} L_i^{\gamma_i}$

Where i is the inverse of the price elasticity in that city with respect to the number of workers. When i is small, a small change in γ_i has a larger effect on P_i. Essentially, γ_i captures how sensitive housing prices are to changes in the number of workers in a city. For example, in Singapore, where the land is very developed, γ_i is low because even a small increase in worker numbers will result in a large price increase, compared, for example, to Houston in Texas, with huge amounts of surrounding land.[16] $\overline{P_i}$ can be thought of as the price of housing in a city if only a single worker inhabited it.

Now, it is necessary to determine how workers will behave, and we do so through a rational-choice model. It is assumed workers have a utility function V_i which is this function of the amenities denoted by Z_i and wages W_i, with expenditure share on housing β:

$$V_i = \frac{W_i Z_i}{P_i^{\beta}}$$

This assumes workers have identical preferences across locations, an assumption which will be later relaxed. Following from these equations, and considering the interest rate R exogenously determined on global capital markets, it is possible to solve for equilibrium and show that equilibrium labour by city is given by: $L_i = \left(\frac{\alpha^{1-\eta}\eta^{\eta}}{R^{\eta} V^{1-\eta}} A_i T_i^{1-\alpha-\eta} \left(\frac{Z_i}{\overline{P}_i^{\beta}}\right)^{1-\eta}\right)^{\frac{1}{1-\alpha-\eta+\beta\gamma_i(1-\eta)}}$

With Σ^{L}_{i} normalised to 1. This results in aggregate income of an economy:

$$Y = \left(\frac{\eta}{R}\right)^{\frac{\eta}{1-R}} \left[\sum_i \left(A_i \left[\frac{\overline{Q}}{Q_i}\right]^{1-\eta}\right)^{\frac{1}{1-\alpha-\eta}} T_i\right]^{\frac{1-\alpha-\eta}{1-\eta}}$$

Where $Q_i = \frac{P_i^{\beta}}{Z_i}$ and $\overline{Q} = \Sigma Q_i L_i$ i.e. the employment-weighted average of Q_i across cities. Aggregate production is decreasing in the dispersion of prices as 1- η <1. However, a more accurate model of reality considers imperfect mobility of workers, i.e. where they have different preferences over location. This means that worker utility is now given by:

$$V_{ji} = \varepsilon_{ji} \frac{W_i Z_i}{P_i^{\beta}}$$

Where ε_{ij} is the idiosyncratic valuation of worker j for city i, and all ε_{ij} are independently and identically distributed from a multivariate extreme value distribution, with the moment generating function given by $F_g(\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_n) = e^{-\sum_i^N \varepsilon_i^{-\theta}}$. $\frac{1}{\theta}$ is the degree of labour mobility.

Importantly, this now results in each city facing an upward sloping supply curve for its labour. Labour supply by city is then instead:

Where V now denotes average utility. This results in aggregate income

$$Y = \left(\frac{\eta}{R}\right)^{\frac{\eta}{1-\eta}} \left[\sum_i \left(A_i \left[\frac{\overline{Q}}{Q}\right]^{1-\eta} T_i^{1-\alpha-\eta}\right)^{\frac{1}{(1-\eta)(1+\frac{1}{\theta})-\alpha}}\right]^{\frac{(1-\eta)(1+\frac{1}{\theta})-\alpha}{1-\eta}}$$

Which, although still strictly decreasing in price dispersion, is less so as $\frac{1}{\theta}$ >0.

From this, we can now calculate parameters to calibrate the model. Hsieh and Moretti calibrated their figures on the distribution of housing prices, wages, and employment across the US in 1964

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16 Rendering the elasticity with respect to the number of workers rather than the population is equivalent if the worker-population ratio remains constant rather than the city grows, and is also equivalent if consumers of housing are assumed to entirely possess labour income i.e. capital income is concentrated among a very small fraction of the population.

and 2019, a period in which extensive housing restrictions were expanded.

Hsieh and Moretti's estimation technique can only be used to calculate the cost of a change in housing restrictions, which makes sense in the US. However, because the UK's housing restrictions have been around since 1948, and the UK only began to collect data on earnings and the jobs distribution by local authority in 1997, we have had to adapt our approach.[17] Specifically, we construct a synthetic counterfactual where we lower the rent in all the UK to the marginal cost of increasing the density of housing constructions in the UK. For all parameters not defined below, we use those estimated by Hsieh and Moretti.

Parameters Estimation

The Marginal Cost Of Housing

80-85% of an apartment building is typically rentable space.[18] At these figures for construction cost of 6+ storey flat with lifts, results in a cost of £198,060 per 76m^2 dwelling, the typical size.[19] [20] Assuming that we are converting from two-storey property to eight-storey costs, this involves knocking down the original building and rebuilding with additional foundations, resulting in a cost of £264,080 per marginal full house before adjusting for location - the cost of building the 4 homes spread over the only 3 new homes created. This rises to £315,576 after averaging of outer and inner indices for London, however, this varies by region (see table).

Table 1:

Assumption	**Conservative**	**Central**	**Stretch**
Project size	£1m	£10m	£100m
Implied cost factor	1	0.89	0.795
Project levies	150%	100%	0%
Price index convergence	None	None	Parity at population-weighted mean
Price Elasticity of Supply	1.75	10	Infinite

Table 2: Construction costs of increasing density by region and implied rents, with and without infrastructure levies included (note that rents below these values will not rise). See Appendix III for source data.

Region	**Implied conservative rent (£)**	**Implied central rent (£)**	**Implied stretch rent (£)**
North East	767.51	650.85	556.17
North West	817.02	692.84	556.17

17 Data on male (but not female) British earnings by council go back to 1974, but the job distribution by council is not available before 1997.

18 Ehrlich. How Much Rentable Space Is There in an Apartment Building? – S-Ehrlich. www.s-ehrlich.com/how-much-rentable-space-is-there-in-an-apartment-building/. Accessed 17 Sept. 2023.

19 Costmodelling Limited. "Costmodelling - Typical Building Costs." Costmodelling.com, 2022, costmodelling.com/building-costs.

20 Wilson, Lindsay. "How Big Is a House? Average House Size by Country." Shrink That Footprint, 7 July 2022, shrinkthatfootprint.com/how-big-is-a-house/

Yorkshire + Humberside	792.26	671.85	556.17
West Midlands	800.52	678.84	556.17
East Midlands	841.78	713.84	556.17
East of England	858.29	727.83	556.17
South West	833.53	706.84	556.17
South East	916.05	776.82	556.17
London	1,065.37	889.09	556.17

Properties increased in size this way would have lower garden space per home as our proposal involves no growth in footprint, and we can correct for by raising prices by 5%.[21] In the conservative case we assume that all projects are £1m, i.e. they consist of demolishing and rebuilding individual houses at a time, while for the central case we assume about 10 are done simultaneously and for the stretch case we assume around 100 area, resulting in project sizes of £10m and £100m respectively.[22]

How much does the marginal person in a city cost the local government in the UK?

We can estimate the cost of an additional person from first principles by estimating the cost of the construction of additional social services they would need. This figure is not only useful in our model, but generally, such as modelling immigration reform. To our knowledge, no detailed public estimate of the capital cost of an additional person in a UK city is centralised anywhere, and so we provide a preliminary estimate below. We can split up the costs of the capital needed in government-provided services into the following broad categories: education, healthcare, utilities, and transport. We note that this method is highly conservative because it assumes that the government is not able to derive any value from existing capital, such as current schools and hospitals.

Education: Given how long that a student needs to be in a school, how much infrastructure is needed to support that additional student? The best current figures show that Nursery schools cost £2,620/m^2, primary schools £2,530/m^2, secondary schools £2,650/m^2 and sixth form colleges £2,500/m^2 to construct.[23] When combined with the government's best practices for the size of schools for a number of students N, 258+3.0N for primary, 813+4.7N for secondary and 275+5.2N for post-16.[24] This yields a total additional education cost of £2277/person, normalised to population.[25]

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21 Cottrell, Anna. "This Is How Much Your Garden Is Adding to Your House Value." Gardeningetc.com, 21 Feb. 2021, www.gardeningetc.com/news/this-is-how-much-your-garden-is-adding-to-your-house-value.

22 Larger projects experience discounts of up to 20% in the modelling of the sources, making this overestimate the resulting cost of housing construction.

23 See Appendix III

24 Primary dimensions will be used for the nursery. Department for Education. Area Guidelines for Mainstream Schools Building Bulletin 103. June 2014. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/905692/BB103_Area_Guidelines_for_Mainstream_Schools.pdf. Accessed 17 Sept. 2023

25 If implemented, we expect the costs to be lower, as schools could partially expand in addition to opening new ones. We calculate, given average primary school has 281 pupils, secondary school has 986 pupils and sixth form 211 pupils, this gives a cost of £8834 per year of childhood or £1835 once combined with the population ratio. We use the higher number. Department for Education. "Schools, Pupils and

Healthcare: We don't know how much the total value of all NHS buildings are, however, we can make an approximate guess by combining the NHS' spending on maintenance and calibrating this with expected depreciation. The NHS spends £8.8bn on infrastructure maintenance a year, and economists typically assume 5% depreciation rates, yielding a cost of £2,588 per person.[26]

Utilities: If we are redeveloping existing homes, they should be already connected to utilities as the infrastructure exists. Because they are natural monopolies arising from large fixed costs, we can expect marginal costs to decline for all relevant customer numbers.[27] This means that adding additional customers will reduce the cost of providing the utilities, not raise them, making this self-financing at present value.

Transportation: Cities are so economically valuable because of their high concentration and that residents can move easily within the city. This means, for conservatism, that we need to calculate how much it would cost to build additional capacity for new residents especially for London due to higher costs. We only calculate the costs for London as no other city has a large underground network. If we use the construction costs of the new Elizabeth line, approximately £18.9bn for 42km of tunnels, we can conclude a restoration cost per additional person of £9,100.[28]As this entirely takes the form of increasing density, no new roads should be required.

Additional Costs: Individuals will need to be housed while their houses are developed. Note that this strictly is not a cost absorbed by the government, however, will be factored into the price so is relevant here. We can guess this would take, conservatively, two years on average to redevelop, which, keeping current rent, would cost ~£37,200 at prevailing prices for London.[29]

Total Cost: Once we account for per-person costs, we need to scale this up to the average UK family size of 2.4 people. This gives a value of £72,993, which will be partially financed from stamp duty and other existing levies so will not entirely need to be composed of new taxes.[30] For London, then, this gives total new expenses for constructing one additional unit of housing for the average family of £404,348. When compared to a current median house price of £685,200, even including the additional council services, this still results in a fall of 41%.[31] In fact, because we do not mix-adjust for the size of houses (ie. London houses are smaller than other houses in the country, and will therefore be cheaper), this is an underestimate.[32] Extrapolating this for

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Their Characteristics, Academic Year 2019/20." Explore-Education-Statistics.service.gov.uk, 2020, explore-education-statistics.service.gov.uk/find-statistics/school-pupils-and-their-characteristics/2019-20. Accessed 17 Sept. 2023. Thomson, Dave. How Many Small School Sixth Forms Fail to Meet New Guidelines on Viability? - FFT Education Datalab. 19 Apr. 2016, ffteducationdatalab.org.uk/2016/04/how-many-small-school-sixth-forms-fail-to-meet-new-guidelines-on-viability/. Accessed 17 Sept. 2023. https://data.unicef.org/how-many/how-many-children-under-18-are-there-in-the-uk/

26 "Estates Returns Information Collection, Summary Page and Dataset for ERIC 2021/22." NHS Digital, digital.nhs.uk/data-and-information/publications/statistical/estates-returns-information-collection/england-2021-22. Accessed 17 Sept. 2023.

27 We know that this assumption holds in much larger cities than London, with cities much larger still supplied by a single utility.

28 London has currently 402 km of Tube lines, of which 45% are underground, implying an £82bn restoration cost.

29 Matharoo, Gagan. "What's the Average Rent in London in 2022?" RentLondonFlat, 28 May 2022, www.rentlondonflat.com/average-rent-in-london/.

30 Strictly, this figure is an average of the inner and outer London price indices due to partial substitutability of some services across council boundaries in principle. This is an underestimate because the london TTWA includes land not inside inner or outer London. "Average Size of Households in the United Kingdom (2010 - 2021)", www.globaldata.com/data-insights/macroeconomic/average-household-size-in-the-united-kingdom-2096133/. Accessed 17 Sept. 2023.

31 Pitcher, Greg. "Here's What the Average House Price Buys in Every London Borough." Evening Standard, 4 July 2023, www.standard.co.uk/homesandproperty/property-news/average-london-house-price-buys-in-every-borough-b1091165.html. Accessed 17 Sept. 2023.

32 This also means that the welfare gains of the policy are understated, as it would permit either further falls in prices or increases in the size of houses, of which Britain has some of the smallest in Europe.

rents, assuming that rental yields remained the same, this would give rents of £977/month, reducing London to the national median.[33] This figure is multiplied by 1.5 to guarantee that local residents would not lose out for the conservative estimation: as the economic growth from this is under every specification sufficient to fund the migration simply from higher revenue from existing taxes, it is altogether ignored for the stretch case.

Infrastructure Levies

As mentioned earlier, we also calculate the magnitude of additional taxes needed by calculating the cost of additional infrastructure needed. This requires calculating the marginal cost of an additional resident in a city.

We have chosen to use a Price Elasticity of Supply (PES) value of 10.0, drawing from the average observed in the U.S. While the U.S. does not operate under a framework of zero housing restrictions, we adopt this value for the sake of conservative estimation. Historical studies from the U.S., such as those by Muth (1960) and Follain (1979), have often reported infinite elasticities.[34] [35] DiPasquale (1999) identified a range of elasticity from 3.0 to infinity.[36] Malpezzi and Maclennan (2001) find a US pre-war elasticity of between 4 and 10, and postwar elasticity of between 6 and 13. While more recent research tends to report lower elasticity values - for example, Saiz (2010) determined the price elasticity for 95 metropolitan areas in 2000 to range between 0.60 and 5.45, with a population-weighted average coming in at 1.75, or Malpezzi and Maclennan (2001) giving a value between 0 and 1 for the UK post-war in comparison to the 6-13 for the US.[37] [38] For the central estimate, we thus use 10 for the US, as the post-war average - to be incredibly conservative for the conservative case we use an elasticity of 1.75 following Saiz (2010), and an infinite elasticity, reflecting the price elasticity in the setting most similar to our own from a regulatory standpoint, for the stretch case.

Results

Table 3: GDP effects of deregulation under perfect and imperfect mobility

	Nominal GDP, conservative	Nominal GDP, central	Nominal GDP, stretch	Real GDP, conservative	Real GDP, central	Real GDP, stretch
Perfect Mobility						
London liberalisation only	2.22%	5.30%	6.63%	4.29%	11.54%	19.76%
All urban areas liberalisation	2.01%	4.10%	6.19%	4.12%	9.14%	15.19%
Imperfect Mobility						

33 As of the most recent by-borough data release: Magnus, Ed. "Rents and Yields across 50 UK Cities Revealed." This Is Money, This Is Money, 3 Dec. 2020, www.thisismoney.co.uk/money/buytolet/article-9005315/Rents-yields-50-UK-cities-revealed.html. Accessed 17 Sept. 2023

34 Muth, Richard F. "The Demand for Non-Farm Housing. In AC Harberger (Ed) The Demand for Durable Goods." (1960).

35 Follain, James R. "The price elasticity of the long-run supply of new housing construction." Land Economics 55.2 (1979): 190-199.

36 DiPasquale, Denise. "Why don't we know more about housing supply?." The Journal of Real Estate Finance and Economics 18.1 (1999): 9-23.

37 Saiz, Albert. "The geographic determinants of housing supply." The Quarterly Journal of Economics 125.3 (2010): 1253-1296.

38 Malpezzi, Stephen, and Duncan Maclennan. "The long-run price elasticity of supply of new residential construction in the United States and the United Kingdom." Journal of housing economics 10.3 (2001): 278-306.

London liberalisation only	1.71%	3.66%	6.12%	3.26%	7.39%	14.15%
All urban areas liberalisation	1.57%	2.88%	4.55%	3.18%	6.12%	10.09%

Table 4: Welfare effects of deregulation under perfect and imperfect mobility

	Welfare, conservative	**Welfare, central**	**Welfare, stretch**
Perfect mobility			
London liberalisation only	4.06%	7.59%	20.42%
All urban areas liberalisation	6.73%	12.40%	26.70%
Imperfect mobility			
London liberalisation only	3.98%	6.51%	14.30%
All urban areas liberalisation	6.60%	11.72%	21.20%

Real GDP growth strictly assumes that only the cost of housing declines: as in reality some of the new housing would, at least under current regulations, be used also as shop or other business space; this would cause real GDP to rise further due to declines in business costs. We note that local infrastructure provision is fully funded by taxes included above on this rise, so as quality of life is independent of city size these estimates are in equilibrium robust.[39] The welfare effects for imperfect mobility are measured in terms of the average percentage increase in welfare across individuals to avoid privileging those with higher idiosyncratic local valuations.[40] However, the welfare effect estimates assume all housing stock is owned by a foreign absentee landlord, and are hence overestimates - the actual welfare effects can be approximated by summing the GDP effect and the product of the non-owner-occupied housing proportion of the housing stock and the difference between the naive welfare and GDP effects.

Discussion

Using many conservative assumptions, we conclude that removing density restrictions would increase real UK GDP by 6.1%. Our nominal figure of 2.9% is lower than the 8.9% found by Hsieh and Moretti, under a more moderate proposal of merely reducing the housing restrictions in the most productive cities in the US to the American average: a likely reason for this is that the UK has relatively less variation in productivity across cities. The maximum wage ratio across the Travel to Work Areas (TTWAs) we have observed is 1.58, between London and Burnley. In contrast, the U.S. exhibits a twofold income disparity between its most prosperous city, San Francisco, and its least prosperous large city, San Juan - which, unlike our estimate, excludes the rural population. Even more significant disparities exist between the wealthiest and most impoverished U.S. sub-districts. Hsieh and Moretti (2019)'s study took a conservative approach by assuming no city agglomeration elasticities. This results in an understatement of London's equilibrium size, as the rise in population would result in a rise in productivity. However, this

39 Albouy, David. Are big cities bad places to live? Estimating quality of life across metropolitan areas. No. w14472. National Bureau of Economic Research, 2008.

40 Interpreting the aggregate utility figures literally would imply that tax schemes should transfer as much income as possible from individuals who do move to who don't, as since utility is linear here in wages and workers face no labour-leisure tradeoff in this setting the utility-maximising income distribution is to endow all income to the individual with the highest idiosyncratic valuation.

assumption doesn't underestimate GDP growth, as the agglomeration elasticity is likely constant across city sizes - wages in London fall less, but those in the North also rise less, with population shifts.[41] As Lucas (1987) noted, agglomeration benefits must be present to explain firm clustering in places with more expensive factors of production.[42]

While the aforementioned disparities in GDP impact due to housing restrictions are influenced by productivity variations, we can also consider the geographical factors and definitions, such as TTWAs, that might skew these observations. Travel to Work Areas (TTWAs) are primarily defined by where the majority of people commute for work. However, individuals routinely live in TTWA and work in another. The census, wage and jobs data, sourced from councils, doesn't align with TTWA boundaries, reducing the accuracy of the estimates. It's also plausible that economies of scale might emerge if the construction industry were to undergo a significant and permanent expansion, further reducing costs - or due to the decline in housing costs for the construction workers reducing the wage bill for construction firms in equilibrium. Standardisation of planning rules across the country could accomplish this also.

Beyond the challenges of geographic definitions and data alignment, another dimension of concern is the distributional impact across regions. In a scenario of perfect mobility, each worker remains indifferent to potential destinations. This means there are no distributional consequences, ceteris paribus. However, in the case of imperfect mobility, benefits accrue to all extant residents of regions experiencing outward migration, with the largest improvements in welfare for those who do not migrate, fulfilling the government's levelling up agenda. The model doesn't consider commuting costs, meaning that it gives no gains from building beyond the cost-minimising price within a given TTWA - but gains do exist to building much higher because of the commuting cost reductions. Lastly, we do not address development expansion, such as the deregulation of the green belt. This also has the potential for very substantial gains, potentially reducing pre-equilibrium housing prices by a further factor of 2 or 3 beyond the values computed here, and thus bringing much larger potential GDP and welfare gains.

Conclusion

In this paper, using the Hsieh and Moretti 2019's model, we find that current housing restrictions cost the UK 6.1% of GDP. We expect this to be an underestimate primarily because we model cities without commuting costs and fixed geographic size, while, in reality, housing restrictions mean that cities are both less dense in the centre than they could be and less large. However, our estimate should still inform policymakers, particularly because of the political difficulty in removing the green belt, and provide further quantitative support for existing housing reform. Residents and renters have long suffered, mostly unwittingly, from the costs of housing restrictions. For them, and the UK economy, these restrictions need to be removed.

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41 Kline, Patrick, and Enrico Moretti. "People, places, and public policy: Some simple welfare economics of local economic development programs." Annu. Rev. Econ. 6, no. 1 (2014): 629-662.

42 Lucas Jr, Robert E. "On the mechanics of economic development." Journal of monetary economics 22, no. 1 (1988): 3-42.

Appendix I: Datasources

Several different data sources were used. To determine wages and labour employed per local authority, the ONS ASHE 8 dataset was used, which provides employment information by place of residence: as individuals are assumed not to leave their TTWA, this brings identical information to ASHE 7, but has the advantage of including data on the City of London, meaning it provides slightly increased accuracy on assessing the data for London. The Isles of Scilly, some Cornish islands with roughly 2000 inhabitants, were excluded due to lacking data. To provide information on rental prices, the ONS rent survey was employed. For population characteristics, such as age, education and race, which are regressed in the subsequent Appendix to produce wage data, the 2021 census was used. All of these are however in local authority form, which does not map exactly to cities. To correct for this, the local authority to TTWA mapping used in Hilber and Vermeulen 2016 was employed, with local authorities that have been combined since the dataset ceased in 2008 being marked as in the TTWA with the most entries amongst the combined counties, with ties broken by assigning it to the TTWA that was most frequent elsewhere in the dataset.[43] The procedure was done in order of the local authority code.[44]

Appendix II: Wage Regression

Wages were adjusted based on the educational, ethnic, and age-based composition of the population, with the results displayed in Figure 1.

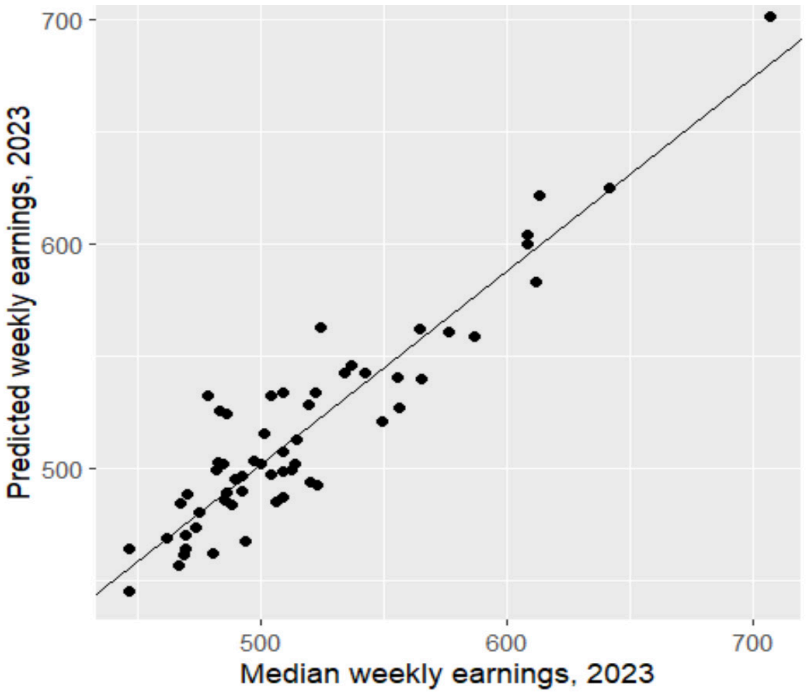

Figure 1: Predicted by median weekly earnings, 2023.

Appendix III: Construction Costs

Table 5: Construction costs by type of building, unadjusted by region or size.[45]

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43 Hilber, Christian AL, and Wouter Vermeulen. "The impact of supply constraints on house prices in England." The Economic Journal 126, no. 591 (2016): 358-405.

44 The code and data can be found at https://github.com/DuncanMcClements/ASI_housing_code/tree/main.

45 Costmodelling Limited. 2022. "Costmodelling - Typical Building Costs." Costmodelling.com. 2022. https://costmodelling.com/building-costs.

Residential entities	Construction cost, £/m²
Estate housing: generally	1,500 - 1,660
Estate housing: single storey	1,620 - 1,800
Estate housing: 2 storey	1,480 - 1,640
Estate housing: 3 storey	1,490 - 1,650
Estate housing: detached, generally	1,690 - 1,870
Estate housing: detached, single storey	1,660 - 1,840
Estate housing: detached, 2 storey	1,620 - 1,800
Estate housing: detached, 3 storey	1,680 - 1,860
Estate housing: semi-detached, generally	1,500 - 1,660
Estate housing: semi-detached, single storey	1,620 - 1,800
Estate housing: semi-detached, 2 storey	1,500 - 1,660
Estate housing: semi-detached, 3 storey	1,520 - 1,700
Estate housing: terraced, generally	1,420 - 1,580
Estate housing: terraced, single storey	1,540 - 1,720
Estate housing: terraced: 2 storey	1,360 - 1,520
Estate housing: terraced: 3 storey	1,390 - 1,550
Small - medium scale housing developments: generally	1,870 - 2,070
Small - medium scale housing developments: single storey	1,900 - 2,120
Small - medium scale housing developments: 2 storey	1,830 - 2,030
Small - medium scale housing developments: 3 storey	1,870 - 2,070
Small - medium scale housing developments: detached, generally	1,950 - 2,170
Small - medium scale housing developments: detached, single storey	1,910 - 2,130
Small - medium scale housing developments: detached, 2 storey	1,950 - 2,170
Small - medium scale housing developments: detached, 3 storey	2,010 - 2,230
Small - medium scale housing developments: semi-detached, generally	1,840 - 2,040
Small - medium scale housing developments: semi-detached, single storey	1,900 - 2,120
Small - medium scale housing developments: semi-detached, 2 storey	1,800 - 2,000
Small - medium scale housing developments: semi-detached, 3 storey	1,820 - 2,020
Small - medium scale housing developments: terraced, generally	1,810 - 2,010
Small - medium scale housing developments: terraced, single storey	1,810 - 2,020
Small - medium scale housing developments: terraced: 2 storey	1,750 - 1,950
Small - medium scale housing developments: terraced: 3 storey	1,770 - 1,970
One-off housing: generally	2,290 - 2,550
One-off detached housing: generally	2,380 - 2,640
One-off detached housing: single storey	2,170 - 2,410
One-off detached housing: 2 storey	2,280 - 2,540
One-off detached housing: 3 storey	2,340 - 2,600
One-off semi-detached housing: generally	2,180 - 2,420
One-off semi-detached housing: single storey	2,190 - 2,430
One-off semi-detached housing: 2 storey	2,100 - 2,340
One-off semi-detached housing: 3 storey	2,110 - 2,350
One-off terraced housing: generally	2,210 - 2,450

One-off terraced housing: single storey	2,260 - 2,500
One-off terraced housing: 2 storey	2,140 - 2,380
One-off terraced housing: 3 storey	2,140 - 2,380
Flats/apartments without lifts: generally	1,780 - 1,980
Flats/apartments without lifts: single storey	1,860 - 2,060
Flats/apartments without lifts: 2 storey	1,620 - 1,800
Flats/apartments without lifts: 3-5 storey	1,920 - 2,140
Flats/apartments without lifts: 6+ storey	1,960 - 2,180
Flats/apartments with lifts: generally	2,370 - 2,630
Flats/apartments with lifts: 2 storey	1,800 - 2,000
Flats/apartments with lifts: 3-5 storey	1,950 - 2,170
Flats/apartments with lifts: 6+ storey	2,040 - 2,260
'One-off' custom-built apartments/flats: standard quality, 3-5 storeys	2,900 - 3,220
'One-off' custom-built apartments/flats: high quality in residential tower	3,860 - 4,280
Sheltered housing: generally	1,640 - 1,820
Sheltered housing: single storey	1,890 - 2,090
Sheltered housing: 2 storey	1,650 - 1,830
Sheltered housing: 3 storey	1,520 - 1,680
Sheltered housing: 4 storey	1,690 - 1,870
Student residences: large budget schemes with ensuite accommodation	2,250 - 2,490
Student residences: smaller schemes (40-100 units) mid-range specification	1,980 - 2,200
Student residences: smaller high quality courtyard schemes college style	2,230 - 2,470
Nurses residences	1,830 - 2,030
Staff residential accommodation	2,060 - 2,280
Hotels: budget roadside excluding dining facilities	2,090 - 2,330
Hotels: budget city centre with dining and bar facilities	2,580 - 2,860
Hotels: mid range with conference and leisure facilities	2,680 - 2,980
Hotels: business city centre with conference and leisure facilities	3,780 - 4,180
Hotels: luxury city centre with conference and leisure facilities	5,150 - 5,710
Barracks, mess accommodation, section houses etc	3,190 - 3,530
Youth hostels	2,480 - 2,760
Short-stay hostels for the homeless, etc	2,220 - 2,460