

‘Trophy Architects’ and design as rent-seeking: Quantifying deadweight losses in a tightly regulated office market

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Abstract

Britain tightly restricts the supply of office space creating substantial economic rents, but its development restrictions are politically administered and therefore gameable, inducing rent-seeking activity. We find that ‘Trophy Architects’ (TAs) – prior winners of a lifetime achievement award – obtain more space on a given site apparently by signalling architectural merit. Analysis of 2,039 office buildings shows TAs build 14 stories taller, thereby increasing a representative site value by 152 percent and capturing potential economic rents of £148m. However, we argue this apparent premium is merely compensation for the extra costs, risks and delays of using a TA to game the planning system; and therefore an indirect measure of the deadweight costs of this form of rent-seeking.

JEL classification: H11; K25; R33.

Keywords: Land use regulation, regulatory costs, rent-seeking, office markets, trophy architects, quasi-natural experiment

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[the Minister]... “will only approve skyscrapers of exceptional design. For a building of this size to be acceptable, the quality of its design is critical... the proposed tower is of highest architectural quality” (Deputy Prime Minister of the United Kingdom, John Prescott, 2003)

Why does the incidence of tall buildings vary so substantially across the world’s cities – even cities of similar size and prosperity? The answer appears to be largely regulation. It is also notable that the largest buildings in some cities are designed by architects we define here as ‘Trophy Architects’ (TAs) whereas in others they are not. TAs we identify on the basis of having won one of architecture’s three major lifetime achievement awards, so certifying their outstanding reputations to the world at large. This paper investigates what role such architects may play in the extreme case of London, a city with particularly restrictive regulation constraining the supply of office space, making it hard to construct tall buildings and so generating substantial potential rents, but with a regulatory system where decisions are as much politically as rule determined.

Our results suggest that the primary function of these TAs in London is as rent-seeking agents. In so far as the evidence supports this conclusion we can cast light on what has long proved to be a kind of ‘dark matter’ for public economics; credible quantitative estimates of the costs of rent-seeking. Surprisingly, despite the ubiquity and relative stringency of land market regulation worldwide, we are aware of only one previous attempt to quantify rent-seeking costs in this context (Antwi and Adams 2003). As well as contributing to the growing literature on land use regulation and that on rent-seeking, this paper also adds to the emerging literature on the ‘vertical city’ or tall buildings, to our understanding of the extent and sources

of any premium for famous architect design and the relatively small body of studies of commercial real estate using sales data from observed transactions for individual buildings.

The emerging vertical city literature has found increasingly persuasive evidence of vertical agglomeration economies as well as price premia (Koster *et al.* 2014a and b or Liu *et al.* 2018). In addition a recent contribution (Ahlfeldt and McMillen 2018) has documented the role played by the supply side as well as the demand side in the incidence of tall offices compared to residential buildings: they have different costs of construction.

As with previous studies we find a significant relationship between architectural design and economic outcomes (Asabere *et al.* 1989; Fuerst *et al.* 2011; Gat 1998; Hough and Kratz 1983; Nase *et al.* 2013; Vandell and Lane 1989), measuring ‘economic outcomes’ as the price paid for space. Buildings designed by our TAs do command a small but significant premium suggesting that there is a productivity advantage associated with their buildings. This is dwarfed, however, by their capacity to get additional floors on a given site when regulations do not absolutely forbid this. Abstracting from this design premium, we are then able to estimate the increase in site value attributable only to the extra floorspace that the signalling power of their reputations appears to allow.

Tall buildings command a premium – often substantially greater than the cost of making them taller (Glaeser *et al.* 2005; Cheshire and Hilber 2008). The number of tall buildings per capita varies remarkably in cities around the world. Elementary urban economics leads one to expect there to be more in big cities as agglomeration economies and land prices increase with city size, especially where such cities, like Hong Kong, are crowded onto islands; or are constrained by growth boundaries. But while the New York metro area is more than twice as

populous as Hong Kong, Hong Kong has eight times as many skyscrapers¹ – buildings over 100 metres tall – per person than New York. A medium sized, provincial city such as Brisbane, Australia, has six times as many skyscrapers per person as Paris and eight times as many as London. Topping all cities in the tall buildings league table is a real surprise: Benidorm in Spain. This small tourist city has some 71,000 residents but 1.15 times as many skyscrapers and nearly 17 times as many high rise buildings – buildings over 35 metres – per resident as New York.

In both these leagues, London, despite its size and prosperity and one of the most tightly constraining growth boundaries in the world, comes near or at the bottom. The only tall building league London tops is the proportion of its skyscrapers designed by TAs: on the definition used in this paper – 25 percent compared to only 3 percent in Chicago and zero in Brussels or Benidorm. This, alone, is enough to demonstrate that the essential role of TAs in London is not that they have particular skills at designing tall buildings.

An increasing volume of literature demonstrates that British land markets are some of the most tightly regulated in the developed world (Cheshire and Sheppard 2002, 2005; Cheshire and Hilber 2008; Cheshire *et al.* 2015; Hilber and Vermeulen 2016). Land supply for urban development has been tightly constrained since 1947 and supply for each legal category of use is separately regulated. There are also tight regulations on building heights throughout Britain. Every significant decision, moreover, is politically determined, so lobbies flourish and decisions are gameable.

¹ Information on the number of skyscrapers or high rise buildings by city is from <http://www.emporis.com/>; data on population are from official figures and estimated for comparable metro areas, represented by Functional Urban Regions or Metropolitan Statistical Areas.

Given such a system it was not surprising that Cheshire and Hilber (2008) found the regulatory burden on office development in London, measured as a Regulatory Tax (RT) as originally defined by Glaeser *et al.* (2005), was the highest estimated for any major office location in Western Europe. Only Brussels approached the low level of regulatory burden estimated for New York by Glaeser *et al.* (2005). According to Cheshire and Hilber (2008) across British cities this value of RT (measured as the difference between the price of office space and its marginal construction costs, as a percentage tax) far exceeded any found in European office centres. In London's West End it averaged 809 percent between 1999 and 2005. The highest value found in any year in Manhattan was 50 percent (Glaeser *et al.* 2005). Cheshire and Hilber (2008) also provided direct evidence that regulatory restrictiveness was the primary cause of the high values of RT observed in Britain.

We have, therefore, good evidence that the system of land use regulation in Britain creates very significant economic rents. Although there were earlier ideas on similar lines (for example, Tullock 1967) it was the landmark paper by Krueger (1974) which first formalized the point that if regulatory restrictions create economic rents, people and economic agents will compete for them and compete in a variety of ways ranging from outright illegality via, for example, bribery or extortion, to more benign and legal means. In so far as these rent-seeking activities do not take the form of productive activities or pure transfers they represent a deadweight welfare loss (see Krueger 1974; or Posner 1975). Even though the concept of rent-seeking and its implications have been influential, quantifying the magnitude of deadweight losses arising from even specific examples has proved to be difficult and comparatively few empirical studies exist (De Rosal 2011). As Tullock (1997 pg 150) complained: '...I have been perturbed by the difficulty of finding any actual measurable cost....' However, we argue that the use of Trophy Architects in London to gain permission

to build bigger, especially taller, buildings on a given site is a specific case where we can produce a credible, if approximate, measure of the net deadweight losses arising from the employment of TAs as rent-seeking agents. This measure is only approximate for a number of reasons, but one is that there could be unmeasured 'consumption benefits' from TA-designed buildings for tourists and passers-by. While we tested for such benefits in a number of ways, there could still be social benefits we fail to capture.

So far as we know Evans (1988), was the first to observe that Krueger's model translates almost precisely into the context of restrictive land use regulations and, in particular, applies to the British system of land use planning. Sass and Pogodzinski (1990) made a similar point in the context of the US system but neither of these papers attempted any quantification. The specific mechanisms of the British system are particularly relevant to the issue of rent-seeking since, unlike the US Zoning or European Master Planning systems, the British system is not rule-based. Decisions in the British context, while informed by planning policies, are ultimately political; and therefore gameable². The initial decision on whether to permit development is taken by a political committee - the Local Planning Authority (LPA). This can be appealed ultimately to the national government minister responsible for the planning system.

The quotation at the head of this paper is taken from such an appeal decision from the then minister deciding to give permission for the Shard – now the tallest building in London. The decision-making surrounding the Shard's route to gaining planning consent illustrates what we have in mind perfectly. Irvine Sellar, a real estate investor with no experience of large

² There are guidelines influencing decisions, such as the National Planning Policy Framework, originally issued as DCLG (2012) but subsequently updated, or local plans, but these are no more than guides, subject to political decisions within the legal framework.

scale development, bought a building near London Bridge Station in 1998 purely as an investment (Sellar 2015). Very soon afterwards the government announced it would encourage higher density development near transport hubs. Opportunistically Sellar thought why not develop a 400 metres tall building with 8-times the internal space as the existing 1960s built HQ of PriceWaterhouseCoopers. He consulted the head planner at the Borough of Southwark (Fred Manson) and was told that ‘it would need a signature architecture to win approval’ (Adeney 2017). Renzo Piano had won his second TA award, the Pritzker Prize, in 1998 so Sellar flew directly to Berlin to recruit him for the project. Although denounced by English Heritage, who inadvertently coined the name by which it is known claiming it would “*tear through historic London like a shard of glass*” the project ultimately gained permission. The government minister who was the final decision maker after the public enquiry, was John (now Lord) Prescott. He may not have been an architectural connoisseur but was persuaded of the building’s ‘highest architectural quality’, surely helped by Renzo Piano’s recent award of the Nobel prize of architecture, and so gave permission. When asked if he would do a tall building in London again, given the immense difficulties, Sellar (2015) answered he would ‘because it is very profitable’.

This is only anecdotal evidence of the causal link between employing a TA and obtaining permission to build taller. However, we have found persuasive and more systematic evidence from the comparison between London and Chicago reported in Section IV. In London receiving one of the three awards we use to define TA status is associated with an architect’s buildings becoming 11 floors taller: but in the unconstrained context of Chicago there is no height gain in their buildings at all. This does strongly support the conclusion that it is the reputational signalling power of an architect’s lifetime achievement award, not the distinctive quality of a building’s design, which allows a TA to game the system in London.

Despite the size of the economic rents potentially at stake, the British land use planning system produces few cases of proven corruption, but it does appear to produce a rather more elevated form of rent-seeking activity on the part of developers: the employment of TAs to game the system and stack more floors onto a given site. We also find that the quantity of extra space obtained in this manner interacts with the local restrictiveness of the planning system. It is significantly more difficult to build taller in Boroughs with more restrictive planning regimes. While TA designed buildings do command a price premium per square metre, the additional value conferred on the site arises predominantly from the extra space in a TA building, so suggesting a substantial – in Section V we estimate 68.5 percent of the increase - rent-seeking component. Buildings designed by TAs and located on sites where tall buildings are not absolutely prohibited, are systematically and very significantly taller – 14 floors taller – than those designed by ‘standard’ architects.

Offsetting for the extra price per square metre of space we then compare the value of the extra space that TAs generate on a representative site with the direct costs of TA construction – their buildings cost more to build. We find that even with these higher construction costs TAs appear to represent a hugely profitable form of not just *rent-seeking* but *rent-acquisition* for the developer: a 152 percent increase in returns. The direct cost of more expensive construction appears to be only a small component of the additional costs associated with employing a TA to game the system, however. In particular, large TA schemes are subject to greater scrutiny and likely to be appealed at every stage with a greater probability of ultimate failure. This adds legal and consultancy costs and waiting time but, above all, increases uncertainty. This uncertainty will be translated into a greater risk premium and higher financing costs (Mayo and Sheppard 2001). Developers will therefore require a higher

expected rate of return to justify the gamble of hiring a TA to gain permission to build extra space on a given site.

Given that the London real estate market is reasonably efficient and competitive (Cheshire and Hilber 2008) we can infer that the rents we estimate for a representative site successfully developed using a TA are close to the expected costs of that rent-seeking: or, in the terminology of the rent-seeking literature, there is ‘complete dissipation’ (see De Rosal 2011). Since we net out any ‘productive value’ of TA design by offsetting for the price premium their space commands, we can say that TA costs will also approximate the total deadweight welfare loss less, perhaps, some external social benefits to people enjoying the view of the TA buildings. Note, however, that we tested for and found no evidence to support the possibility that views or proximity to TA designed buildings increase the value (so by implications benefits of) other office buildings.

Our paper proceeds as follows: we first explain the basic mechanisms of the British planning system focusing on its particular operation in London. The next section describes our data, followed by a section setting out our central empirical estimates of the impact of TA design on the *size* of office buildings. We then analyse the impact of TA design in terms of the *price* per m² of built space and per m² of site area. Section IV examines the evidence for our causal interpretation: that TAs are employed in London essentially as agents to obtain rents generated by restrictions on the supply of office space. In Section V, we compare the increase in the value of permitted space estimated for a representative site in the City of London associated with a TA to the extra construction costs employing a TA imposes. We then conclude.

I. THE PLANNING SYSTEM IN LONDON

To understand how the rents we claim exist are generated and how prestigious design(ers) can be used to seek them, it is essential to understand some details of England's planning system and its particular features in London³. Permission to build is not given because of a quasi rule-based zoning system as in the US nor as in the even more rule-based Master Planning system of Continental Europe. Permissions rest on a process known as 'development control', exercised by the relevant Local Planning Authority (LPA) which is the smallest governmental jurisdiction. There are 357 such LPAs in England and 13 within inner London. Any building, qualifying extension or alteration, or any change of legal use requires development permission from the LPA. The LPA is composed of local politicians advised by professional planning officers. In October 2018 46 percent of English LPAs had an up to date local plan: the rest did not. Even when there is a local plan, decisions may not follow it; equally decisions may not follow the guidance of the professional officers. They are highly political and subject to lobbying. There is then a system of appeal, first to the planning inspectorate and then, beyond that, to the national government minister responsible for planning and development. In practice this means that the outcome of applications for development cannot be predicted beforehand, there can be long (5-years would not be uncommon) delays as decisions go through the three tiers of decision-making and all decisions are subject to lobbying and political pressure. This planning framework was established by the Town and Country Planning Act of 1947: so it has been in place in its essential form for 70 years.

³ Planning in the three countries of Great Britain shares many features but there are specific differences, particularly in Scotland. There are also some particular features of planning in London, especially in the City of London and Docklands – see text for details.

While effectively established in 1947, there were earlier legal policies relevant for building in London going back to the 19th century. Before about 1875 finance and technology restricted building heights but the invention of elevators and steel frames allowed for much taller buildings (Turvey 1998). But height and building sizes in London became strictly controlled following the London Council Act of 1890 which set a statutory limit of 27m plus two stories in the roof; then decreased in 1894 to 24m plus 6m to the rooftop (Inwood 2005, p. 211). Therefore neither skyscrapers – nor anything resembling skyscrapers – were built in London until after 1956, when these blanket height restrictions were finally abandoned. However even after 1956 the then London County Council continued to enforce plot-ratio restrictions of between 2 and 5½:1, and individual London Boroughs separately maintained their own prohibitions on high rise building: some, such as Islington, continue even to 2019 to prohibit any building above 7 stories except for a small area bordering the City of London. The City itself gradually relaxed some restrictions during the 1980s and 1990s although specific provisions, such as Conservation Areas still prevent building high on a substantial proportion of its area (City of London 2010).

In addition, there are sight corridors protected under the *London View Management Framework* along which no building may be higher than the base of the dome of St Pauls (see Figure 2), and additional height protected zones specified for areas surrounding the London Monument, the Tower of London, the Thames River, and a number of historic and skyline features (City of London 2012). These height restrictions cover a large proportion of inner London – 75 percent of the Borough of Westminster, for example, has Conservation Area status. Individual buildings may also be 'Listed': given historic preservation status that forbids any external or internal alteration. There are more than 30,000 such buildings in Inner London.

To summarize, therefore, the planning and related policies that are strictly relevant for the analysis in this paper are:

1. Decisions on development applications are made by means of ‘development control’ – so decisions to permit any legally defined development are typically discretionary, made by locally elected politicians and subject to appeal. This process is quasi-judicial in character but ultimate power of decision rests with the responsible national minister when the appeal process is exhausted⁴;
2. Absolute height restrictions prior to 1956;
3. Plot-ratios (equivalent to Floor Area Ratios) restricting the allowable floor area on a given site thereafter until the 1980s and 1990s;
4. Continuing binding height restrictions within; Conservations Areas, Protected view lines of St Pauls extending as far as 16kms, the Houses of Parliament, the Monument, the Tower of London, the Thames Policy area, and an absolute ban on the re-development of the numerous Listed buildings in Central London.

II. DATA

Descriptive statistics are shown in Tables 1 and 2.

II.i Sample of buildings and sales

Data on office building characteristics and sale prices were obtained from Estates Gazette, CoStar and Real Capital Analytics. Our aim was to capture the whole population of office buildings sold in Inner London (for the relevant definition of this area see Dericks 2013)

⁴ Development has a legal definition under the 1947 Act and subsequent amendments to that Act. In effect it relates to any change of use of an existing plot of land or building unless the change is exempt. Very small extensions or alterations outside Conservation Areas are exempt but all office construction or change of use from, say, a shop to an office, even without physical alteration, would constitute ‘development’ and need permission.

between 1998 and 2018. Combined, there were some 6,500 unique sales over this period.

This dataset however had to be cleaned and supplemented with additional information about individual buildings and we restricted the sample to purpose-built office buildings of three or more floors and at least 150m² of floorspace to avoid offices in shops or industrial premises or other buildings designed for other purposes. We also discarded all sales which occurred less than 12 months following the previous sale (Clapp and Giacotto 1999). The location of buildings in the sample is shown in Figure 1. The resulting final number of distinct buildings was 2,039 which, allowing for those sold more than once, yielded a total of 2,739 sales.

Tables 1 & 2 here: Descriptive statistics for building size and hedonic regressions

II.ii Trophy Architects

Architectural excellence is necessarily a subjective judgment but peer recognition seems the most objective measure available; it also – for purposes of testing our hypothesis – has the advantage of visibility to politicians and planners. We have taken the lifetime achievement awards from the Royal Institute of British Architects (RIBA), the American Institute of Architects (AIA), and the Pritzker Prize as the most prestigious and obvious recognition of architectural excellence and so classified all winners as ‘TAs’. We adopt this term to emphasize that we are identifying not necessarily the ‘best’ architects but those with the most powerful signalling power of architectural merit.

For regressions on building size, buildings are recognized as designed by ‘TAs’ if the architect’s first TA award had been conferred before the building in question received *planning permission*. For the regressions involving building sales, a sale is defined as a ‘TA sale’ if the architect had received their first TA award before the building *sale*. Additionally, in the case of eponymous architectural firms, the architect who won the relevant TA award

must have been alive and working at the time the building was designed. By these definitions our data yielded 105 TA buildings in the size sample and 186 TA building sales. The architects and the tall buildings in our sample are discussed in Appendix 3. Of the 105 buildings designed by TAs in the size sample, 41 were built before 1956 (in practice between 1870 and 1928), and therefore in an era when available technology or statutory regulations absolutely restricted their height. These pre-1956 buildings are referred to as ‘Pre-Modern’ TA buildings in contrast to ‘Modern’ TA buildings. Of the remaining 64 modern TA buildings, 27 are located outside a Height Protected Area (HPA) and so had potential flexibility with respect to their size via the process of development control and TA signalling power. This means the number of observations available for identification is relatively small but cannot be increased since it constitutes the entire available population of such buildings.

II.iii Planning and amenity data

Data on Conservation Areas was acquired from English Heritage as was data on the ‘Listed’ status of buildings. Analysis revealed that roughly half of the total land area sampled is covered by Conservation Areas. Of the 2,039 buildings in the sample, 29 percent were built while within an HPA and 19 percent are now Listed.

Figure 1 here: The 546 postcode sectors and 2,039 office locations

The variable *Listed Building density* was estimated by; (i) calculating the area contained within each separate Listed building boundary, (ii) randomly placing a point for each 10m² within the area delimited by that boundary, and (iii) then summing the number of those points for each variable falling within a 300m radius of each office property. The 300m radius was chosen for these variables as in each case it performed better in our hedonic models than 100m or 500m.

For the analyses of the effects of Height Protected Area (HPA) status, buildings are recognized as such if they were built within any of the following areas after the relevant height restriction came into force: Conservation Areas, St Pauls Heights Policy Area, Monument Viewing Corridors, Tower of London Local Setting, London Strategic Viewing Corridors, Thames Policy Area, or areas deemed sensitive due to proximity to historic or landmark structures. A building is *not* regarded as being built in an HPA if the site was occupied by a ‘tall’ building before the area became height protected, and therefore ‘tall’ building permission was effectively grandfathered (where ‘tall’ is defined as exceeding the normal permissible height on the site at the time redevelopment was approved). Figure 2 maps these areas. For the price models, buildings were defined as located in an HPA if the building was located within an HPA at the time of sale.

Figure 2 here: HPAs

II.iv Planning permission refusal rate

To measure the restrictiveness of LPAs we use the data set on office planning refusal rates from 1990 to 2008 collected by Hilber and Vermeulen (2016). Since we use refusal rates purely as a control, any reverse causation does not affect our analyses (Ioannidis and Silver 1999). As the City of London and the Docklands LPAs have exceptional planning regimes, measured ‘planning restrictiveness’ in these areas may imply something rather different. To reflect this we add specific dummies for them in the building size models.

II.v Employment density

Data on annual 2000-2008 postcode sector local employment in London is taken from the NOMIS Annual Business Inquiry (ABI) Employee Analysis. Following Wheaton *et al.*

(1997) who found that the primary driver of office demand in London was financial and business services employment, we only include employees in our measure in 2003 SIC codes J or K; corresponding to banking, finance, business services and insurance.

The number of points corresponding to the employment counts within the boundaries of each of the 546 postcode sectors (excluding areas in which there could be no employment such as parks and water bodies) were randomly placed within each boundary for each year.

Systematic testing in the hedonic model showed that coefficient size and statistical significance peaked at 600m and declined monotonically in both directions from there.

Previous empirical studies of the effect of employment density on economic outcomes such as Arzaghi and Henderson (2008) or Jennen and Brounen (2009) found that employment within 500m of office buildings corresponded to the optimal radial bandwidth for New York and Amsterdam. We found results of the hedonic models were not changed according to whether estimates for employment in the building itself was included or not in our calculations. For our building size analyses, because our employment measure was only available from 2000 while many of the buildings were built before the 20th century, the mean 600m employment between 2000 and 2008 is used as a proxy for the employment levels relevant for the building at the time of construction.

II.vi Access to labour force

Access to the labour force was represented by distance to the nearest underground (subway) or other rail station.

II.vii Building characteristics and submarkets

Submarket dummies were based on the EG’s definition and details are shown in Appendix 1. The building quality measure comes directly from EG, which grades each floor of a building as either A or B. Buildings with only grade A space are graded as an A, both A and B space graded as A/B, and B space only is the omitted dummy variable. Additionally, a dummy for the decade in which the building was constructed is included.

III. ANALYSIS

III.i Can TAs build bigger?

The first question is whether office buildings designed by TAs have more floorspace on a given site. Before 1956 the height of a building was fixed by either statutory regulations or technology so we do not expect to find any TA effect for buildings built before then. We also do not expect to find that even the most acclaimed architects would have been able to flex the regulations governing the height and appearance of buildings built in a designated HPA⁵. We test this hypothesis for total floorspace relative to site size and then for height alone.

Table 3 here: Can TAs build bigger? Dep. Var.: Total floorspace/ site area

Table 3 reports the results where total floorspace relative to site area is the dependent variable. Model 1 simply lumps all TA buildings together and has few controls. Since we only expect TAs might plausibly be able to build bigger outside an HPA and after 1956, Model 2 interacts a Modern TA dummy for the building with built outside an HPA. The resulting co-efficient suggests a much bigger effect and just being a TA no longer has a significant impact. Subsequent models add the decade in which the building was constructed,

⁵ Though we do find one exception – the 16-floor New Court new Rothschild HQ building by TA Rem Koolhaas was negotiated with City planners in a Conservation Area. It was the fourth rebuild or extension to the Rothschild Bank’s HQ since 1800.

dummies for the City of London and Docklands, and then in Model 5, the local density of employment around the building. The basic result that Modern-TA buildings are significantly bigger is supported, and we see that the ability of a TA to get more space is confined to sites outside HPAs: and that all buildings are significantly smaller relative to the size of their sites, the more restrictive the local planning regime is. Consistent with a role for local agglomeration economies we also find that, all else equal, buildings are bigger the greater the local concentration of office employment is around them.

Given the relatively small number of TA buildings outside an HPA there has to be concern as to the robustness of these findings. The results reported in Table A1 provide some checks. We apply the quite stringent test of successively dropping the TA building outside an HPA with the largest floor to site area ratio, then the two largest and finally the three largest. Very reassuringly almost nothing changes except, obviously, the estimated extent of the additional floorspace a TA generates for a given site outside an HPA.

Table 4 here: Can TAs build taller? Dep. Var.: No. of floors above ground level

The way TAs succeed in getting more office space on a given site is revealed in Table 4. Their buildings are very much taller. Outside an HPA their buildings have more than 14 extra floors compared with a median building height across the sample of just 7 floors and so are more than three times *taller* on average than buildings designed by Standard Architects (SAs).

Not surprisingly, within HPAs all office buildings tend to be lower and the effect of the other variables of interest, local employment density and planning restrictiveness continue as in

Table 3. As before we subject the results to the robustness test of successively dropping the three tallest buildings. Again results are not affected (see Table A2).

That TA buildings are taller does not exclude the possibility that they may also have a larger footprint on a given site. Table 5 shows the results of testing this idea. It reveals a more complex situation. Inside an HPA all buildings have a larger building footprint to site area ratio presumably as developers strive to get additional floorspace on a given site without adding to height. Modern TA status outside an HPA, however, has little significant effect although the effect is positive and significant at the 10 percent level in the most completely specified model, model (4). The general effect of TA design, however, is significantly to reduce the footprint to site area. The effect of other variables on the size of the building footprint relative to that of the site remain much as previous results would lead one to expect. More restrictive LPAs are associated with significantly smaller building footprints, other things controlled for, but greater concentration of local office employment increases the size of a building's footprint.

Table 5 here: Can TAs get a bigger building footprint? Dep. Var.: Footprint/ site area

III.ii What is the value associated with a TA?

We see that TA buildings are bigger so they have more rentable space which, all else equal, will increase their value but other factors associated with TA design may raise or reduce capital values per m². While a TA building could command a rent premium, a less conventional layout might reduce the rent per m² or the proportion of the gross internal area that is usable. Unconventional building materials or design might also impose additional maintenance costs (for example, the costs of cleaning angled windows in Norman Foster's

40-floor Gherkin building). The unusual design might also mean (and we find some evidence of this - see online Appendix 4) it takes longer to rent out a building: this would reduce the sale price but not the observed rents. Accordingly, rents and capital values could be affected differently: rent per m² might rise because of prestige but less rentable space or higher maintenance costs might nevertheless reduce capital values overall. In sum, we cannot predict the net effect of TA design on value per m² *a priori*: it is an empirical question.

We investigate by means of a ‘classic’ hedonic model. The focus of our interest is on several characteristics of buildings and their settings and also on specific price estimates.

Recognizing the well-known problems of omitted variables we have made great efforts to incorporate as wide a range of relevant control variables as possible and, in particular, the impact of TA design on price. We have also looked carefully to see if there is evidence supporting the emerging tall buildings literature (see for example Liu *et al.* 2018) for an ultimately rising value for taller buildings all else equal.

Table 6 here: What do TAs yield in price/m² of building? Dep. var.: ln(price/m²)

Results are reported in Tables 6 and 7. Note that whereas previously we have been analysing the physical characteristics of 2,039 buildings, we are now measuring the capital value per m² achieved in 2,739 transactions over the period 1998-2018 from those same buildings. White tests do not reject homoskedasticity, and so normal standard errors are reported.

The dependent variable in the models reported in Table 6 is the observed price with the building’s floor area included as an independent variable. The results for all models confirm that a building’s price is increased if it is in an HPA or if local planning is more restrictive (both making space relatively more scarce). They also provide evidence supporting the

importance of localised agglomeration economies: the effect of localised employment density in the primary office sectors on a building's price is always highly significant and positive. Some wholly insignificant variables are not shown: for example in no models experimented with did the number of parking spaces have any significant effect on a building's price. This is perhaps not surprising for London given the reliance on public mass transit and the congestion charge on cars using the central zone where almost all the buildings in the sample are located. The effect of most other variables is as might be expected.

Two aspects of buildings have been explored more intensively. The first relates to design; the second to its own height. It has been suggested that 'Listing' a commercial building might reduce its value (Cullingworth and Nadin 2015, p. 242) since its fabric cannot be adapted or modernized; but historic designation might also be associated with a higher value. Our results show that not only do Listed office buildings in London command a premium but having more Listed buildings in the vicinity of the building sold also significantly increases its price. We also find a significant premium for TA design although the significance of the premium seems to be eroded somewhat once the building height is controlled for (models (2) and (4)). We also explored the possibility that views of, or proximity to, TA-buildings increased a given building's price, so suggesting possible production externalities. We experimented adding (i) TA building counts over distance bands of 600m, 800m, and 1000m, while (ii) varying this TA sample to only reflect buildings above 7 floors, the minimum height necessary to be visible at any distance, (iii) summing up the number of floors above 7F of all nearby TA buildings, (iv) summing up the number of TA awards earned by TAs of their nearby buildings, and interactions between either (ii) or (iii) with (iv). None of these specifications yielded a significant price effect (results available from authors).

There is, in London, as in the Netherlands, a documented rental premium for higher floors – see Cheshire and Hilber (2008) and Koster *et al.* (2014b). Moreover there is an emerging literature on tall buildings and vertical agglomeration economies. Our data is not ideal for fully exploring this aspect of building price since we do not have price or rent by floor: only the total price of individual buildings of known height. We tried to reflect the evidence of Liu *et al.* (2018) who found that the ground floor commanded a substantial rent premium but the rent for the first floor (in UK usage – second floor in US usage) fell by 50 percent with rising rents thereafter and a more rapid acceleration above some 30 floors. We are not able to estimate the marginal effect on price of more floors but models (3) and (4) include dummies for the impact of a building being more than 11 and less than 20 floors; between 21 and 30 floors; or taller than 31 floors. The limited number of observations of buildings more than about 20 floors makes it difficult to have finer classifications. We see all three classes increase a building’s price all else equal with the biggest and most significant increase for the tallest buildings. The coefficient for the intermediate class – 21-30 floors – though positive is imprecisely estimated and not significantly different from the 11 to 20 class.

TA design in all models does appear to have a significant impact on a building’s price suggesting some productivity advantage accruing to its occupiers. We have already seen that TA design achieves larger – notably taller – buildings on a given site if that site is not in an HPA. So now let us turn to estimating the impact that TAs have on the total price of a building on a given site allowing for both these impacts: buildings which are both bigger and more valuable per m². The results are reported in Table 7 where the dependent variable is the price paid for the building per unit area of its site.

Table 7 here: What value does a TA add to a site? Dep. Var.: $\ln(\text{price/site area m}^2)$

The models follow closely those reported in Table 6 but include whether the building was inside an HPA when planning permission was granted and also interacts this with whether it was designed by a TA. We see that in all specifications the interactive benefit of a TA building built outside an HPA (and so with those extra floors on a given site) is substantial and significant. The total effect on a building’s price relative to the size of its site, if it is designed by a TA *outside* an HPA, is the value of the TA and ‘TA outside HPA’ coefficients summed. In the most preferred specification – reported as model (4) – the combined effect of these two factors is approximately .923, or, given the semi-log specification, a 152 percent increase in average building price (see Kennedy 1981, for this calculation).

Taken together, TAs both have a significant influence on the price per unit of floorspace, and produce significant value outside HPAs through increasing total floorspace by building some 14 floors taller.

IV. CAUSATION

For these results to allow us to infer anything about the costs of rent-seeking there has to be a causal relationship. Employing a TA must be a mechanism developers use to signal that their building is of ‘exceptional architectural merit’ and so influence decision-makers to relax height restrictions to capture the economic rents London’s planning restrictions generate. However because of the nature of our data, no obvious instruments are available nor are other standard econometric tools employed to establish causation feasible. We address this critical issue of causation, therefore, by assembling a combination of mutually re-enforcing evidence for TAs’ causal effect on building height in London. We first conduct a quasi-natural experiment on what happens to the height of buildings when an architect gains TA status in:

a) the highly regulated, space-constrained but gameable context of London where rent-seeking should be expected to have a reward, compared to; b) the unconstrained and difficult to game context of Chicago where there are no rents to be gained. While our sample of buildings in the two cities is exhaustive, indeed is the whole relevant population so far as we are able to discover, the combined sample is still only 86 or 87 buildings so may not be judged wholly persuasive. It should be noted that this is not a simple extension of the sample of TA-buildings. Indeed, since in our definition to be classified as a TA-building, a building had to have received planning permission before the architect’s first TA award was conferred, many are not TA buildings. They were designed before their architect had become a TA.

We then systematically rule out plausible alternative explanations as to why offices designed by TAs on non-Height Protected sites in London could be so much taller than those designed by SAs and also demonstrate that being a TA is not in general associated with the ability to design tall buildings. In our judgment, taken together this evidence generates a kind of triangulation process: while none on its own may be conclusive, in combination the evidence is very persuasive.

IV.i Quasi-natural experiment

Our specific definition of a ‘Trophy Architect’ necessarily implies that buildings which were designed by a TA before they won a relevant award are not classed as ‘TA buildings’.

Therefore in practice different buildings by the same designer have different ‘TA’ statuses.

We exploit this fact to test for causation by examining what happens to building height when an architect gains TA status in two very different regulatory contexts.

As previously noted, the supply of office space in London is tightly restricted by the planning system but decisions within that system are eminently gameable because they are discretionary. In contrast, in Chicago, it is reasonable to assume potential ‘rents’ from getting more office space on a given site are negligible because, as in New York (see Glaeser *et al.* 2005, p. 354) regulation has a negligible restricting effect on the supply of office space. This has been recently documented in a number of studies (Barr 2013; Ahlfeldt and McMillen 2018). All height restrictions were removed in Chicago in 1923 although Floor Area Ratio restrictions, though generous, remain. Moreover, the system of land use regulation there, as elsewhere in the US, is ‘rule-based’ and so is much more difficult to game than the British system.

If employing a TA is a rent-seeking mechanism in London, then the receipt of TA status should be associated with the architects’ buildings becoming considerably taller. Their newly acquired status means they can now be employed to signal the architectural merit of their buildings (that 25 percent of all London skyscrapers are TA-designed compared to 3 percent in Chicago is already highly suggestive). By contrast in Chicago we would not expect buildings to increase in height once their designer gains TA status. We test this hypothesis and report the results in Table 8.

There are necessarily a restricted number of observations but we made a great effort to include all buildings from architects active in either London or Chicago since 1923 and who designed both before and after their TA award. The individual Chicago buildings are itemized and described in Table A7.

What we want to estimate is the increase in height observed in, respectively, London and Chicago following the award of TA status. Given our sample size restrictions we limit independent variables to; London/Chicago, TA/non-TA status, and Built in/Outside HPA dummies combined with their two and three-way interactions, and five decade built dummy controls. Given that some such interactions are empty sets the model we fit, therefore, is:

$$\begin{aligned} \text{Floors} = & b_0 + b_1(\text{London} \times \text{TA} \times \text{Built outside HPA}) + b_2(\text{Chicago} \times \text{TA}) + \\ & b_5(\text{Chicago}) + b_3(\text{TA}) + b_4(\text{Built in HPA}) + b_6(\text{Decade built dummy}) + \epsilon \end{aligned}$$

where,

b_0 = constant

b_1 = the causal effect of TAs on building height outside HPAs in London

London/Chicago = building is located in London or Chicago

TA = building designed *after* architect received their TA status

Built in/outside HPA = building built in an HPA at time of construction. None of the Chicago buildings are assumed to be in an HPA – so applies only to London buildings

Table 8 here: The impact on building heights of gaining TA status in London compared to Chicago

The results reported in Table 8 show that, all else equal, buildings in Chicago are a lot taller than in London (depending on the specification some 27 to 35 floors taller). But in Chicago gaining TA status adds nothing to a building’s height – indeed if anything once an architect has gained TA status their buildings tend to be shorter; but this height reduction is not statistically significant. In London, in contrast, consistent with our underlying hypothesis, gaining TA status leads to a substantial and highly significant increase in building height. In the models with age controls the gain is between 9 and 11 floors (Columns 2 and 4). In our

judgment the results reported in Column 4, with age controls but omitting 1 Canada Sq. are likely to be the most reliable. This is because this building was constructed when the area was controlled by the London Docklands Corporation which operated special planning rules designed to maximise development, thus making it unnecessary to try to 'game the system' to get extra space on a given site. These results imply that the effect in London of gaining TA status is estimated to add a similar – certainly not statistically different - height to a building as the average effect estimated for our full sample of TA buildings (10.82 floors vs 14.29, see Table 4). Given the size of their standard errors it is not possible to be absolutely certain that the Chicago and London effects of the award of TA status are significantly different: but it is highly probable that they are. An even simpler test is just to estimate for each city the change in floors associated with the architect gaining TA status. In London their buildings grow by 11.92 floors with a standard error of 2.975: in Chicago their buildings shrink, if not significantly, with 5.256 fewer floors and a standard error of 6.999.

So while the sample is necessarily small in both cities, the results support our hypotheses quite strongly. The evidence from this quasi-natural experiment – what happens to building heights when an architect achieves TA status – provides highly suggestive support of our interpretation: that in the specific conditions of London, TA status has powerful signalling power of architectural merit and is used to gain the rents created by a highly restrictive but gameable planning system.

IV.ii Plausible alternatives

Following extensive consultation with colleagues and industry experts, we identified two alternative plausible reasons why TAs might be favoured for designing tall buildings. The first is that firms wanting to build prestigious headquarters and make a statement may both

build tall and employ a TA to do so. Another possibility is that the technical skills required to design and build tall buildings are rare and highly skewed in their distribution toward TAs. These two alternative causal explanations are explored in detail in Appendix 3, where we first compare the bespoke status (that is buildings commissioned by a firm for its own occupation) of all the ‘tall’ – over 20 story – modern TA buildings in London. We find no evidence that either tall or TA buildings are systematically more likely to be bespoke. It appears, therefore, not to be the case that the exceptionally high frequency of TA design for tall buildings in London is because tall buildings are commissioned by the companies occupying them to ‘make a statement’.

To explore the second possible explanation – that only TAs have the technical capability to design tall buildings – Table A6 compares the tallest buildings in five international cities, selected because they are known to have less restrictive land use regulatory systems than London. Across these five cities only 2.3 percent of tall buildings were designed by TAs compared to 25 percent in London. Moreover in the two least regulated cities, Brussels (which had the lowest estimated level of regulatory tax of any European office centre in Cheshire and Hilber 2008) and Benidorm, not a single tall building was designed by a TA. Clearly the expertise necessary to design tall buildings is not restricted to architects who qualify as TAs by our definition. This second alternative explanation is also hard to reconcile with our specific definition of a ‘Trophy Architect’, which necessarily implies that buildings which were designed by a TA before they won a relevant award are not classed as ‘TA buildings’. Therefore in practice different buildings by the same designer may have different ‘TA’ statuses.

V. WHAT IS THE NET VALUE OF RENTS OBTAINABLE BY DESIGN?

We have demonstrated that TAs may be able to generate more value both by building taller on a given site and because of the TA-premium per m² their buildings command but they also cost more. Some of these extra costs can be estimated directly but most, as we argue below, are likely to be hidden because they represent delays in securing permission and extra risks for a project including, of course, the risk that no permission will be forthcoming. We first look at those costs we can directly estimate.

From Table 4 we can assume that TA-buildings outside an HPA will be some 14 floors taller than SA buildings. This would mean that employing a TA would allow a developer to triple the typically allowable building height of 7 floors to 21. Our task here is to estimate how valuable this increase in floorspace is to a developer allowing for the extra costs, explicitly associated with TA building and design. To address this we apply cost and net floorspace data obtained from Gardiner & Theobald (G&T) for a hypothetical building in the City of London with characteristics approximating the sample median for this location: 8 floors (not 7 as for the sample as a whole), a 2000m² site area and 1600m² footprint. We then compare these cost and net floorspace estimates with those derived from the methodology of Ahlfeldt and McMillen (2018), henceforth referred to as 'A&M'.

TAs charge a premium for their services compared to SAs, and the buildings they design on average incur additional construction costs both because they are taller and because their unit costs per m² are higher. G&T provided estimates of the total construction costs for a standard office building and more expensive TA designs, as well as estimates for the loss of net internal area as office buildings increase in height.

Using the sample median characteristics of office buildings in the City of London, the coefficients in Table 6, Model 4, and the estimated selling price (including the TA-premium) of a TA building, we calculated a sale-price/m² time-series for these hypothetical buildings at 8 and 22 floors across the study period. The results are displayed in Figure 3 along with estimates for the cost/m² of expensive TA and SA buildings by number of floors.

Figure 3 about here: Price per m² and construction costs for representative TA building in the City of London

As we can see, estimated price per m² was highly cyclical but always well above TA building costs, suggesting that a considerable rent could have been earned by using a TA at any time between 1998 and 2018. These achievable TA rents also appear to have trended higher over time.

Given this data we can estimate both the value of surpluses (not profits since this will include the price bid for land, rent-seeking costs, etc.) and the components of those surpluses generated by an SA or a TA for 8- and 22-floor buildings. In the case of a TA the components are the result of additional surpluses accruing from (i) the increase in space and (ii) from the TA-premium accounting for the additional direct costs TA design entails.

Table 9 about here: SA and TA height and surpluses according to Gardiner & Theobald (G&T) and Ahlfeldt & McMillen (A&M)

As shown in Table 9, assuming the market price for office space is £14,000/m², and following G&T's costs and net floorspace protocols, an 8-floor SA building will generate a £110m surplus while a TA design of 22-floors will generate a total surplus of £326m. The difference between the 8-floor SA and 22-floor TA building implies a gain of £216m from

using a TA. The additional surplus accruing to the 22-floor TA building of £216m can be further broken down into a TA price premium (£68m) representing a productivity gain, and the value contributed by the increase in 14 additional floors as the residual (£148m) – a rent.

By contrast, the total economic rent theoretically available to an SA if they were able to build to the profit maximising height of 117-floors instead of 8 is £783m – £110m = £673m. This suggests that for a new office building in the City of London, by restricting heights to 8-floors as opposed to the profit maximising 117 there is foregone rent of £673m. TAs in the right location, however, are able to claw-back some £148m of this through height concessions from planners. These, however, are strictly partial equilibrium calculations: if height restrictions were removed for the market as a whole, the consequent increase in the market-wide supply of space, and fall in its price, would significantly reduce the profit maximising building height – and of course eliminate TA rents and their collateral deadweight losses.

Using the G&T cost estimates the additional cost of the 22-floor TA building relative to a 22-floor SA building is £14m (on A&M cost estimates only £6m). In practice some fraction of this £14m, say 'p', will comprise opportunity costs and therefore represent a deadweight loss, and the remaining fraction will represent a pure transfer to TAs and perhaps construction firms. The magnitude of 'p' will depend upon the particular works these firms undertake relative to a standard 22-floor building and the competitiveness of the TA and construction markets.

Given the apparent substantial rents (£148m) to be earned from hiring a TA to build tall, the natural question to ask is why do not all developers with land outside HPAs seek (and

acquire) rents this way? In the context which we are analysing, the most plausible answer is that since there are no £50 notes lying around on the pavement, let alone £148 million pound notes, there is 'complete rent dissipation'. As was argued in Cheshire and Hilber (2008) there is good evidence that the development industry in London is competitive – a similar conclusion to that reached by Glaeser *et al.* (2005) in their analysis of the extent of the regulatory tax in Manhattan. This suggest that in equilibrium expected actual profits are the same regardless of whether a TA or a SA is employed. All rents are dissipated in rent-seeking activity of one sort or another.

The estimates of rents made so far, however, assume no extra costs beyond those associated with actual design and construction. There are, however, likely to be at least three additional and important sources of cost. The first is extra costs negotiating a way through the process of development control ultimately to obtain permission to build, including the professional fees and expenses involved plus the financing and opportunity costs of the extra delay this imposes. The second is the possibility that TA designed buildings have certain financial penalties associated with them. The third is more intangible. It is the higher expected rate of return that would be required by the developer to offset the greater risks of trying – and perhaps failing – to game the system.

We provide some admittedly fragmentary evidence in Appendix 4 that supports the view that applications for tall buildings designed by TAs take 6-18 months longer to process, and that space in large buildings takes 28-60 months longer to fully let. Although we are not able to estimate the costs of additional planning delay, we do find that the cost imposed by longer letting-times would reduce the profit of our representative TA building by £9m. Note that all three such costs should be regarded as deadweight losses. Assuming these costs completely

dissipate rents and adding the £6m to £14m extra cost associated with employing a TA yields an upper limit for the gross surplus or available rent of £216m-£230m. If we then net out the productive £68m TA floorspace premium, we arrive at an estimate of the net deadweight loss of £148m-£162m.

However, from a social welfare perspective these estimates ignore any external benefits that could be associated with TA design. We have already investigated but found no evidence of productive externalities (views of, or proximity to, TA buildings increasing the price of other buildings) but there could be social value to residents or tourists from viewing such buildings. There is evidence that both historic and modern architecture create some external benefit for residents (Koster and Rouwendal 2017; Ahlfeldt and Maennig 2010; Ahlfeldt and Mastro 2012). So this potential source of external benefit has to be weighed against our estimate of the gross value of deadweight losses. While the evidence for such external benefits associated with TA designed commercial buildings is sparse, nevertheless we should note that in so far as they exist, they imply that our £148m-£162m would clearly be an upper bound estimate for the net deadweight losses arising from TA rent-seeking behaviour.

VI. CONCLUSION

We have come a long way to answering one of the questions posed at the start: why does the incidence of tall buildings vary so much across cities? London has very few because of very tight regulation combined with high costs in negotiating exceptions by using a TA. While it is a partial equilibrium result, the profit maximising height for a new office building in the City of London, if such a building could be built employing a SA, would be 117-floors. We observe that ‘normal’ new office buildings average 8-floors. That such a tall building would

be profit maximising reflects the tight restrictions on London's supply of office space investigated in Cheshire and Hilber (2008).

This paper provides evidence consistent with Krueger's 1974 analysis. If you have a system of regulation which imposes quantitative restrictions on the supply of some 'good' it will create rents, which actors will then compete for. In the quasi-discretionary planning system operating in London we find that developers seem to be able to appropriate those rents literally by design(er). They can employ TAs who, where the regime is at all flexible – that is in the areas not absolutely but discretionally regulated for height – can use their prestige to signal superior aesthetic quality and persuade planners and politicians to permit more building space on a given site, notably by allowing a taller building. Moreover, we have found quite persuasive evidence from the comparison with Chicago suggesting that it is not the intrinsic quality of the design so much as the signalling power of a major lifetime achievement award which is responsible for this effect. In London, unlike the far less restrictively regulated Chicago, the receipt of TA status is associated with the architects' subsequent buildings 'growing' by some 11 floors in the specification we judge most persuasive.

Even allowing for the additional direct costs entailed in building to a TA design, the extra space a TA can generate on a given site increases the profits of their typical buildings. On a representative site this is worth an estimated £216m of which £148 appears to represent rents while £68m represents the additional premium TA-designed space commands. The results from Table 7 provide an alternative way of estimating a TA's addition to site value: an increase of 152 percent. However, while £148m may be a best estimate of the value of the rents that employing a TA appears to generate, if we turn the telescope around the other way

and assume that large denomination bank notes are not lying around on the pavements of London to be picked up, this £148m can be interpreted as simply a measure of the costs imposed by the planning system if it is to be gamed successfully: the cost of rent acquisition using a TA. Thus £148m combined with up to £14m in extra construction costs represents the upper bound estimate for the gross deadweight losses associated with TA design of a single building. However, it omits any external social value which a TA building might also generate and only a fraction of the £14m extra costs may represent a true deadweight loss.

Certainly seeking and acquiring rents by employing a TA has costs, most of which (such as employing lawyers and planning specialists to pursue appeals against initial rejections or additional risk premiums) are deadweight losses; and if there is a case for more high quality architecture than the market delivers, London almost certainly uses a suboptimal method for generating that increase. The current planning regime also delivers any residual rents more or less randomly to lucky developers and their lucky TAs who succeed in flexing the regulations.

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TABLES

Table 1: Descriptive statistics of data used in building size regressions

	N	Mean	Median	St. Dev.	Maximum	Minimum
TA Bldg	105					
Modern TA	64					
Pre-Modern TA	41					
Modern TA Bldg Built outside HPA	27					
Floorspace (m ²)	2,039	6,252	2,262	11,189	113,665	150
Floors (All buildings)	2,039	7.57	7	4.49	90	3
Floors (Standard architect only)	2,039					
Footprint (m ²)	2,039	1,139	816	1,477	16,266	50
Site area (m ²)	2,039	1,283	913	1,795	22,129	53
Floorspace/site area	2,039	4.29	3.90	2.53	26.02	0.22
Footprint/site area	2,039	0.95	1.00	0.13	1.00	0.09
Average Employment 600m	2,039	41,564	36,547	30,300	129,947	0
Built in HPA	598					
Listed	386					

Distribution of Sample by Decade built and Local Planning Authority

Decade Built	<u>Pre-1950</u>	<u>1950s</u>	<u>1960s</u>	<u>1970s</u>	<u>1980s</u>	<u>1990s</u>	<u>2000s</u>	<u>2010s</u>							
No.	977	92	106	121	263	194	187	99							
LPA	Camden	City of London	Westminster	Hackney	Hammersmith		Islington	Kensington	Lambeth	Southwark	Tower Hamlets	Docklands	Wandsworth		
No.	260	495	736	61	45		165	48	19	128	43	37	2		

Table 2: Descriptive statistics of data used in hedonic regressions

	N	Mean	Median	St. Dev.	Maximum	Minimum
TA Bldg	186					
Modern TA	65					
Pre-Modern TA	121					
Modern TA Bldg Built outside HPA	26					
Price (£m)	2,739	55.56	22.00	97.11	1,285.5	0.42
Price (£)/ Floorspace (m ²)	2,739	9,084	7,568	7,169	93,287	509
Price (£)/ Site area (m ²)	2,739	40,206	30,777	36,189	453,932	627
Floorspace (m ²)	2,739	6,805	2,967	10,522	113,665	151
Floors	2,739	7.81	7.00	4.12	55	3
Footprint (m ²)	2,739	1,243	966	1,460	16,266	50
Site area (m ²)	2,739	1,393	1,077	1,719	16,266	53
Floorspace/site area	2,739	4.50	4.11	2.65	28.17	0.22
Footprint/site area	2,739	0.94	1.00	0.13	1.00	0.09
Employment Density 600m	2,739	47,832	42,332	33,750	144,386	0
Sold while in HPA	2,105					
Built in HPA	838					
Listed	462					

Distribution of Sample between Decade built, Year Sold, Local Planning Authority, and Submarket

Decade Built	<u>Pre-1950</u>	<u>1950s</u>	<u>1960s</u>	<u>1970s</u>	<u>1980s</u>	<u>1990s</u>	<u>2000s</u>	<u>2010s</u>							
No.	1,219	125	140	174	393	312	283	93							
Year Sold	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	
No.	37	55	41	56	85	87	81	93	121	119	76	77	98	92	
Year Sold	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>								
No.	242	291	253	214	231	184	206								
LPA	Camden	City of London	Westminster	Hackney	Hammersmith		Islington	Kensington	Lambeth	Southwark	Tower Hamlets	Docklands	Wandsworth		
No.	328	779	948	71	67		210	57	24	145	62	44	4		
Submarket	City Core	City Fringe	Docklands	Midtown	North Central		South Central	Southern Fringe	West Central	West End					
No.	684	312	44	427	90		69	104	141	868					

Table 3: Can TAs build bigger? Dep. Var.: Total floorspace/ site area

VARIABLES	(1) Floorspace/ Site area	(2) Floorspace/ Site area	(3) Floorspace/ Site area	(4) Floorspace/ Site area	(5) Floorspace/ Site area
Modern TA outside HPA		7.193*** (1.307)	6.332*** (1.287)	5.565*** (1.204)	5.422*** (1.192)
TA	1.940*** (0.479)	0.0884 (0.211)	-0.0640 (0.208)	-0.0124 (0.207)	-0.0116 (0.210)
Built in HPA	0.432*** (0.118)	0.531*** (0.112)	-0.141 (0.170)	0.167 (0.160)	0.0758 (0.157)
Average Office Permission Refusal Rate	-10.39*** (0.985)	-10.31*** (0.956)	-10.10*** (0.940)	-8.335*** (2.064)	-7.448*** (2.029)
Decade Built	NO	NO	YES	YES	YES
City of London				0.257 (0.270)	-1.025*** (0.296)
Docklands				3.796*** (0.857)	3.727*** (0.827)
Average Employment 600m					2.44e-05*** (2.77e-06)
Constant	5.074*** (0.124)	5.037*** (0.121)	4.803*** (0.121)	4.574*** (0.265)	3.749*** (0.279)
Observations	2,039	2,039	2,039	2,039	2,039
R-squared	0.095	0.174	0.206	0.239	0.269

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4: Can TAs build taller? Dep. Var.: No. of floors above ground level

VARIABLES	(1) Floors	(2) Floors	(3) Floors
Modern TA outside HPA	15.50*** (3.509)	14.43*** (3.505)	14.29*** (3.512)
TA	0.882*** (0.327)	0.951*** (0.329)	0.952*** (0.334)
Built in HPA	-1.157*** (0.350)	-0.725** (0.325)	-0.818** (0.326)
Average Office Permission Refusal Rate	-13.26*** (1.555)	-11.32*** (3.359)	-10.42*** (3.355)
Decade Built	YES	YES	YES
City of London		0.284 (0.453)	-1.019** (0.476)
Docklands		5.297*** (1.777)	5.227*** (1.756)
Average Employment 600m			2.48e-05*** (4.38e-06)
Constant	7.730*** (0.169)	7.477*** (0.418)	6.639*** (0.448)
Observations	2,039	2,039	2,039
R-squared	0.331	0.351	0.361

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Can TAs get a bigger building footprint? Dep. Var.: Footprint/ site area

VARIABLES	(1) Footprint/ Site area	(2) Footprint/ Site area	(3) Footprint/ Site area	(4) Footprint/ Site area
Modern TA outside HPA	0.107 (0.0682)	0.103 (0.0706)	0.0944 (0.0718)	0.139* (0.0767)
TA	-0.0618*** (0.0143)	-0.0624*** (0.0142)	-0.0624*** (0.0138)	-0.0594*** (0.0139)
Built in HPA	0.0535*** (0.00878)	0.0571*** (0.00939)	0.0519*** (0.00921)	0.0494*** (0.00917)
Average Office Permission Refusal Rate	-0.290*** (0.0590)	-0.489*** (0.176)	-0.438** (0.171)	-0.471*** (0.168)
Decade Built	YES	YES	YES	YES
City of London		-0.0286 (0.0199)	-0.102*** (0.0232)	-0.105*** (0.0229)
Docklands		0.0296 (0.0255)	0.0257 (0.0250)	0.0420 (0.0274)
Average Employment 600m			1.40e-06*** (1.78e-07)	1.47e-06*** (1.77e-07)
Floors				-0.00313** (0.00128)
Constant	0.993*** (0.00661)	1.018*** (0.0209)	0.971*** (0.0202)	0.991*** (0.0211)
Observations	2,039	2,039	2,039	2,039
R-squared	0.061	0.064	0.100	0.107

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6: What do TAs yield in price/m² of building? Dep. var.: ln(price/m²)

VARIABLE	(1) ln(price)	(2) ln(price)	(3) ln(price)	(4) ln(price)
TA	0.158*** (0.0393)		0.138*** (0.0395)	
Modern TA		0.223*** (0.0647)		0.167** (0.0665)
Pre-Modern TA		0.123** (0.0484)		0.125*** (0.0482)
Sold while in HPA	0.0809*** (0.0246)	0.0813*** (0.0246)	0.0889*** (0.0246)	0.0892*** (0.0246)
Listed	0.0545** (0.0272)	0.0596** (0.0275)	0.0520* (0.0271)	0.0539** (0.0275)
Ln(Office Permission Refusal Rate 9yr Moving Average)	0.0441*** (0.0105)	0.0437*** (0.0105)	0.0434*** (0.0105)	0.0433*** (0.0105)
Ln(Employment 600m)	0.168*** (0.0158)	0.167*** (0.0158)	0.173*** (0.0159)	0.172*** (0.0159)
Ln(Listed Building Density 300m)	0.0332*** (0.00780)	0.0338*** (0.00783)	0.0341*** (0.00779)	0.0342*** (0.00781)
Office Grade A/B	0.0656** (0.0313)	0.0660** (0.0313)	0.0672** (0.0312)	0.0680** (0.0313)
Office Grade A	0.214*** (0.0348)	0.214*** (0.0348)	0.213*** (0.0347)	0.214*** (0.0347)
Ln(Percent Occupied)	0.0271*** (0.00520)	0.0272*** (0.00520)	0.0277*** (0.00518)	0.0277*** (0.00518)
Ln(Floorspace m ²)	0.947*** (0.00941)	0.945*** (0.00944)	0.933*** (0.00998)	0.933*** (0.01000)
Floors 11-20			0.127*** (0.0374)	0.127*** (0.0375)
Floors 21-30			0.00731 (0.0986)	0.00438 (0.0988)
Floors 31+			0.459*** (0.125)	0.445*** (0.128)
Decade Built	YES	YES	YES	YES
Submarket	YES	YES	YES	YES
Year Sold	YES	YES	YES	YES
Constant	-7.723*** (0.245)	-7.713*** (0.245)	-7.694*** (0.246)	-7.687*** (0.246)
Observations	2,739	2,739	2,739	2,739
R-squared	0.880	0.880	0.881	0.881

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: What value does a TA add to a site? Dep. var.: $\ln(\text{price}/\text{site area m}^2)$

VARIABLES	(1) Ln(Price/ Site area)	(2) Ln(Price/ Site area)	(3) Ln(Price/ Site area)
Modern TA outside HPA	0.736*** (0.206)	0.771*** (0.202)	0.774*** (0.151)
Modern TA	0.270*** (0.0702)	0.173** (0.0753)	0.149** (0.0685)
Pre-Modern TA	0.213** (0.0919)	0.222** (0.0929)	0.157* (0.0911)
Sold while in HPA	0.0405 (0.0351)	0.0494 (0.0346)	0.0306 (0.0334)
Listed	-0.0204 (0.0410)	0.00621 (0.0417)	-0.0801** (0.0396)
Ln(Office Permission Refusal Rate 9yr Moving Average)	0.0446*** (0.0158)	0.0473*** (0.0161)	0.0239* (0.0136)
Ln(Employment 600m)	0.246*** (0.0442)	0.247*** (0.0448)	0.238*** (0.0711)
Ln(Listed Building Density 300m)	0.0899*** (0.0129)	0.0899*** (0.0128)	0.0558*** (0.0121)
Office Grade A/B	0.115** (0.0454)	0.103** (0.0456)	0.167*** (0.0414)
Office Grade A	0.564*** (0.0486)	0.520*** (0.0510)	0.490*** (0.0461)
Ln(Percent Occupied)	0.0455*** (0.00873)	0.0449*** (0.00868)	0.0463*** (0.00801)
Decade Built	NO	YES	YES
Submarket	NO	NO	YES
Year Sold	YES	YES	YES
Constant	6.120*** (0.425)	6.107*** (0.431)	6.106*** (0.775)
Observations	2,739	2,739	2,739
R-squared	0.356	0.360	0.451

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: The impact on building heights of gaining TA status in London compared to Chicago

VARIABLES	(1) Floors	(2) Floors	(3) Floors Omit 1 Canada Square	(4) Floors Omit 1 Canada Square
Modern TA outside HPA	13.12*** (3.735)	8.719** (3.895)	14.37*** (3.536)	10.82*** (3.141)
Chicago TA	-7.156 (6.414)	-4.400 (7.604)	-8.259 (6.341)	-6.430 (7.499)
TA	0.209 (1.644)	-1.303 (2.309)	1.367 (1.223)	0.320 (1.572)
Built in HPA	-1.344 (2.004)	-5.046 (3.598)	0.421 (0.930)	-2.223 (2.051)
Chicago	32.23*** (5.773)	27.28*** (6.494)	34.58*** (5.266)	31.57*** (5.071)
Decade Built Constant	NO 7.617*** (2.510)	YES 4.429*** (0.785)	NO 5.208*** (0.653)	YES 4.429*** (0.786)
Observations	87	87	86	86
R-squared	0.474	0.505	0.516	0.539

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: SA and TA height and surpluses according to Gardiner & Theobald (G&T) and Ahlfeldt & McMillen (A&M)

Standard Architect					
Method	G&T	G&T	A&M	Max Surplus G&T	Max Surplus A&M
Floors	8	22	22	117	117
Net Internal Area	10,203	26,853	23,854	110,649	109,327
Total Costs	32,814,237	104,856,390	46,177,432	766,214,185	477,863,151
Sale Price	142,848,000	375,936,000	333,952,084	1,549,080,000	1,530,574,297
Surplus	110,033,763	271,079,610	287,774,652	782,865,815	1,052,711,145
Trophy Architect					
Method	G&T	G&T	A&M	Max Surplus G&T	Max Surplus A&M
Floors	8	22	22	122	119
Net Internal Area	10,203	26,853	23,854	113,634	111,028
Total Costs	37,048,054	118,516,283	52,159,705	913,942,603	567,658,681
Sale Price	168,811,233	444,263,971	394,649,300	1,880,029,226	1,836,908,637
Surplus	131,763,179	325,747,688	342,489,595	966,086,623	1,269,249,955

MAPS & FIGURES

Figure 1: The 546 postcode sectors and 2,039 office locations

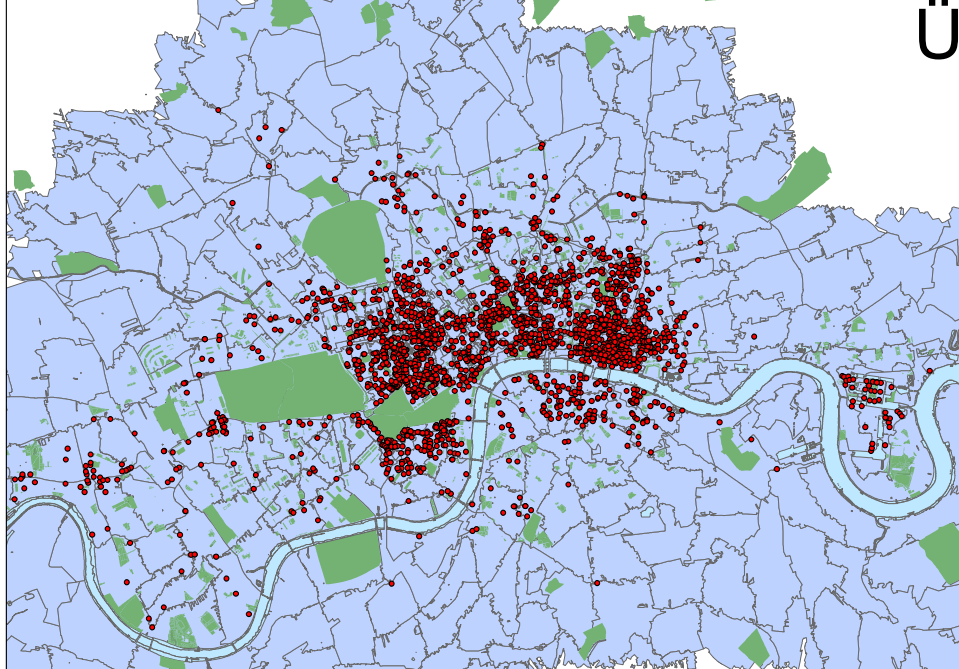


Figure 2: Height Protected Areas (HPAs)

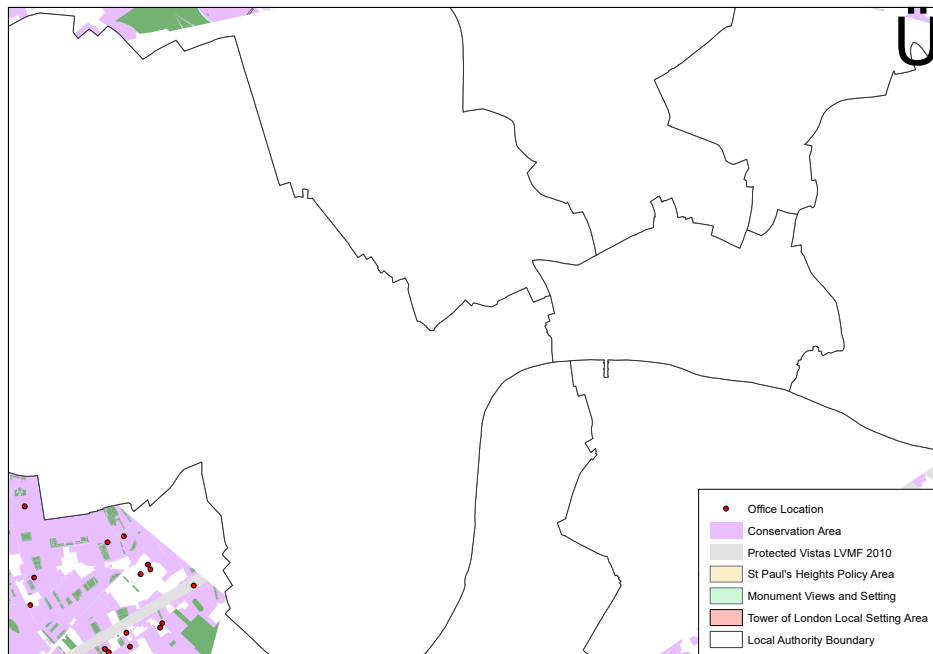
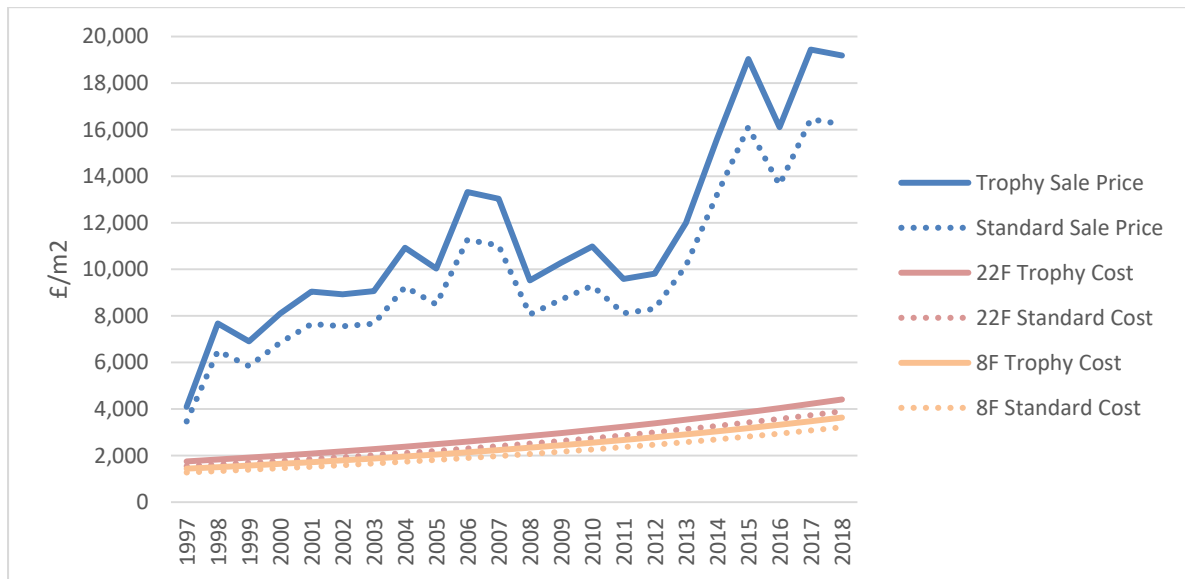


Figure 3: Price per m² and construction costs for representative TA building in City of London



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Appendix I: Estates Gazette’s London Office Submarket Definitions by Postcode District

City Core: EC1A, EC2M, EC2N, EC2R, EC2Y, EC2V, EC2A (only Finsbury Pavement, Finsbury Square, Appold Street and Chiswell Street), EC3, EC4 (excluding EC4A & EC4Y)

City Fringe: EC1M, EC1N (excluding postcode sector 2), EC1R, EC1V, EC1Y, EC2A (excluding Finsbury Pavement, Finsbury Square, Appold Street and Chiswell Street), E1

Southbank: SE1 postcode sectors 0, 1, 2 & 9

Docklands: E14

Midtown: EC4A & EC4Y, EC1N (sector 2), WC1, WC2 (excluding Leicester Square)

West End: W1, SW1, NW1 sectors 2 (Euston Road only), 3, 5 & 6, Leicester Square (WC2) and W2 sectors 1, 2 & 6

South Central: Remainder of SE1 and all of SE11

North Central: Remainder of NW1 and N1 and all of E8

West Central: Remainder of W2 and all of W6, W8, W14, SW3, SW5, SW6, SW7 & SW10

For Online Publication only**Appendix 2: Dropping the Tallest/Largest Buildings from the Sample****Table A1: Robustness: Successively omitting largest (floorspace/site area) three TA buildings: Dep. var.: floorspace/site m²**

VARIABLES	(1) Floorspace/ Site Area Full Sample	(2) Floorspace/ Site Area Omit Greatest	(3) Floorspace/ Site Area Omit 2 Greatest	(4) Floorspace/ Site Area Omit 3 Greatest
Modern TA outside HPA	5.422*** (1.192)	5.013*** (1.156)	4.494*** (1.075)	3.866*** (0.914)
TA	-0.0116 (0.210)	-0.0124 (0.210)	-0.00328 (0.209)	0.00833 (0.209)
Built in HPA	0.0758 (0.157)	0.0607 (0.157)	0.0819 (0.156)	0.0346 (0.149)
Average Office Permission Refusal Rate	-7.448*** (2.029)	-7.397*** (2.028)	-7.272*** (2.028)	-7.027*** (2.019)
Built 1950s	0.186 (0.180)	0.194 (0.180)	0.192 (0.180)	0.208 (0.180)
Built 1960s	0.756*** (0.241)	0.764*** (0.241)	0.760*** (0.240)	0.781*** (0.240)
Built 1970s	0.610*** (0.233)	0.620*** (0.232)	0.615*** (0.231)	0.642*** (0.228)
Built 1980s	0.201 (0.163)	0.221 (0.161)	0.212 (0.161)	0.236 (0.159)
Built 1990s	0.318* (0.185)	0.354* (0.182)	0.345* (0.182)	0.375** (0.181)
Built 2000s	1.362*** (0.238)	1.345*** (0.236)	1.352*** (0.236)	1.405*** (0.230)
Built 2010s	1.556*** (0.424)	1.604*** (0.422)	1.493*** (0.410)	1.418*** (0.403)
City of London	-1.025*** (0.296)	-1.018*** (0.296)	-0.998*** (0.296)	-0.961*** (0.294)
Docklands	3.727*** (0.827)	3.453*** (0.797)	3.543*** (0.795)	3.621*** (0.793)
Average Employment 600m	2.44e-05*** (2.77e-06)	2.45e-05*** (2.77e-06)	2.40e-05*** (2.72e-06)	2.42e-05*** (2.71e-06)
Constant	3.749*** (0.279)	3.740*** (0.279)	3.743*** (0.279)	3.704*** (0.277)
Observations	2,039	2,038	2,037	2,036
R-squared	0.269	0.253	0.242	0.236

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A1 successively removes the TA buildings with the greatest (Floorspace/Site Area) ratio in the sample. These are 8 Canada Square (26.02), ‘The Cheesegrater’ 122 Leadenhall (25.04), and ‘The Shard’

32 London Bridge Street (23.62).

Table A2: Robustness: Successively omitting tallest three TA buildings: Dep. var.: No. floors

VARIABLES	(1) Floors Full Sample	(2) Floors Omit Tallest	(3) Floors Omit 2 Tallest	(4) Floors Omit 3 Tallest
Modern TA outside HPA	14.29*** (3.512)	11.59*** (2.390)	10.30*** (2.077)	9.468*** (1.987)
TA	0.952*** (0.334)	1.004*** (0.331)	1.027*** (0.330)	1.027*** (0.330)
Built in HPA	-0.818** (0.326)	-1.037*** (0.249)	-0.989*** (0.245)	-1.019*** (0.243)
Average Office Permission Refusal Rate	-10.42*** (3.355)	-9.330*** (3.119)	-9.005*** (3.080)	-8.888*** (3.067)
Built 1950s	0.890*** (0.285)	0.964*** (0.270)	0.959*** (0.266)	0.975*** (0.265)
Built 1960s	3.713*** (0.676)	3.806*** (0.672)	3.797*** (0.673)	3.815*** (0.673)
Built 1970s	2.127*** (0.401)	2.251*** (0.382)	2.239*** (0.382)	2.260*** (0.382)
Built 1980s	0.889*** (0.267)	0.998*** (0.241)	0.976*** (0.238)	1.014*** (0.234)
Built 1990s	1.357*** (0.317)	1.490*** (0.292)	1.466*** (0.293)	1.536*** (0.289)
Built 2000s	2.789*** (0.430)	3.035*** (0.355)	3.058*** (0.355)	3.030*** (0.353)
Built 2010s	4.462*** (0.801)	4.131*** (0.731)	3.851*** (0.679)	3.931*** (0.673)
City of London	-1.019** (0.476)	-0.855* (0.440)	-0.804* (0.435)	-0.791* (0.433)
Docklands	5.227*** (1.756)	5.613*** (1.737)	5.862*** (1.735)	5.355*** (1.702)
Average Employment 600m	2.48e-05*** (4.38e-06)	2.58e-05*** (4.26e-06)	2.46e-05*** (4.09e-06)	2.48e-05*** (4.08e-06)
Constant	6.639*** (0.448)	6.461*** (0.406)	6.464*** (0.403)	6.443*** (0.402)
Observations	2,039	2,038	2,037	2,036
R-squared	0.361	0.365	0.350	0.331

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A2 successively removes the TA buildings from the sample in order of most above ground floors. These are ‘The Shard’ 32 London Bridge Street (87F), ‘The Cheesegrater’ 122 Leadenhall Street (48F), and 25 Canada Square (45F).

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Appendix 3: Causal Interpretation of Relationship between TA Design and Additional Stories?

As discussed in Section V of the paper we identified two possible objections to the causal interpretation we have put onto the strong relationship between whether a building is in a non-HPA and designed by a modern TA, on the one hand, and its additional height and resulting increased value of the site all else controlled for, on the other. The first of these objections is that companies wishing to make a landmark statement may tend to commission both taller buildings and TAs to be their designers. The second is that designing tall buildings is particularly demanding of architectural skill so tall buildings are more likely to be designed by famous – or trophy – architects.

The crux of the first objection to our interpretation of causation is that bespoke developments must cause *both* (i) buildings to be tall *and* (ii) TAs to be chosen as their architect. If either of these conditions does not hold, then the bespoke status of developments cannot be an explanation of why TA buildings are taller than those of ‘normal’ architects.

To address the first of these relationships, we take TA status as given⁶ and determine whether bespoke status can influence building height. Table A3 below shows that there have been 59 modern office buildings built by TAs in London. Of these 59, 20 (or 34 percent), were commissioned to be built by a firm specifically for their own use. Following our earlier analyses, Table A4 shows a series of hierarchical regressions on the height of modern TA buildings depending on bespoke status and a number of controls. Under none of the specifications is the bespoke variable a statistically significant determinant of building height. Robust standard errors are shown because heteroskedasticity is identified in the data with a White test; homoskedastic standard errors yield the same result.

Tables A3 & A4 about here

To address the second necessary assumption that bespoke developments preferentially choose TA designers, we now take tall building status as given⁷ and determine whether bespoke status

⁶ We imposed this restriction to ensure the feasibility of data collection.

⁷ Again so as to make data collection feasible.

influences the likelihood of choosing a TA. Table A5 shows the 47 office buildings in London that have ever been built above 20 floors, and of these 20, or 43 percent, were bespoke. Now examining TAs, 13 of these 47 buildings were designed by TAs, and of these TA buildings 6, or 46 percent, were also bespoke. A comparison of means test does not reject the null hypothesis that among London's tallest offices the probability that a given (TA or non-TA) building will be bespoke is identical to the probability that a TA building specifically will be bespoke ($p=0.80$). Therefore bespoke developments do not appear to be either taller (necessary assumption 1) or to preferentially choose TA designers (necessary assumption 2). Either of these findings alone would be sufficient to invalidate the inference that bespoke status accounts for our observed relationship between TAs and building height, but together this conclusion is stronger still.

Table A5 about here

As a way of addressing the second potential criticism of our causal interpretation – that only TAs have the requisite skills to design tall buildings, Table A6 provides data on tall buildings from a selection of cities around the world. These cities are selected because they have comparatively flexible restrictions on building tall. They are: Chicago, Houston, Brussels, Benidorm (Spain), and Sao Paulo. Chicago and Houston are at the least restrictive end of the US spectrum of restrictiveness with respect to commercial buildings at least. Brussels was the office centre in Western Europe identified by Cheshire and Hilber (2008) as having the lowest estimated value of Regulatory Tax. Benidorm, especially when it was developed as a resort town during the 1970s and 1980s, had both lax restriction and lax enforcement, and while Sao Paulo does have significant restrictions on very tall buildings it is quite unrestrictive with respect to buildings up to 100 metres. The sample of buildings in these cities consisted of those buildings above 100m: corresponding to roughly 25 floors.

Table A6 about here

We can see that only a small fraction (2.3 percent) of the tallest buildings in these five international cities was designed by a TA, and that this fraction is an order of magnitude lower than in London. There are also no TA buildings at all in Brussels or Benidorm – both cities with a far higher incidence of tall buildings per capita than London. A comparison of means

test rejects with high confidence the probability that there is no difference between the incidence of tall TA buildings in London and the other cities ($p < 0.0001$). This result contradicts the idea that only TAs have the skills to build tall. It is also suggestive that there is a unique process at work in London which associates tall buildings with TAs: we argue that this process is rent-seeking in the face of a highly restrictive yet gameable planning regime; not bespoke status or TAs' exceptional technical skill.

Table A7 about here

‘Trophy Architects’ and design as rent-seeking

Table A3: Are bespoke buildings taller? Population of Modern TA office buildings in London (n=59)

Building Name	Address	TA	Award	Floors	Year Approved	Borough	Bespoke
‘The Shard’	32 London Bridge Street	Renzo Piano	RIBA Gold 1989, AIA Gold 2008, Pritzker 1998	87	2003	Southwark	NO
‘The Cheese grater’	122 Leadenhall	Richard Rogers	RIBA Gold 1985, Pritzker 2007	50	2004	City of London	NO
	25 Canada Square	Cesar Pelli	AIA Gold 1995	45	1998	Tower Hamlets	YES
	8 Canada Square	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	45	1997	Tower Hamlets	YES
	30 St Mary Axe	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	40	1997	City of London	YES
	25 Bank Street	Cesar Pelli	AIA Gold 1995	33	2001	Tower Hamlets	NO
	40 Bank Street	Cesar Pelli	AIA Gold 1995	33	2001	Tower Hamlets	NO
Willis Building	51 Lime Street	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	26	2002	City of London	YES
Shell Centre	2 York Road	Howard Robertson	RIBA Gold 1949	26	1957	Lambeth	YES
	33 Canada Square	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	24	1996	Tower Hamlets	YES
	1 Cabot Square	leoh Ming Pei	RIBA Gold 2010, AIA Gold 1979, Pritzker 1983	21	1988	Tower Hamlets	NO
Bastion House	140 London Wall	Phillip Powell & Hidalgo Moya	RIBA Gold 1974	21	1974	City of London	NO
	12 Endeavour Square	Richard Rogers	RIBA Gold 1985, Pritzker 2007	20	2015	Newham	NO
Moor House	120 London Wall	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	19	1998	City of London	NO

'Trophy Architects' and design as rent-seeking

The Place	25 London Bridge Street	Renzo Piano	RIBA Gold 1989, AIA Gold 2008, Pritzker 1998	18	2007	Southwark	NO
	88 Wood Street	Richard Rogers	RIBA Gold 1985, Pritzker 2007	18	1995	City of London	NO
Principal Place	115 Worship Street	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	17	2017	Hackney	NO
New Court	St Swithin's Lane	Rem Koolhaas	RIBA Gold 2004, Pritzker 2000	16	2006	City of London	YES
Central St Giles	1-13 St Giles High Street	Renzo Piano	RIBA Gold 1989, AIA Gold 2008, Pritzker 1998	15	2005	Camden	NO
New Lloyd's Register of Shipping	71 Fenchurch Street	Richard Rogers	RIBA Gold 1985, Pritzker 2007	14	1996	City of London	YES
Fountain House	130 Fenchurch Street	Howard Robertson	RIBA Gold 1949	14	1956	City of London	NO
	5 Endeavour Square	Richard Rogers	RIBA Gold 1985, Pritzker 2007	13	2015	Newham	NO
	10 Bishop's Square	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	13	2001	Tower Hamlets	NO
	1 London Wall	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	13	2000	City of London	NO
Building 7	Chiswick Business Park	Richard Rogers	RIBA Gold 1985, Pritzker 2007	12	2014	Hounslow	NO
Paddington Waterside	35 North Wharf Road	Richard Rogers	RIBA Gold 1985, Pritzker 2007	12	2001	Westminster	NO
	100 Liverpool Street	Michael & Patricia Hopkins	RIBA Gold 1994	11	2015	City of London	NO
Roman Wall House	1-2 Crutched Friars	Michael & Patricia Hopkins	RIBA Gold 1994	11	2014	City of London	NO
	100 Wood Street	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	11	1997	City of London	NO
Langbourne House	10 Fenchurch Street	Denys Lasdun	RIBA Gold 1977	11	1982	City of London	NO
	1 More London Place	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	10	2000	Southwark	YES

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	3 More London Place	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	10	2000	Southwark	NO
Gibbs Building	215 Euston Road	Michael & Patricia Hopkins	RIBA Gold 1994	10	2000	Camden	YES
City Hall	110 The Queen's Walk	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	10	1998	Southwark	YES
Reuter's Building	1 Paul Julius	Richard Rogers	RIBA Gold 1985, Pritzker 2007	10	1992	Tower Hamlets	YES
The Ark	201 Talgarth Road	Ralph Erskine	RIBA Gold 1987	10	1989	Hammersmith	NO
ITN Building	200 Gray's Inn Road	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	10	1989	Camden	YES
Board of Trade Building	Whitehall	Emmanuel Vincent Harries	RIBA Gold 1951	10	1957	Westminster	YES
Holborn Place	33 Holborn Circus	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	9	1995	City of London	NO
Milton Gate	1 Moor Lane	Denys Lasdun	RIBA Gold 1977	9	1986	City of London	NO
Bloomberg Place Building 1	50 Cannon Street	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2012	City of London	YES
Bloomberg Place Building 2	50 Cannon Street	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2012	City of London	YES
The Walbrook	25 Walbrook	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2007	City of London	NO
One New Change	9-36 Cheapside	Jean Nouvel	RIBA Gold 2001, Pritzker 2008	8	2005	City of London	NO
	2 More London Place	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2000	Southwark	YES
	4 More London Place	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2000	Southwark	NO

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	6 More London Place	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2000	Southwark	NO
	7 More London Place	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	2000	Southwark	YES
Tower Bridge House	St Katharine’s Dock	Richard Rogers	RIBA Gold 1985, Pritzker 2007	8	1999	Tower Hamlets	NO
	50 Finsbury Square	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	1998	Islington	NO
	10 Gresham Street	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	8	1997	City of London	NO
Tower Place West	Tower Hill	Norman Foster	RIBA Gold 1983, AIA Gold 1994, Pritzker 1999	7	1998	City of London	NO
Broadwick House	15-17 Broadwick Road	Richard Rogers	RIBA Gold 1985, Pritzker 2007	7	1998	Westminster	NO
Stirling Square	1-5 Carlton Gardens	James Stirling	Pritzker 1981	7	1988	Westminster	NO
	1 Poultry	James Stirling	Pritzker 1981	7	1986	City of London	NO
Neo Bankside Pavillion E	118 Southwark Street	Richard Rogers	RIBA Gold 1985, Pritzker 2007	6	2006	Southwark	NO
Channel 4 Headquarters	124 Horseferry Road	Richard Rogers	RIBA Gold 1985, Pritzker 2007	5	1991	Westminster	YES
Francis Taylor Building	Inner Temple	Edward Maufe	RIBA Gold 1944	5	1956	City of London	YES
	16 Winchester Walk	Edward Cullinan	RIBA Gold 2008	4	2016	Southwark	NO

Table A4: Bespoke status on Modern TA building height

VARIABLES	(1) Floors	(2) Floors	(3) Floors	(4) Floors	(5) Floors
Bespoke	1.527 (3.776)	1.817 (3.746)	-0.335 (3.387)	0.182 (3.368)	-3.047 (5.662)
Built in HPA	-8.175** (3.873)	-9.837** (4.129)	-6.102 (3.816)	-6.427 (3.900)	-4.172 (5.877)
(Bespoke)×(Built Outside HPA)					7.250 (9.577)
Average Office Permission Refusal Rate	-3.119 (23.42)	-8.086 (24.46)	-36.41 (79.89)	-23.74 (88.83)	-12.79 (81.68)
City of London			-3.974 (13.28)	-9.263 (12.09)	-8.200 (11.40)
Docklands			17.59** (6.598)	16.79** (6.685)	16.01** (6.907)
Average Employment 600m Decade Permission Granted	NO	YES	YES	0.000117 YES (0.000109)	0.000111 YES (0.000118)
Constant	21.00*** (3.346)	12.39** (4.857)	16.37 (13.42)	12.54 (15.61)	10.75 (14.62)
Observations	59	59	59	59	59
R-squared	0.077	0.133	0.248	0.263	0.273

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

‘Trophy Architects’ and design as rent-seeking

Table A5: Are bespoke buildings designed by TAs? Population of London office buildings >20-floors (n=47)

Building Name	Address	Architect	TA	Bespoke	Floors	Height	Year Built	Local Authority	Demolished
‘The Shard’	32 London Bridge Street	Renzo Piano	YES	NO	87	310m	2012	Southwark	-
One Canada Square	1 Canada Square	Cesar Pelli	NO	NO	50	235m	1991	Tower Hamlets	-
‘The Cheesegrater’	122 Leadenhall Street	Richard Rogers	YES	NO	48	225m	2014	City of London	-
Tower 42	25 Old Broad Street	Richard Seifert	NO	YES	47	183m	1980	City of London	-
Heron Tower	110 Bishopsgate	Kohn Pedersen Fox	NO	NO	46	203m	2011	City of London	-
HSBC Tower	8 Canada Square	Norman Foster	YES	YES	45	200m	2002	Tower Hamlets	-
-	25 Canada Square	Cesar Pelli	YES	YES	45	220m	2002	Tower Hamlets	-
‘The Gherkin’	30 St Mary Axe	Norman Foster	YES	YES	40	180m	2003	City of London	-
‘The Scalpel’	52-54 Lime Street	Kohn Pedersen Fox	NO	YES	39	192m	2018	City of London	-
‘The Walkie-Talkie’	20 Fenchurch Street	Rafael Vinoli	NO	NO	36	160m	2014	City of London	-
Euston Tower	286 Euston Road	Sidney Kaye, Eric Firmin & Partners	NO	NO	36†	124m	1970	Camden	-
Britannic House	1 Ropemaker Street	F. Milton Cashmore & Niall D. Nelson	NO	YES	35‡	122m	1967	City of London	-
Broadgate Tower	201 Bishopsgate	Skidmore, Owings, and Merrill	NO	NO	33	164m	2009	City of London	-
-	25 Bank Street	Cesar Pelli	YES	NO	33	153m	2003	Tower Hamlets	-
-	40 Bank Street	Cesar Pelli	YES	NO	33	153m	2003	Tower Hamlets	-
Centre Point	103 New Oxford Street	Richard Seifert	NO	NO	33†	121m	1965	Camden	-
One Churchill Place	1 Churchill Place	HOK International	NO	YES	32	156m	2004	Tower Hamlets	-
Millbank Tower	21-24 Millbank	Ronald Ward & Partners	NO	YES	32	118m	1961	Westminster	-
-	10 Upper Bank Street	Kohn Pedersen Fox	NO	YES	31	151m	2003	Tower Hamlets	-

‘Trophy Architects’ and design as rent-seeking

King’s Reach Tower	Stamford Street	Richard Seifert	NO	NO	29‡	111m	1978	Southwark	-
Empress State Building	Empress Approach	Stone, Toms & Partners	NO	NO	28‡	100m	1961	Hammersmith	-
Portland House	Bressenden Place	Howard Fairbairn & Partners	NO	NO	28	102m	1963	Westminster	-
The Willis Building	51 Lime Street	Norman Foster	YES	YES	28	125m	2007	City of London	-
Drapers Gardens	12 Throgmorton Street	Richard Seifert	NO	YES	28	99m	1967	City of London	2007
Commercial Union Tower	1 Undershaft	Gollins, Melvin, Ward	NO	YES	26	118m	1969	City of London	-
Shell Centre	2 York Road	Howard Robertson	YES	YES	26	107m	1962	Lambeth	-
Stock Exchange Tower	125 Old Broad Street	F. Milton Cashmore & Partners	NO	YES	26‡	99m	1969	City of London	-
Limebank House	168 Fenchurch Street	Richard Seifert	NO	YES	26	93m	1969	City of London	1998
Kleinwort Benson Building	20 Fenchurch Street	William H. Rogers	NO	YES	25	91m	1968	City of London	2008
New London Bridge House	25 London Bridge Street	Richard Seifert	NO	NO	25	94m	1967	Southwark	2010
-	99 Bishopsgate	Richard Seifert	NO	NO	25	104m	1976	City of London	-
The London Studios	58-72 Upper Ground	Elsom Pack & Roberts	NO	YES	25	82m	1973	Southwark	-
Southwark Towers	32 London Bridge Street	T.P. Bennett & Son	NO	NO	25	100m	1976	Southwark	2009
-	33 Canada Square	Norman Foster	YES	YES	24	105m	1999	Tower Hamlets	-
‘The Can of Ham’	60 St Mary Axe	Foggo Associates	NO	NO	23	91m	2018	City of London	-
Ropemaker Place	25 Ropemaker Street	Arup Associates	NO	NO	23	96m	2006	Islington	-
Marble Arch Tower	55 Bryanston Street	T.P. Bennett & Son	NO	NO	23	82m	1966	Westminster	-
Market Towers	1 Nine Elms Lane	GMW Architects	NO	YES	23	75m	1975	Lambeth	-
-	6-8 Bishopsgate	GMW Architects	NO	YES	23	88m	1981	City of London	-

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IQL S9 International Quarter	12 Endeavour Square	Richard Rogers	YES	NO	23	92m	2018	Newham	-
Westminster City Hall	64 Victoria Street	Burnet, Tait and Partners	NO	NO	22	76m	1966	Westminster	-
Angel Court	1 Angel Court	Fitzroy Robinson and Partners	NO	NO	21	94m	1980	City of London	-
-	200 Aldersgate Street	Fitzroy Robinson and Partners	NO	NO	21	91m	1992	City of London	-
One Cabot Square	1 Cabot Square	Pei, Cobb, Freed & Partners	YES	NO	21	89m	1991	Tower Hamlets	-
Bastion House	140 London Wall	Phillip Powell & Hidalgo Moya	YES	NO	21	69m	1976	City of London	-
Century House	100 Westminster Bridge Road	Devereux Architects	NO	NO	21	73m	1959	Lambeth	-
New Scotland Yard	10 Broadway	Chapman, Taylor and Partners	NO	NO	21	67m	1962	Westminster	2017
City Tower	40 Basinghall Street	Burnet, Tait and Partners	NO	NO	21	69m	1957	City of London	-

†Building was allowed exceptional height as a concession for funding local roadworks.

‡Additional floor(s) added since construction. Data represents originally constructed floor count.

Table A6: Breakdown of buildings >100m and TAs by selected city

City	Bldgs >100m per million Population	Total Bldgs >100m	Office Bldgs	Residential Bldgs	Hotel Bldgs	Other Bldgs	TA Bldgs	Total TA Percentage
London	7	55	28	20	1	6	14	25.45
Chicago	111	301	123	160	16	2	9	2.99
Houston	40	88	60	19	3	6	5	5.68
Brussels	15	17	15	2	0	0	0	0.00
Benidorm	384	26	0	25	1	0	0	0.00
Sao Paulo	20	231	75	142	9	5	1	0.43
<i>Non-London</i>	-	<i>663</i>	<i>273</i>	<i>348</i>	<i>29</i>	<i>13</i>	<i>15</i>	<i>2.26</i>
Total	-	718	301	368	30	19	29	4.03

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Table A7: Chicago Buildings Designed by TA Architects before and after their TA Award

Building Name	Address	Architect	TA	Floors	Height	Year Built
The Willis Tower	233 South Wacker Drive	Nathaniel Owings	NO	110	442m	1974
John Hancock Centre	875 North Michigan Avenue	Nathaniel Owings	NO	100	344m	1969
Onterie Centre	441 East Erie Street	Nathaniel Owings	YES	58	174m	1986
Three First National Plaza	70 West Madison Street	Nathaniel Owings	NO	57	234m	1981
One Magnificent Mile	940-980 North Michigan Avenue	Nathaniel Owings	NO	57	205m	1983
330 North Wabash	330 North Wabash Avenue	Ludwig Mies van der Rohe	YES	52	212m	1973
Madison Plaza	10 North Wells Street	Nathaniel Owings	NO	44	182m	1982
The Plaza on Dewitt	260 East Chestnut Street	Nathaniel Owings	NO	43	120m	1966
One Financial Place	440 South LaSalle Street	Nathaniel Owings	NO	39	157m	1985
Harris Bank Addition II	115 South LaSalle Street	Nathaniel Owings	NO	38	155m	1974
Gateway Centre III	222 South Riverside Plaza	Nathaniel Owings	NO	35	137m	1971
321 North Clark	321 North Clark Street	Nathaniel Owings	YES	35	155m	1987
Cook County Administration Building	69 West Washington Street	Louis Skidmore	YES	35	145m	1964
Equitable Building	401 North Michigan Avenue	Louis Skidmore	YES	35	139m	1965
Hartford Plaza South	150 South Wacker Drive	Nathaniel Owings	NO	33	126m	1971
Dirksen Federal Building, Chicago Federal Centre	219,230 South Dearborn Street	Ludwig Mies van der Rohe	NO	30	117m	1964
One Illinois Centre	111 East Wacker Drive	Ludwig Mies van der Rohe	YES	30	110m	1970
33 West Monroe	33 West Monroe Street	Nathaniel Owings	NO	29	114m	1980
University Hall	601 South Morgan Street	Louis Skidmore	YES	28	103m	1965
Loop Transportation Centre	203 North LaSalle Street	Nathaniel Owings	YES	27	102m	1985
525 West Monroe	525 West Monroe Street	Nathaniel Owings	NO	26	101m	1983
33 North Dearborn	33 North Dearborn Street	Nathaniel Owings	NO	25	106m	1966
676 North St. Clair	676 North St. Clair Street	Nathaniel Owings	NO	25	101m	1979
500 North Michigan Avenue	500 North Michigan Avenue	Nathaniel Owings	NO	24	99m	1968
River North Point	350 North Orleans Street	Nathaniel Owings	NO	24	85m	1977
Gateway Centre IV	300 South Riverside Plaza	Nathaniel Owings	NO	23	98m	1983
Harris Bank Addition I	111 West Monroe Street	Louis Skidmore	YES	23	98m	1958
CDW Plaza	120 South Riverside Plaza	Nathaniel Owings	NO	21	87m	1967
Gateway Centre I	10 South Riverside Plaza	Louis Skidmore	YES	21	87m	1965
Hartford Plaza North	100 South Wacker Drive	Louis Skidmore	YES	20	74m	1961
Inland Steel Building	30 West Monroe Street	Louis Skidmore	NO	19	77m	1956

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Appendix 4: Some Effects of TAs on Development Costs and Returns

In Section VI we showed the estimated value of a TA designed building in a non-HPA in the City of London using sample mean values observed from buildings in the City. These are shown in Table A8 below.

Table A8 here: City of London means for relevant variables

Kufner (2011) argues that planning applications for tall buildings in London require extra time to process and we provide some evidence in Tables A9 and A10. Although fragmentary this is consistent with this claim. There is also likely to be a substantial increase in the uncertainty of the outcome. An increase in uncertainty associated with attempting to build higher using a TA will be translated by the developer into higher risk. Developers will therefore demand a greater expected return (Mayo and Sheppard 2001). Furthermore, there may be additional planning costs when attempting to build exceptionally tall. For instance city planners generally require additional and more extensive impact assessments for tall buildings⁸, legal assistance may be protracted, the architect may be asked to successively redesign the proposal at various stages of the planning negotiation⁹, the planning authority may take additional time to deliberate¹⁰, and permission may still be ultimately refused at the local or national level (Kufner 2011). Therefore, in order to assess the actual profit incentives for developers to hire TAs one should rescale expected returns by a discount rate commensurate with the additional planning risks and delays, and account for the additional costs of submitting a large scale development proposal to a local authority.

⁸ Additional assessments are: impact on TV/radio and air traffic assessment; more extensive environmental impact, sunlight and daylight assessment; wind-tunnel assessment, London Views Management Framework assessment (LVMF) and Tower of London world heritage site assessment. These assessments require consultation with: London City airport, BAA safeguarding team, Royal Parks, Mayor of London, Surveyor to the Tower of London, Surveyor to the Fabric of St Paul’s Cathedral, International Council on Monuments and Sites (UNESCO), Design Council/CABE, adjoining LPAs on development which is likely to affect land in the LPA, LPAs with Strategic Views identified in LVMF.

⁹ Powell (2006) for instance shows how at least 10 successive design proposals of Norman Foster’s ‘Gherkin’ at 30 St Mary Axe were given to the City of London for review until their final approval.

¹⁰ Kufner (2011) suggests that these additional regulatory demands increase the duration of the planning approval process for tall buildings by 1 to 2.5 years.

Table A9 here: Planning histories building size

Table A10 here: Planning histories building approval

From Table A9 we see that both ‘average’ and ‘tall’ buildings may have their initially proposed sizes either increased or decreased before final planning approval although the variation observed for ‘tall’ buildings greatly exceeds that for conventional ones. In Table A10, time elapsed to resolve the first planning application is perhaps the best metric for direct comparison of planning delay because once the first application has been accepted, future application approvals are generally processed more quickly¹¹. Taking a look at planning application timescales, Table A10 appears to show that first applications for ‘tall’ buildings require between 6-18 months of additional deliberation before a decision and two of the three were ultimately decided by the Cabinet minister responsible, whereas this was true of none of the normal-sized buildings. Taken together with the additional assessment requirements noted in the body of the paper, there appear to be substantial additional costs imposed by attempting to build tall. Unfortunately these various costs are so difficult to estimate with any certainty that our building cost consultants Gardiner & Theobald were unable to quote an expected value for them.

In addition to the planning costs and uncertainties associated with building tall there is a further possible complicating factor: the speed with which TA buildings can be let. The TA rents estimated here assume that upon sale the building will have achieved the same occupancy rate as the sample average (91 percent). Of course in reality new developments are likely to be speculative, and it is far from certain that the building will be fully let on completion. Indeed, major projects with planning permission are routinely paused or abandoned in London due to a failure to secure a sufficient number of pre-lets. Any difference in the ability of average compared to tall buildings to secure first tenants and then become fully-let may further offset apparent economic rents and so reduce actual profits¹².

Table A11 here: Planning history lettings

¹¹ Private communication with City of London Planning Authority to whom we are grateful for supplying this data.

¹² For instance, ‘The Shard’ 32 London Bridge didn’t secure its first office tenant until nearly 10 months after its opening.

We look at this – at least for this small sample of buildings – in Table A11. We see that, unsurprisingly, the bespoke (built for specific occupiers) Riverbank House and ‘Gherkin’ achieved the fastest first and complete lettings of, respectively, the ‘average’ and ‘tall’ buildings. However it took the ‘tall’ ‘Gherkin’ 62 more months to achieve this than the ‘average’ Riverbank House. Looking at the non-bespoke buildings the two other ‘average’ buildings achieved first lettings between 4-43 months and full lettings 55-89 months *before* the other two ‘tall’ buildings. This admittedly small case study suggests that in general tall/large buildings do indeed struggle to secure full tenancy compared to their smaller counterparts.

Yet another possible way in which the employment of a TA might influence developers’ expected revenues would be if TA buildings systematically conceded different rent-free periods in order to attract tenants. Note that since building sales can (and generally are) timed by developers to coincide with full occupation, rent-free concessions for space in TA-designed buildings would not necessarily show up in the sale price analysis of Table 6¹³; nevertheless any such differentials are relevant to developer profits. We test this hypothesis with a sample of 17 leases from TA and 59 leases from standard buildings comprising 47 buildings altogether, and examine whether TA buildings yielded different rent-free periods in a series of hierarchical regressions. All leases in the sample contained a positive rent-free period incentive. Robust standard errors are used as White tests reject homoskedasticity. The results reported in Table A12 provide no evidence that rent-free periods vary significantly between type of architect or the amount of space leased.

Table A12 here: Rent-free period regressions

In sum, it appears that at least a substantial proportion of the additional, very conservatively estimated ‘rent’ needs to be set against identifiable additional costs and the additional time (6-18 months) and expense, incurred in obtaining planning approval for tall buildings, and the longer period required to fully let such a building (up to 140 months). Assuming the TA building could; (i) be let for rents of £861/m² per year¹⁴ discounted at 10%, (ii) receive time-proportionate lettings and a 24 month additional wait to fully let the building from construction

¹³ Note that it is superfluous to test for increased rents in TA buildings, since any rental-price anomalies would directly translate into higher sale prices, which were not observed in Table 6.

¹⁴ Source: Gardiner & Theobald. This assumption yields annual rents for our hypothetical 8-floor SA and 22-floor TA building of £9m and £27m/year (including the TA-premium), respectively, if fully let.

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start (taking a total of 48 months), and therefore sell it, and (iii) a cost of capital of 10 percent; the net cost to the developer of this slower take-up would be the difference in the *gain* in total rental payments over the longer letting period of £32m, and the additional financing *cost* incurred over that same period of £41m. Net, therefore, this letting delay nominally costs the developer £9m. These results are summarized in Table A13 below.

Table A13 here: Quantifiable costs of delay

We then must also add the unquantifiable costs associated with the required higher rate of expected return to the developer to compensate for the risky business of going down the TA route and trying to build tall rather than taking the much less risky route provided by a building of standard permitted heights. Assuming that developers cannot earn supernormal returns would suggest that such ‘unquantifiable’ costs are equivalent to as much as £162m minus £9m, or £153m.

The estimates of surpluses, economic rents, and deadweight losses in Section VI were calculated by comparing the estimated costs and sale prices of SA and TA buildings. Surplus-maximising building heights of SA and TA buildings were estimated through iterative calibration.

Table A8: Variable means for City of London office buildings

Variable	Values assumed
Modern TA	e [†]
Within HPA	1 [‡]
Listed	1
Office Permission Refusal Rate	0.44%
Employment Density 600m	93,388
Listed Building Density	2,144
Above Ground Floors	8/22
Office Space Grade A	e
Percent Occupied	91%

[†]ln(e)=1, i.e. the dummy variable is indicated in log form.

[‡]ln(1)=0, i.e. the dummy variable is not indicated in log form.

Table A9: Planning histories building size

Building	Address	TA	Initial Floors Proposed	Final Floors Accepted	Initial Floorspace m ² Proposed	Final Floorspace m ² Accepted	Percentage Floorspace Change
Clements House	20 Gresham Street	NO	8	8	32,396	32,022	-1
Riverbank House	2 Swan Lane	NO	11	11	39,567	42,291	+7
Premier Place	2-5 Devonshire Square	NO	9	9	27,000	23,226	-14
Heron Tower	110 Bishopsgate	NO	34	46	32,516	42,873	+24

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‘Gherkin’	30 St Mary Axe	YES	90	40	285,658	47,035	-84
‘Walkie-Talkie’	20 Fenchurch Street	NO	42	36	91,000	84,913	-7

Table A10: Planning histories building approval

Building	Address	Number of Applications Submitted	Number of Applications Approved	Average Time to Decision (Months)	First Application Time to Decision (Months)	Initial Application Consultation	Permission granted by Cabinet minister responsible
Clements House	20 Gresham Street	3	3	10.0	10	12/1997	NO
Riverbank House	2 Swan Lane	2	2	7.5	10	06/2002	NO
Premier Place	2-5 Devonshire Square	5	5	2.6†	4	02/1997	NO
Heron Tower	110 Bishopsgate	2	2	14.5	22	07/1999	YES
‘Gherkin’	30 St Mary Axe	2	1	14.5	16+‡	02/1996	NO
‘Walkie-Talkie’	20 Fenchurch Street	2	2	13.5	16	05/2005	YES

†Simultaneous applications were submitted and decided concurrently.

‡Application withdrawn after 16 months of deliberation.

Table A11: Planning history lettings

Building	Address	Bespoke Development	Construction Start†	Date First Tenant Signed	Months to First Tenant from Const. Start	Date Building Fully Let	Months to Full Occupation from Const. Start
Clements House	20 Gresham Street	NO	06/2006	05/2008	23	06/2010	48
Riverbank House	2 Swan Lane	YES	09/2009	10/2006	-35	10/2006	-35
Premier Place	2-5 Devonshire Square	NO	07/1999	11/2000	16	11/2000	16
Heron Tower	110 Bishopsgate	NO	07/2007	10/2010	39	01/2016	103*
‘Gherkin’	30 St Mary Axe	YES	07/1995	11/1997	27	11/1997	27**
‘Walkie-Talkie’	20 Fenchurch Street	NO	07/2007	06/2012	59	03/2016	105***

†Construction is considered to have started once demolition of the previous building commenced.

* Completed 03/2011; only 45 percent let as of 02/2013; 63 percent let as of 09/2013; 100 percent let as of 01/2016.

**100 percent effectively let through purchase of scheme by Swiss RE on 06/1998 conditional on planning permission which was then granted on 08/2000.

***Completed 04/2014; construction paused between 04/2009-02/2011; 57 percent pre-let as of 09/2013, 87 percent let as of 05/2014, 98 percent let as of 09/2015, 100 percent let as of 03/2016.

Table A12: Rent-free period regressions

VARIABLES	(1) Rent-Free Period (months)	(2) Rent-Free Period (months)	(3) Rent-Free Period (months)	(4) Rent-Free Period (months)
TA Building	5.203 (3.440)	1.115 (3.052)	-0.442 (3.033)	-0.913 (3.013)
Lease Length (years)		1.467*** (0.269)	1.102*** (0.249)	1.178*** (0.234)
Lease Floorspace m ²			0.000354 (0.000274)	0.000368 (0.000276)

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Building Depreciation				0.334 (0.372)
Contract Start 2003	3.734 (4.174)	10.93* (6.328)	13.24 (8.593)	12.72 (8.700)
Contract Start 2004	-2.889 (4.446)	4.119 (6.460)	8.349 (8.900)	8.276 (8.895)
Contract Start 2005	10.70** (4.188)	16.13** (6.586)	19.03** (8.846)	18.68** (8.878)
Contract Start 2006	-2.438 (3.975)	3.140 (6.123)	5.909 (8.643)	5.947 (8.648)
Contract Start 2007	-9.401 (5.807)	-0.215 (7.151)	0.780 (8.963)	0.210 (9.034)
Contract Start 2008	-8.924 (5.958)	5.365 (7.691)	8.307 (9.713)	7.738 (9.909)
Contract Start 2009	15.33 (11.05)	25.31** (10.74)	24.70** (10.98)	24.43** (10.98)
Contract Start 2010	2.714 (5.591)	13.84 (7.167)	15.22 (9.275)	13.61 (9.479)
Contract Start 2011	-6.540 (4.245)	9.913 (6.892)	11.45 (9.070)	9.985 (9.512)
Contract Start 2012	-1.448 (4.125)	11.01 (6.815)	13.21 (8.905)	11.57 (9.224)
Contract Start 2013	1.234 (5.499)	15.76** (6.504)	17.47** (8.625)	15.03 (9.288)
Constant	17.27*** (3.463)	-9.729 (7.561)	-8.693 (9.113)	-9.913 (9.054)
Observations	76	76	76	76
R-squared	0.287	0.567	0.598	0.603

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Building Depreciation = the number of years between the building construction date/most recent refurb and the lease start.

Table A13: Quantifiable costs of delay

	Total rents received until sale	Extra financing cost	Net quantifiable costs of delay
8-floor SA	£8m after 24months	£33m×10%×2 years= £7m	-
22-floor TA	£40m after 48months	£119m×10%×4 years = £48m	-
Difference	+£32m	-£41m	-£9m

References Appendix 4

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