The Cost of Regulatory Constraints on the British Office Market

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1 Introduction: The Problem and the Research Methodology

1.1 An obvious problem in analysing the economic impacts of land use planning is identifying exactly what element in total occupation costs – the cost of space to economic agents - may reasonably be attributed to 'planning' restrictions. This is because i) Such restrictions take many forms over and beyond restricting the supply of land or space; and ii) It is essential to compare like for like or to eliminate from the results the normal factors such as city size, income level, transport costs, topography and growth rate that urban economic theory tells one should be expected to influence the price of land and space. Furthermore if we want to estimate the impact of any measured increase in space costs resulting from 'planning' or more generally from regulation we would need to go a second step – not included in this research. It would be necessary to estimate the impact on output, employment and incomes of any increase in space costs regulatory constraints imposed.

1.2 This project aims to estimate just the first of these elements: the total cost of regulatory constraints on the price of office space expressed as a 'tax' rate – that is as a percentage of construction costs. To do this we adapt a methodology first developed and applied to the Manhattan housing market by Glaeser, Gyourko and Saks (2005). The key idea of the approach is simple; in a world with competition among property developers and free market entry and exit (both reasonable assumptions), price will equal (minimum) average cost since this includes 'normal' profit. In the absence of restrictions on heights or space for construction, buildings should rise to a point where the marginal cost of adding an additional floor equals the market price of this additional floor. If building higher is less profitable per m^2 than building over a greater area, still we should expect the marginal cost of an extra floor to be equal to price: buildings would just be lower on average but the overall urban land take would be greater. Bertaud and Brueckner (2005) demonstrate the formal equivalence of height restrictions compared to land supply restrictions. Equally, if regulation is complex and compliance costs are high but affect the cost per building or development rather than the cost per floor, this will increase the price of space in an additional floor relative to the marginal costs of construction. The gap between the observed market price and the marginal construction cost can be interpreted as a 'regulatory tax' – the additional cost of space resulting - in aggregate - from the system of regulation in that particular market. If the sales price of an additional floor of office space exceeded the marginal cost of building this

additional floor then developers would have an arbitrage opportunity. The difference between the price of floor space and its cost of construction must be due to some form of regulation.

1.3 In the context of the residential sector, an elaborate and theoretically rigorous methodology was set out in Cheshire and Sheppard (2002) for estimating both the gross and the net costs of planning imposed restrictions on supply and the net welfare cost these had. The methodology involved estimating implicit prices for housing and garden space and planning produced amenities; then by matching these to a household income survey, estimating both the structure of demand for these housing and planning 'goods' and the indirect utility function of households. If it was assumed that urban housing markets were in equilibrium (for which there was reasonable empirical evidence) these could be combined to estimate the *de facto* supply of space released by the planning system within the housing market concerned (Reading) since equilibrium requires that all available space be consumed. It was then possible to estimate via the indirect utility function and estimated demand system, the impact on welfare in terms of equivalent variation in incomes of changes in the supply of both planning amenities and housing space consequent on a more or less restrictive supply of space and planning amenities consistent with a more or less restrictive release of housing land via the planning system.

1.4 This, however, is demanding on data and research time and depends on being able to explicitly identify and estimate the economic impacts of the goods/amenities generated by planning, the impact of regulation on supply and the indirect utility functions of residents/citizens. Even if it were not so data intensive, it is not clear such a methodology could be adapted to estimating the economic and welfare impacts of regulation of the supply of non-residential property because of the difficulty - perhaps impossibility - of estimating the relevant production function. Below, we estimate the magnitude of this regulatory tax over time for office space in various UK markets by comparing the market price of space in an additional floor (were it possible to build one) with the (marginal) construction cost of building this additional floor. The difference between the two numbers will be interpreted as a 'regulatory tax'.

1.5 The Glaeser *et al* (2005) methodology, as they apply it to New York condominiums, has the considerable attraction that it is intellectually coherent, resting on established microeconomic theory, and it is not demanding with respect to data and estimation

techniques. It could be applied to any category of space in which a unit of space in an additional story was a more or less perfect substitute for an additional unit of space obtained via a larger building footprint or garden. Thus it could be applied to offices or hotels as well as high rise blocks of flats but more doubtfully to industrial, retail or warehouse space. Its downside is that it is a 'black box' number in that it does not differentiate between costs that are imposed by different aspects of regulation but is an aggregate measure of the cost of all regulatory constraints taken together: that is, restrictions on land supply, space by floor area ratios or off-street parking requirements or height restrictions or indeed compliance complexity or delays in decision making. In addition it only gives a 'cost' not a **net** welfare or **net** impact on output measure. As is well known there are measurable benefits from some aspects of regulation and since space is substitutable to a degree both in production and consumption the effects on output or welfare can only be estimated if both the benefits and the extent of substitutability are known.

1.6 Our empirical analysis builds on the best available data for the British office market. Time-series data on marginal construction cost by market (per square foot or square metre) was obtained from the leading professional construction cost estimators (Davis Langdon) who produce the data for the Spon Handbooks used by quantity surveyors and architects (Davis Langdon 2005). See Appendix A for a detailed description of the methodology Davis Langdon used to derive the marginal cost of construction. Unfortunately, comparable time-series data on the market price of office space in the sense of capital values is not readily available, only rental and yield data can be obtained (from CB Richard Ellis, CBRE, the largest property consultancy in the UK). This is because office buildings are treated as income producing properties that are typically leased (rather than sold) floor by floor. Given this complication, we need to impute the market price of an additional floor of office space (the 'capitalised value') using the available information on rents, yields, rent-free periods and vacancy rates. The estimation procedure is briefly described below and explained in more detail in Appendices B to D. Since we do not observe transaction prices but must rely on estimates, we carry out a quite extensive sensitivity analysis adapting the most 'conservative' and 'radical' assumptions which are defensible. These provide an upper and a lower bound estimate in addition to a central, perhaps most plausible, value. Finally we provide some more tentative estimates for the regulatory tax imposed on office space in some continental European cities for which there are data.

1.7 It is helpful to report at the start the value of the 'regulatory tax' estimated by Glaeser *et al* (2005) for New York apartments. They report their results as a ratio (rather than as a quasi tax rate) fractionally in excess of 2 for the most recent year for which they had data, 2002. In our measure this would translate to a value of 1.07. They also investigate other data which suggested that the value of the regulatory tax on housing was higher in some West Coast urban areas, such as the Bay Area and Los Angeles, than it was in the New York urban area as a whole (it was higher in Manhattan than it was in the New York metro area) although it was still substantial in the New York area. However, in 10 of the 21 urban areas investigated there was no measurable impact of regulation on house prices. Nor was there any indication of a 'regulatory tax' on office property in Manhattan. This provides some standard against which to evaluate the results for office property in British cities reported below.

2 Short Description of Data

2.1 Our data come from four different sources. CBRE (which incorporates the former CB Hillier Parker and before that Hillier Parkers the first agency to publish rental and yield data including the *Investors Chronicle Hillier Parker* reports) provided us with (headline) prime rents and equivalent yield data for 14 local office markets in the UK (see Table 1 for a list of the markets). Both time-series cover all 14 local markets. Most time-series reach back until 1973 with two series (those for the City of London and London West End) reaching back until 1960. CBRE also provided us with total occupation cost data, although only for 2004 and 2005 for 8 of the 14 relevant markets. We obtained the matching marginal construction cost data for all 14 markets from Davis Langdon based on actual construction projects in those markets also going back to 1960. Finally, we obtained regional vacancy rate information from the Office of the Deputy Prime Minister (ODPM) and national rental void data from IPD.

3. Methodology Used to Compute the Regulatory Tax

3.1 Our goal is to estimate, as accurately as possible, the magnitude of the regulatory tax over time for the 14 local office markets. The regulatory tax can be expressed as:

$$Regulatory\ Tax_{jt} = V_{jt} - MCC_{jt} \quad (1)$$

where V is the market value of an additional square metre of office space in market j at time period t and where MCC is the corresponding marginal construction cost of adding one square metre of an additional floor.

The computation of the two components V and MCC is described below.

3.2 *Deriving the Market Value of a Square metre of Office Space in an Additional Floor:* The market value of a square metre of additional office space is estimated using the 'Equivalent Yield Model', which is probably the most commonly used model to value income producing property in Britain.[2] According to the equivalent yield model, the property value can be expressed as:

$$V_{jt} = \frac{I_{jt}}{y_{jt}} + \frac{R_{jt} - I_{jt}}{y_{jt}\left(1+y_{jt}\right)^{n_{jt}}} \tag{2}$$

where V_{jt} is the value of the property (in location j at time period t), y_{jt} is the corresponding equivalent yield, R_{jt} is the so called 'current rental value', I_{jt} is the 'passing income' and n_{jt} is the number of years to the next rent review.

The equivalent yield is equal to the internal rate of return (IRR) of two cash flow streams (a stream of 'passing incomes' up to the rent review and then a stream of current rental values, assumed to be constant (in real terms) in perpetuity). The 'passing income' (which is expressed in nominal terms) only includes the rents that the tenants 'pass' on to their landlord. Tenants that are still in their rent-free period or non-rented space do not contribute to the passing income. Hence, in order to get from the (headline) prime rent to the passing income, adjustments for rent-free periods and vacancies have to be made as follows:

$$I_{jt} = Prime\ Rent_{jt} \times \left(1 - \frac{Rent\ Free\ Period_{jt}}{Typical\ Contract\ Length}\right) \times \left(1 - \frac{Vacancy\ Rate\ in\ \%_{jt}}{100}\right). \tag{3}$$

The 'current rental value' is measured in real terms and is assumed to remain constant in perpetuity. The capitalised value of the current rental value reflects the reversion value at the time when the current lease expires.

[2] See for example Brown and Matysiak (2000) for a more detailed discussion of the 'Equivalent Yield Model'.

If we make the reasonable assumption that the current rental value (in real terms) equals the passing income, then the property value can be expressed as

$$V_{jt} = \frac{I_{jt}}{y_{jt}}. \tag{4}$$

Using equation (3), the estimated value can finally be expressed as:

$$V_{jt} = \frac{\text{Prime Rent}_{jt} \times \left(1 - \frac{\text{Rent Free Period}_{jt}}{\text{Typical Contract Length}}\right) \times \left(1 - \frac{\text{Vacancy Rate in \%}_{jt}}{100}\right)}{y_{jt}}. \tag{4.1}$$

The main advantage of using the equivalent yield model to estimate the capitalised value of office space is that it requires estimates of only two unknown variables, namely, an estimate of the passing income and the equivalent yield. The equivalent yield can be estimated from comparable properties in the local market place that have recently been sold (i.e., it can be derived through 'reverse engineering' using transaction prices and rental income information).

Although the equivalent yield model is simplistic and obviously has a number of serious economic shortcomings, it provides surprisingly accurate valuations. This is probably for some combination of two reasons: First, professional valuers are familiar with subtle changes in the market that will influence the choice of yield; and second, valuers' valuations – based on the equivalent yield model – are the basis for transactions ('deals'). Hence, even if a valuation does not reflect the 'true value' of a property (reflecting all future cash flows discounted at the 'correct' rate), as long as buyers and sellers use the same valuation model, they will end up agreeing on a (transaction) price that reflects the model's predicted value.

3.3 *Estimating the Marginal Construction Cost of Adding an Additional Floor of Office Space:* In order to get the best possible estimate of the marginal construction cost, we commissioned Davis Langdon to provide us with marginal construction cost data for an additional floor of prime office space in our 14 local office markets. The time-series for the 14 markets are based on the observed values of a number of past development projects in those 14 markets. Davis Langdon-location adjustment factors and tender price indices are then used for the 14 markets to create a time-series of true marginal construction costs back to 1960. The estimating method is described in more detail in Appendix A.

3.4 *Estimating the Magnitude of the Regulatory Tax and Reported Measure:* The regulatory tax is computed as the estimated market value per square metre (fully adjusted for rent-free periods and vacancy rates) minus the marginal construction cost data provided by Davis Langdon. Rather than reporting the regulatory tax directly, we report a quasi-tax rate, the regulatory tax relative to marginal construction cost:

$$Regulatory\ Tax\ Rate_{jt} = \frac{Regulatory\ Tax_{jt}}{MCC_{jt}} = \frac{V_{jt} - MCC_{jt}}{MCC_{jt}} = \frac{V_{jt}}{MCC_{jt}} - 1. \quad (5)$$

These regulatory tax rates are reported for all 14 markets and for all time periods with available data (see Figures 1.1 – 1.14).

3.5 *Sensitivity Analysis:* Given that the regulatory tax is not directly observed but must be estimated making various assumptions, it is sensible to carry out a robustness check of results altering the underlying assumptions.

Specifically, the results of three alternative sets of assumptions are reported in subsequent sets of figures (Figures 2.1 – 2.14, 3.1 – 3.14 and 4.1 – 4.14). The alternative sets of assumptions are as follows:

1. Upper Bound: Assume that 50% of the difference between total occupation cost and prime rent is due to a regulatory tax and assume a 10% rent-premium for top floor space (Figures 2.1 – 2.14)
2. Use the fully adjusted prime rent as the basis (as in the central estimate) but assume a 10% premium for top floors (Figures 3.1 – 3.14)
3. Lower Bound: Use the fully adjusted prime rent as the basis (as in the central estimate) but assume a 0.5 percentage point higher yield than reported by CBRE (Figures 4.1 – 4.14)

4 Methodologies Used to Impute Missing Values

4.1 Our raw data comes in different time-intervals. The prime rent data, for example, are quarterly for the City of London and London's West End back to 1960; however, they are

quarterly, monthly, half-annually and annually for the other 12 markets (with the exception of three markets back until 1973). Similarly, the yield data comes in various time intervals. The construction cost data is annual. Hence, in order to make our data comparable, we use annual numbers when available and compute annual numbers (averages from the available monthly, quarterly or half-annual data) when not.

4.2 Even though we use annualised data we still have missing values for a number of variables and markets. For example, we only obtained *rent-free period data* for two markets (the City of London and London's West End) and only between 1993 and 2006. For the remaining years and other markets we need to impute the rent-free periods using the available data (see Appendix B for details). Similarly, we need to impute *equivalent yields* prior to 1973 using the available data. The methodology is described in Appendix C. The imputed values obviously introduce an additional degree of uncertainty into estimates prior to 1972 (1972 Hillier Parker yields were available and these are believed to be comparable to the CBRE data series). We also have to impute *vacancy rates* from relatively short time-series of regional data from ODPM and longer time-series data from IPD. The methodology is described in more detail in Appendix D. In terms of the impact the need to impute values makes on the final estimates we should say that for yields this could be significant and unless we can find a satisfactory data series covering the period 1960 to 1971 we should be very cautious with respect to any interpretation of estimated values of the regulatory tax or trends in that tax prior to 1972. The absolute differences to estimates resulting from any plausible alternative values of rent free periods and vacancy rates are, however, comparatively small. We are confident, therefore, that while the need to impute values for such data is not entirely satisfactory, the additional margin of error it may introduce into the estimates is small in absolute terms.

4.3 We have to impute *missing rental values* using national rent-index data from Hillier Parker (today CBRE). The Hillier Parker ICHP national rent-index data is available back to 1965, which allows us to impute missing rental values between 1965 and 1972. Such data are only available for 1965, 1969, 1972 and then at an annual basis. For missing years we assume a linear trend.

4.4 Finally, we impute total occupation cost by assuming a constant scaling factor to fully adjusted prime rents using the ratio: average of the total occupation cost for each market 2004

and 2005 divided by fully adjusted prime rent. We can match prime rent and total occupation costs for 8 of the 14 markets. For the remaining 6 markets we assume the ratio of the geographically closest market for which data are available.

4.5 For the small number of continental European cities for which we are able to provide some estimates we had to make other – more significant - adjustments and assumptions described in Section 6.

5 Results and their Interpretation

5.1 The results are summarised in Tables 1 to 3. Table 1 shows the markets investigated. Table 2 illustrates the sensitivity of the results to alternative assumptions; and Table 3 reports the mean value of the 'regulatory tax' and other descriptive statistics for each year from 1961 to 2005. The markets were selected to cover as wide and representative a range as possible including the main office locations in Scotland.

5.2 It is clear from Table 2 that there are no realistic assumptions which eliminate a substantial regulatory tax. The mean value, at 2.37, even for the most conservative lower bound estimate is more than twice that estimated for Manhattan housing by Glaeser *et al* (2005).

5.3 Table 3 shows the annual mean values. We should largely discount values before 1973 since these are i) weighted to the two London markets; and ii) we are uncertain as to the reliability of the estimated yields prior to 1972.

5.4 It is immediately clear that the estimated size of the regulatory tax moves with the real estate cycle. This is because real estate prices are substantially more cyclically volatile than are construction costs although, of course, one effect of any regulatory tax would be to constrain supply and so reduce the elasticity of supply in the upswing and increase the volatility of the cycle. Indeed, the high point of 4.01 for the mean value, reached in the boom of 1973, has not been exceeded since although this is partly a weighting issue: in 1973 the London markets had a greater weight in the mean. Nevertheless, the basic message is clear: there is a considerably higher value of the estimated regulatory tax on office space averaged

across all British office markets than there is in the most highly regulated sector of the most regulated markets in the US.

5.5 It is more revealing, however, to look at the time series data for the individual markets reported in Figures 1.1 to 1.14 – this discussion is in terms of the central estimate. The most revealing point of all is the contrast between the City and West End of London and the role of Canary Wharf and the development of Docklands. In the early 1960s, the City office market dominated supply and the City was the dominant location, with a quasi-monopolistic control. It had a highly restrictive planning policy both in terms of height restrictions (which still endure) and historic designation. The British development industry was significantly protected from international competition and supply was constrained. The response to the expansion in demand for office space in the 1960s was a rapid rise in prices reflecting both the actual limits on supply and supply restriction. The estimated value of the regulatory tax reached a high point in 1973, only just below a value of 18 (a 'tax rate' of 1800 percent). This fell back to just more than 5 in the downturn of the mid-1970s.

5.6 Another difference between the City and other office locations is that of the political economy of the control on planning. In all locations other than the City, voting, and so political control, rests with householders. As has been cogently argued by Fischel (2001) this produces a pressure to restrict development to protect house owners' asset values. This is likely to be re-enforced by the asymmetry of the incidence of costs and benefits of physical development with the costs - both short term and in terms of asset value losses - being very localised while benefits are thinly and widely spread. In the City of London, however, political control of the planning system reflects the local business community and its interests. While these include property owners and real estate investors, the business community is dominated by other groups who have a mutual interest in retaining the City as a successful and competitive location for their businesses. The planning system in the City is likely, therefore, to be responsive to threats to local competitiveness and these were visible by the early 1980s. By the time of the property market recovery of the second half of the 1980s and despite the growth of the financial services sector, the City was already under threat from both Docklands and other financial centres (including satellite centres such as Reading in which more office space was constructed during the early 1980s than in the City itself) and its planning policies became notably more relaxed. While the value of the regulatory tax in the City rose during the later 1980s, it never reached the high of 1973. Indeed, in contrast to the

rest of Britain, the regulatory tax estimate for the City has been on a downward trend since 1973. We can see from the evidence that is available for the Docklands that the regulatory regime was far less restrictive there, with an estimate of the regulatory tax never exceeding 4 – though that still represents a quasi-tax rate of 400 percent. The West End, in contrast, a market which specialises in sectors other than financial services and with much stronger planning protection for conservation reasons with height restrictions which are impossible to breech (unlike in the City where employing a 'trophy architect' has been a mechanism for building higher) and control resting with residents has experienced a steady increase in regulatory restrictions with its high value of 1973 exceeded in 2000 and a mean value estimated for its regulatory tax of 7.9 over the past six years – almost twice that in the City (4.6).

5.7 The pattern outside the London locations is much as would be expected. The estimated regulatory tax was much lower until quite recently and in Newcastle in the 1970s was negative for a short time. In a representative satellite centre such as Reading, which was a major recipient of the back office move from London from the late 1960s, the value of the regulatory tax was high during the late 1970s and early 1980s but fell back somewhat as the market expanded. By 2000 the local market was quite specialised in hi-tech companies and the value of the regulatory tax fell below 2 as the dot.com boom collapsed. It has been creeping up since 2002/2003. The absolute value varies in provincial centres with Edinburgh and Leeds seemingly the most restrictive. But it has been tending to rise in all centres since the mid 1990s and has only been consistently below a value of 2 in Newcastle in the relatively depressed North East.

5.8 All these numbers relate to our 'central' estimate but, of course, values of measures on alternative assumptions follow similar trends – just absolute values differ. Perhaps the salient fact is that even on the most conservative of all assumptions there is a significant estimated value for the regulatory tax in all locations for recent years. The lowest – Newcastle – has a value of more than 1.6 and most major provincial centres are around 2; London's West End has had an estimated value of between 4 and 9 since the early 1970s and has a current value of 8. These are estimated on the most conservative assumptions, so are lower bounds, and compare with a value not significantly different from zero for offices in Manhattan (Glaeser *et al* 2005). Moreover there may be a degree of endogeneity between construction costs and planning restrictiveness. In areas like the City or the West End developers may need an

expensive design and a 'trophy architect' to get planning permission for buildings offering more rentable space per unit area of the site. In Newcastle, the local community may be so pleased that any developer wants to build that it is correspondingly easier to get permission and *de facto* the planning regime imposes a lower regulatory tax. This possible endogeneity will mean that our central estimate systematically tends to understate the value of the regulatory tax rather than overstate it, however, and this should be borne in mind in interpreting the alternative estimates and selecting the most plausible.

6 Estimates for some Continental European Cities

6.1 These estimates reported in Table 4 are far more tentative than those for the British locations and are not strictly comparable. Construction cost data are derived from Gardiner and Theobald (2006) – the main competitor of Davis Langdon – and show a range rather than a single value. They also relate to average rather than marginal costs. There is one common centre – London – and the values given in Gardiner and Theobald (2006) for London are used to provide a conversion factor – assumed to be constant across locations – to convert Gardiner and Theobald average costs to the same basis as Davis and Langdon's estimates of marginal costs. Rents are from the same source – CBRE – but information on yields is derived from IPD national reports. Moreover the precise way in which yields are represented varies from country to country (and there is no information for Belgium and Denmark) so we had to assume that simply allowing for a constant 20 percent discount off reported headline rents (approximately the mean value of rent free periods in Britain for 2004 and 2005) was an adequate adjustment. Despite these strong assumptions to cover for missing or non-comparable data even approximate estimates are available only for nine continental locations.

6.2 Considerable caution is therefore needed in interpreting the results reported in Table 4 and it is probably more reliable to look at the values in relation to each other than in comparison to those reported for British locations and Manhattan. Focusing on this we do observe that the rank order is as would be expected. Qualitative evidence has long existed that the planning systems in Belgium and The Netherlands do not restrict supply to the extent observed in most EU countries. In the case of The Netherlands this seems to be related to the historic growth of the planning system (which exercises strong regulation but not supply restriction) out of the system of land drainage leaving a legal obligation on planning authorities to supply land for

urban use (Needham, 1992). In the case of Belgium it seems to result from simply having historically had a relaxed attitude to development. The estimates of the regulatory tax are lowest for Amsterdam and Brussels[3] – the two locations representing these countries. Both cities are comparatively large and prosperous – certainly larger and more prosperous than any of the British provincial cities. The economic region of Brussels – as distinct from the administrative city of Brussels – covers about one third of Belgium (IAURIF, 2002). The other location with a low estimate is La Defense, the Parisian equivalent of Docklands (where for the same two years the value of the regulatory tax was estimated to be 2.66 compared to 1.26 in La Defense). The highest estimates are for Frankfurt, Barcelona and the city of Paris. In no case is this surprising.

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[3] Values for the yield are not available for Belgium. However applying the highest observed yield produces a value for the regulatory tax of 0.79 and the lowest observed yield a value of 1.40.

Tables

Table 1: Investigated Office Markets

Location ID	Office Market
1	City of London
2	London WE
3	*City of London (Bishopsgate)*
4	*London WE (Berkeley Square)*
5	London Docklands (Canary Wharf Tower)
6	London Hammersmith (Inner Suburban London)
7	Manchester (North West)
8	Newcastle (Upon Tyne)
9	Corydon (Outer Suburban London)
10	Edinburgh (Scotland)
11	Glasgow (Scotland)
12	Maidenhead (South East)
13	Reading (South East)
14	Bristol (South West)
15	Birmingham (West Midlands)
16	Leeds (Yorkshire and Humberside)

Table 2: Summary Statistics: Regulatory Tax relative to Marginal Construction Cost – Alternative Assumptions

Variable: Ratio: Regulatory Tax / MCC	Obs	Mean	Std. Dev.	Min	Max
Specification:					
- Based on prime rent (*no adjustment*)	480	3.70	2.92	0.13	22.06
- Prime rent *partially adjusted* for rent-free periods	480	3.03	2.66	-0.05	19.81
- Prime rent *fully adjusted* for rent-free periods and vacancy rates (**Central estimate**)	480	2.64	2.37	-0.14	17.55
- Upper bound: Assume 10% premium for top floor plus 50% of fully adjusted total occupation cost markup	480	3.88	3.10	0.15	23.95
- Based on fully adjusted prime rent plus 10% premium for top floor	480	3.01	2.60	-0.05	19.41
- Lower bound: As central estimate but assume 0.5 percentage point higher yield	480	2.37	2.15	-0.18	15.78

Data Sources: CBRE (prime rent, yield and total occupation cost information), Davis Langdon (marginal construction cost information), IPD (national void rate index) and ODPM (regional vacancy rates).

Table 3: Summary Statistics: Relative Regulatory Tax over Time (1961-2005)
(Central Estimate)

Year	Obs	Mean	Std. Dev.	Min	Max
1961	*2*	*2.93*	*0.33*	*2.70*	*3.16*
1962	*2*	*3.07*	*0.12*	*2.98*	*3.15*
1963	*2*	*3.13*	*0.24*	*2.96*	*3.31*
1964	*2*	*2.99*	*0.20*	*2.85*	*3.13*
1965	*8*	*1.68*	*1.04*	*0.42*	*2.96*
1966	*8*	*1.85*	*1.13*	*0.53*	*3.37*
1967	*8*	*2.02*	*1.24*	*0.64*	*3.83*
1968	*8*	*2.36*	*1.63*	*0.73*	*4.97*
1969	*8*	*2.69*	*2.33*	*0.71*	*7.27*
1970	*8*	*2.69*	*3.22*	*0.39*	*9.98*
1971	*8*	*2.88*	*3.42*	*0.37*	*9.99*
1972	*8*	*2.58*	*3.36*	*0.20*	*9.63*
1973	11	4.01	5.08	0.62	17.55
1974	11	2.86	4.49	0.00	15.57
1975	11	1.87	1.81	0.14	6.37
1976	11	2.43	1.53	0.80	5.36
1977	11	2.86	2.29	1.06	7.38
1978	11	3.00	2.30	1.14	7.65
1979	11	3.13	2.64	1.12	8.70
1980	11	2.06	2.24	0.27	7.12
1981	11	2.42	2.42	0.34	8.08
1982	11	2.34	2.45	0.36	8.51
1983	11	2.16	2.37	0.16	8.13
1984	12	2.08	2.19	-0.07	7.85
1985	12	2.18	2.32	-0.07	8.13
1986	12	2.20	2.54	-0.11	8.90
1987	12	2.61	3.79	-0.12	13.35
1988	12	2.73	3.66	-0.14	11.79
1989	12	3.10	3.36	0.20	11.36
1990	12	2.95	2.88	0.42	9.27
1991	13	2.61	1.97	0.60	7.61
1992	13	2.24	1.32	0.54	5.46
1993	13	1.91	1.03	0.46	4.60
1994	13	2.63	1.35	0.78	6.02
1995	13	2.96	1.65	0.99	7.13
1996	13	3.24	1.91	1.12	7.99
1997	13	3.30	2.14	1.10	8.46
1998	14	3.23	2.15	1.02	8.58
1999	14	3.21	2.16	1.06	9.18
2000	14	3.45	2.41	1.10	10.22
2001	14	3.09	2.17	0.86	8.73
2002	14	2.56	1.64	0.81	6.90
2003	14	2.07	1.26	0.63	5.69
2004	14	2.17	1.53	0.67	7.05
2005	14	2.63	1.91	0.99	8.89

Table 4: Estimates of Regulatory Tax for Selected European Cities

Location	Estimated Regulatory Tax 2004/05
Amsterdam	1.38
Brussels	1.20 [a]
Copenhagen	[1.45] [b]
Frankfurt	3.62
Hamburg	[2.1] [c]
Barcelona	3.07
Paris: La Defense	1.26 [d]
Paris: City	2.91
Stockholm	2.44

Notes:

[a] Assume yield = mean of The Netherlands and France

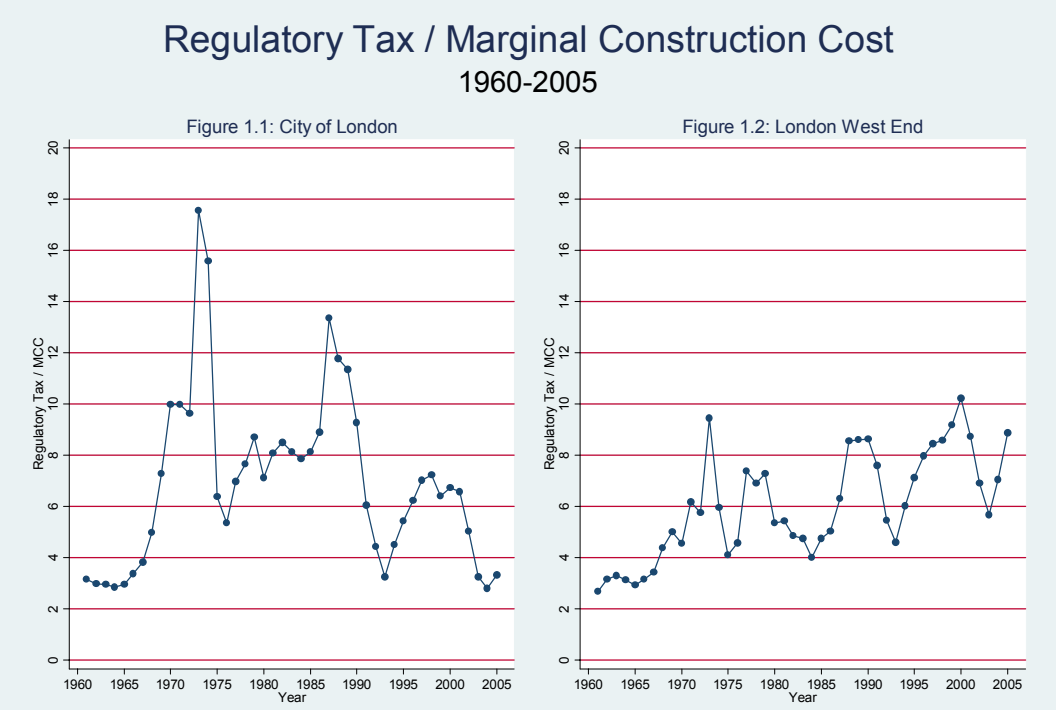
[b] Assume yield and construction costs = mean of Sweden and Germany

[c] Assume construction cost = 0.95 x Frankfurt

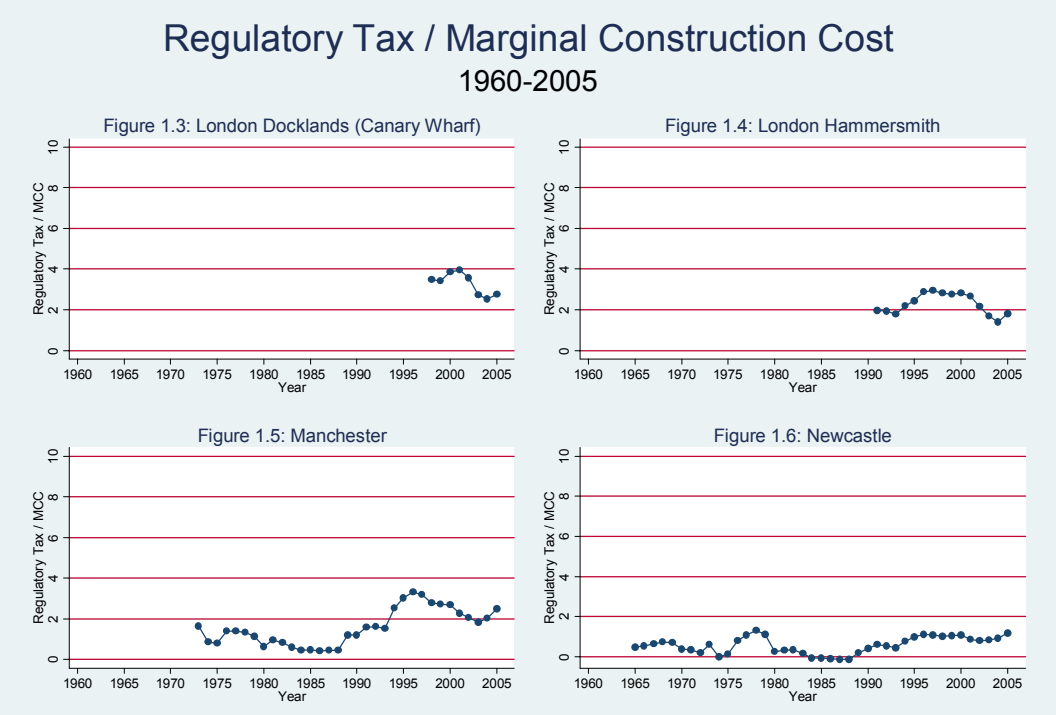
[d] Rents only available for half 2005: given movement of rents in Paris: City over 2004-05 seem likely to be representative

Figures

Figures 1.1-1.14:
Regulatory Tax relative to Marginal Construction Cost—***Central estimate***
(based on prime rents; fully adjusted for rent-free periods & vacancy rates)

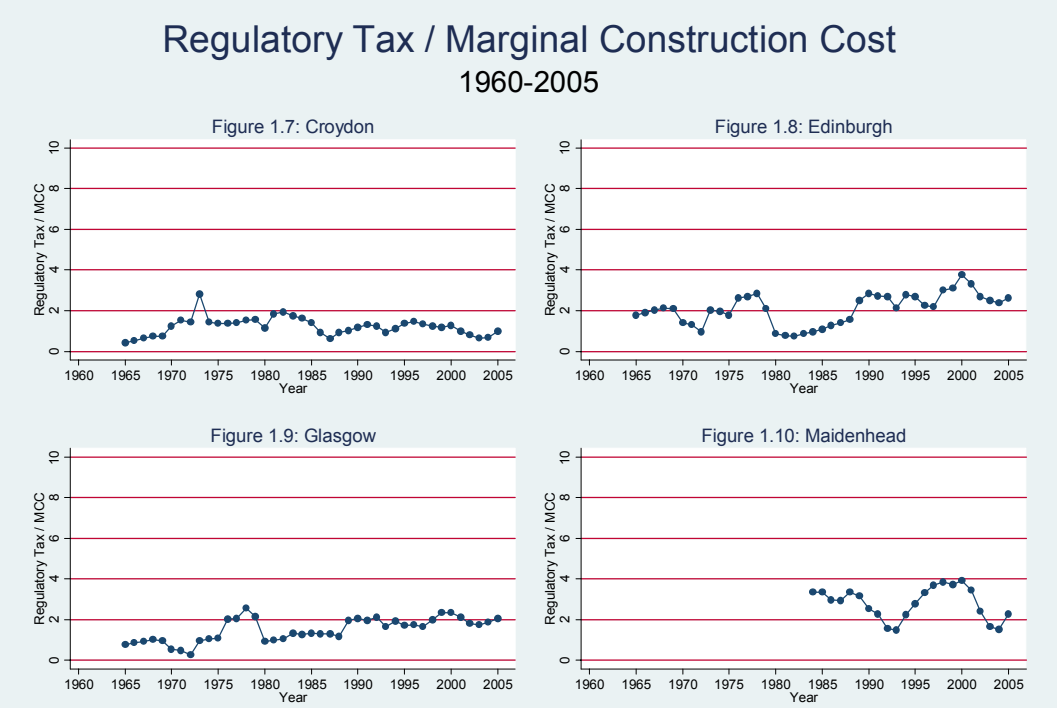


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

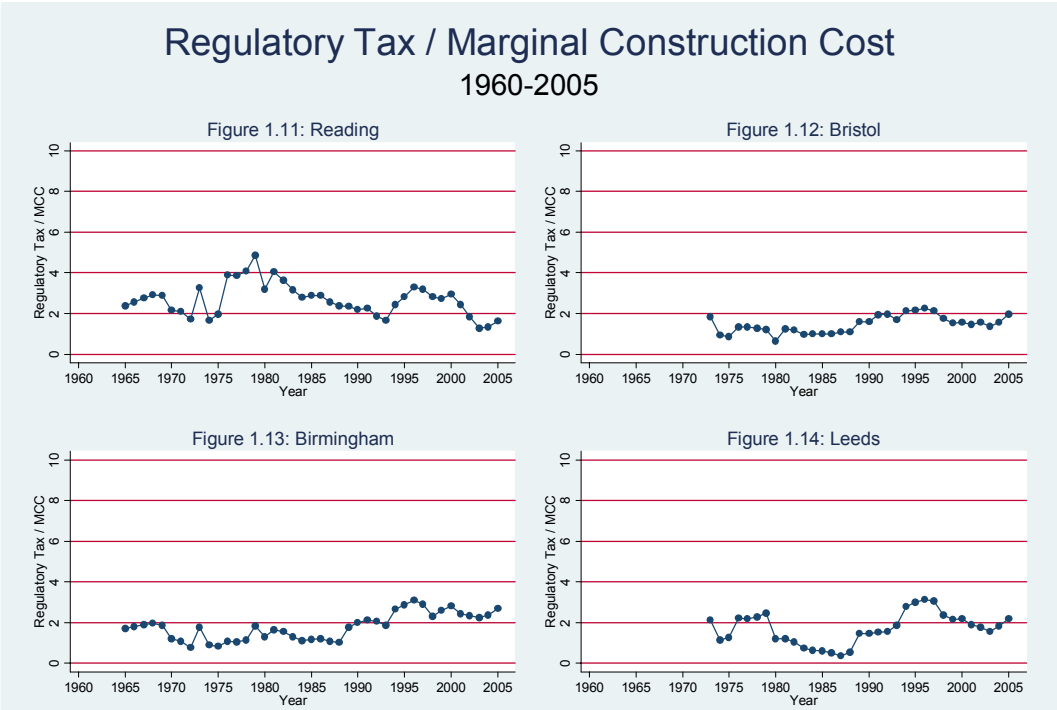


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Figures 1.1-1.14 *(Continued)*:
Regulatory Tax relative to Marginal Construction Cost—***Central estimate***
(based on prime rents; fully adjusted for rent-free periods & vacancy rates)

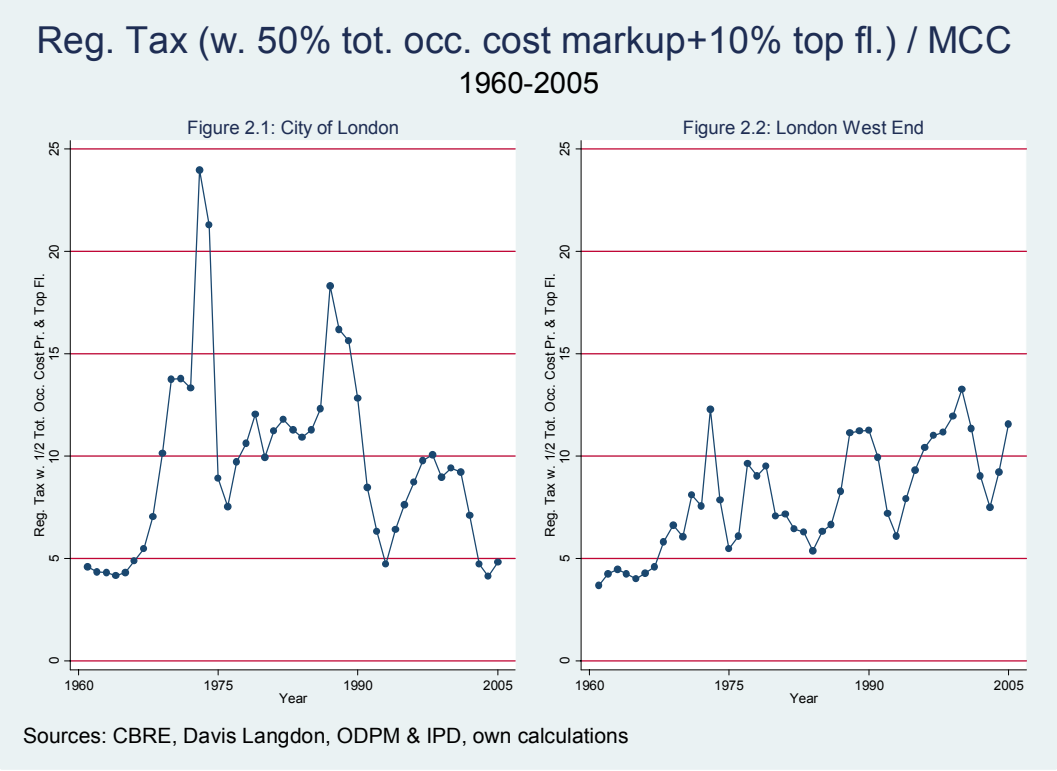


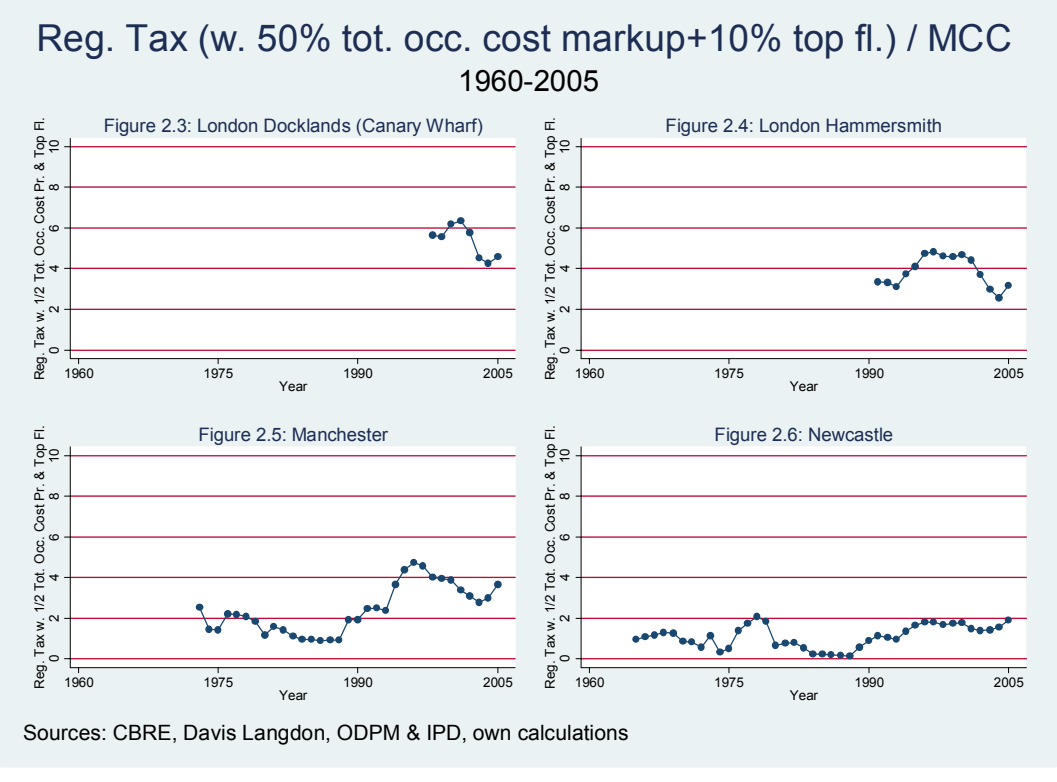
Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations



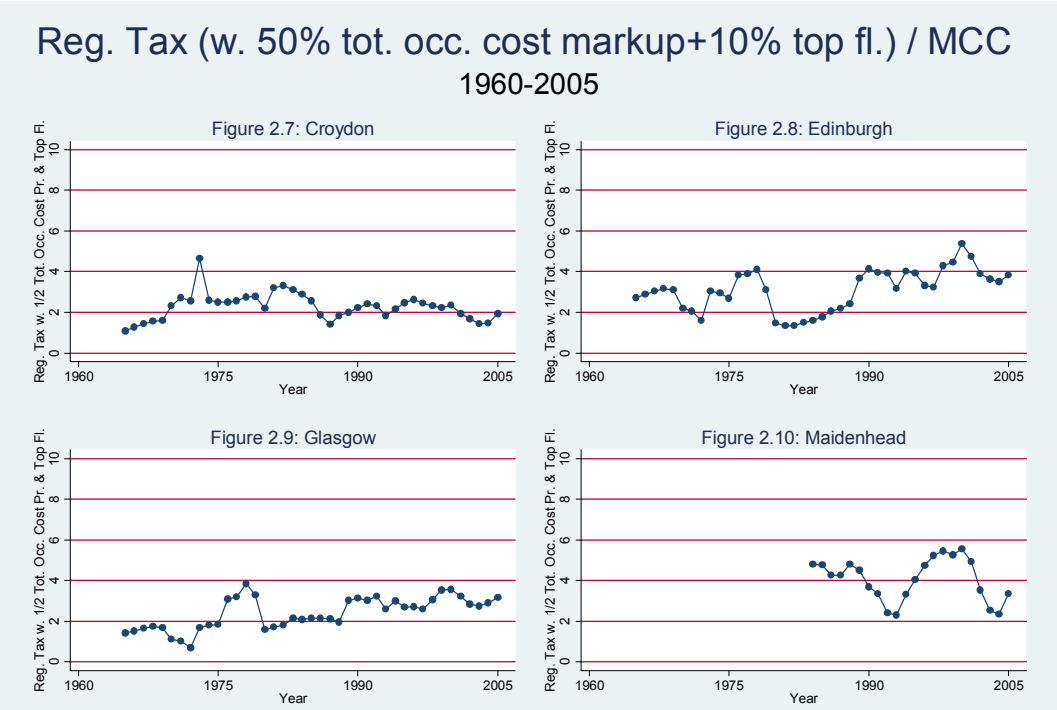
Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Figures 2.1-2.14:
Regulatory Tax relative to Marginal Construction Cost—*Upper Bound*
(based on assumption that 50% of the difference between total occupation cost and prime rent is due to a regulatory tax and assume a 10% rent-premium for top floor space)

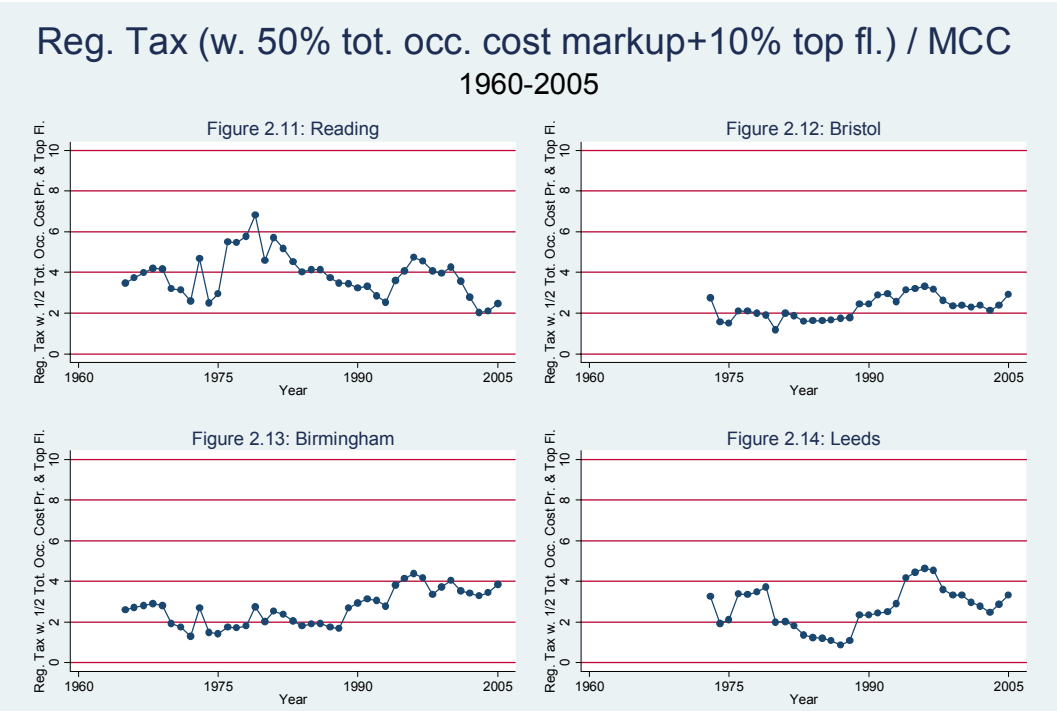




Figures 2.1-2.14 (*Continued*):
Regulatory Tax relative to Marginal Construction Cost—*Upper Bound*
(based on assumption that 50% of the difference between total occupation cost and prime rent is due to a regulatory tax and assume a 10% rent-premium for top floor space)

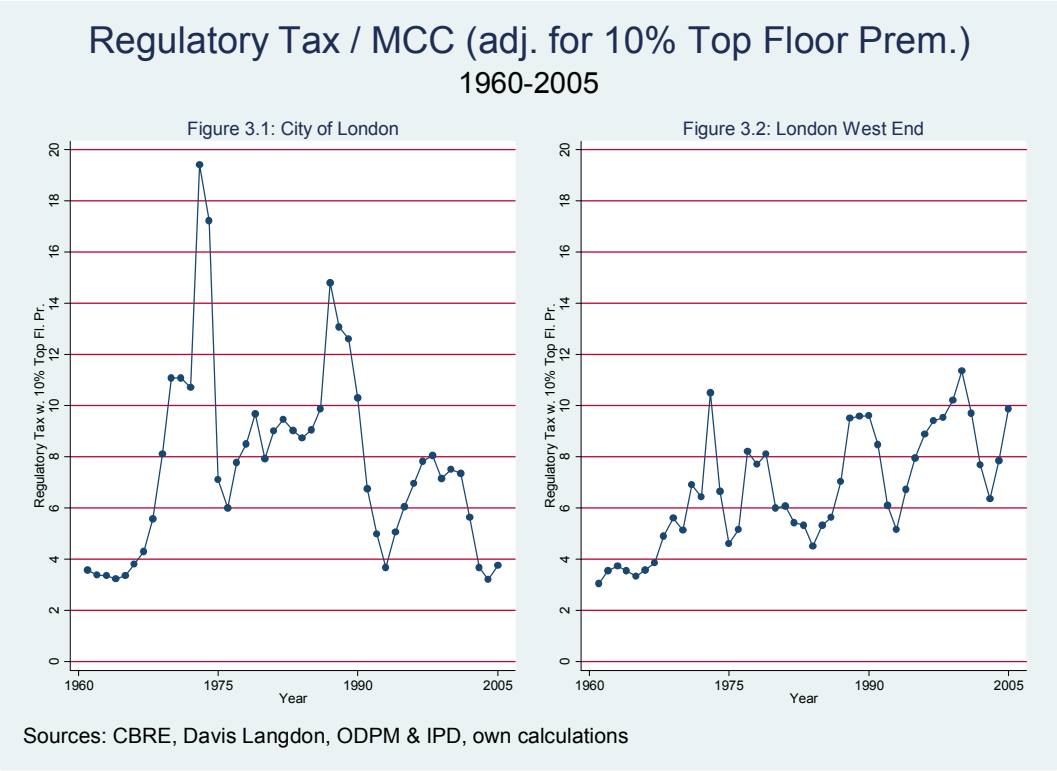


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

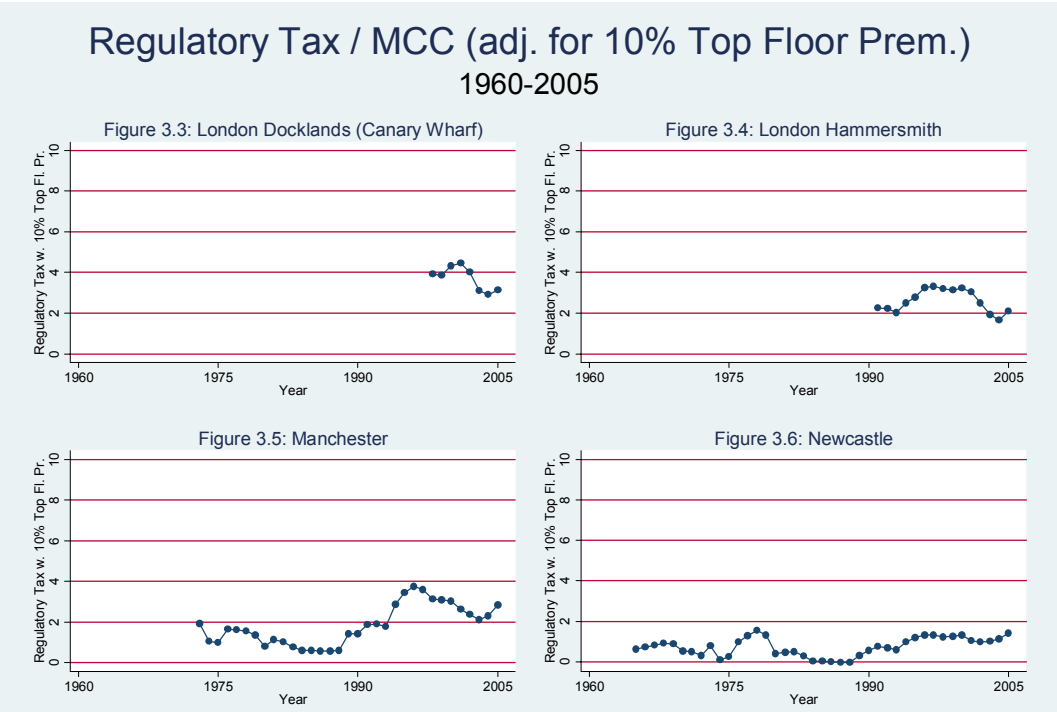


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Figures 3.1-3.14:
Regulatory Tax relative to Marginal Construction Cost—
Based on fully adjusted prime rent plus 10% premium for top floor

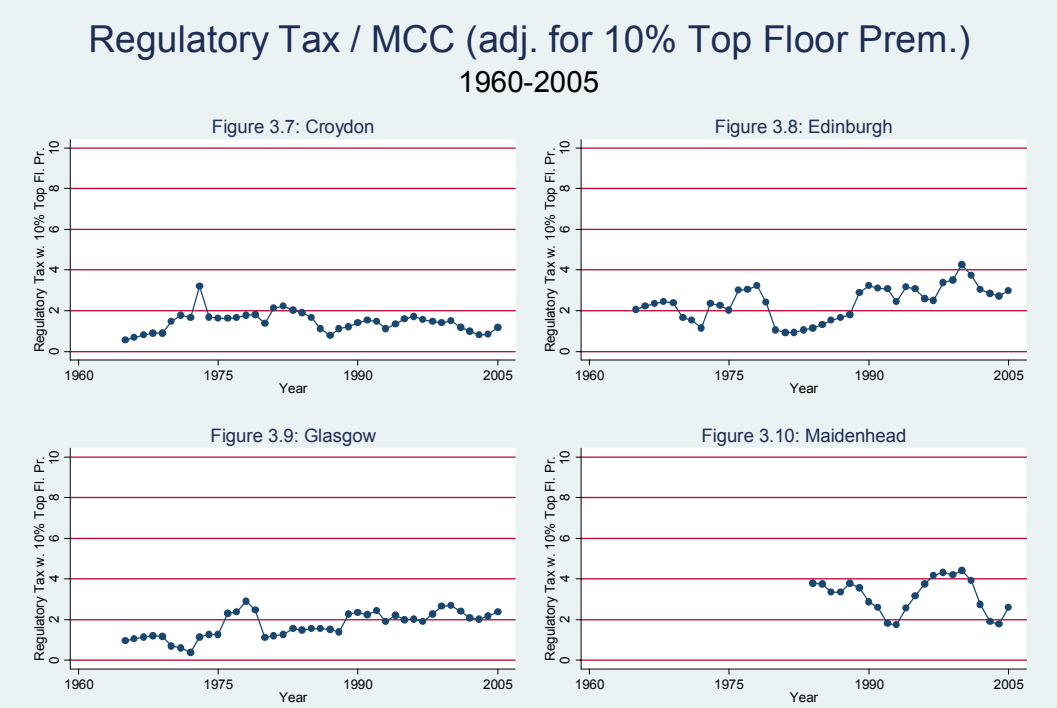


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

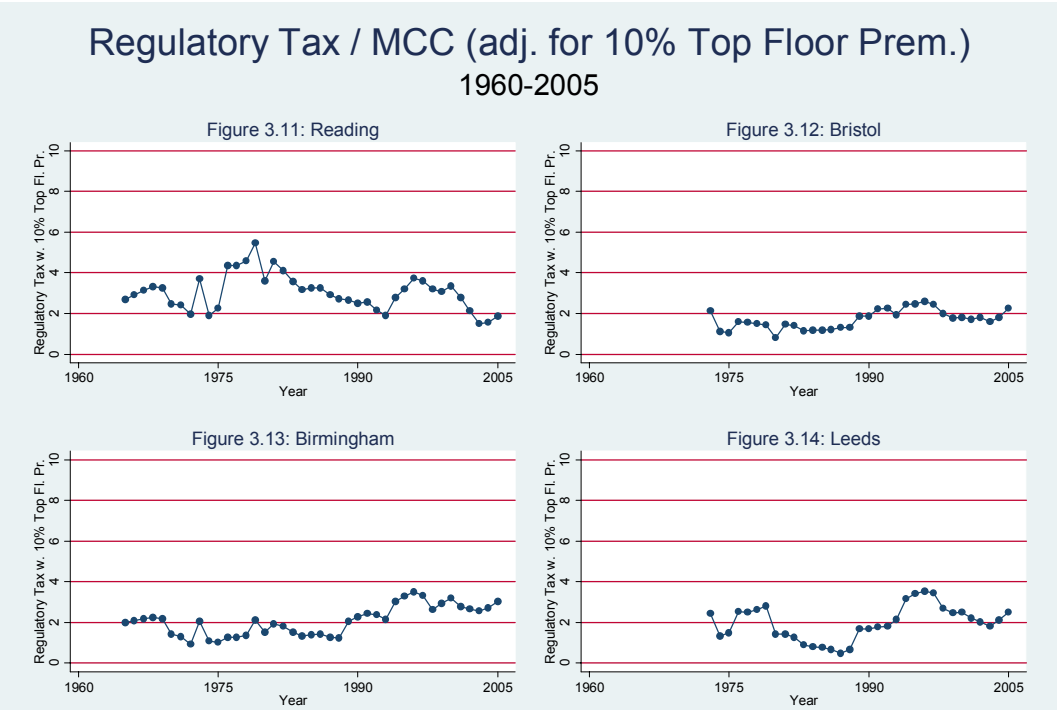


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Figures 3.1-3.14 (*Continued*):
Regulatory Tax relative to Marginal Construction Cost—
Based on fully adjusted prime rent plus 10% premium for top floor

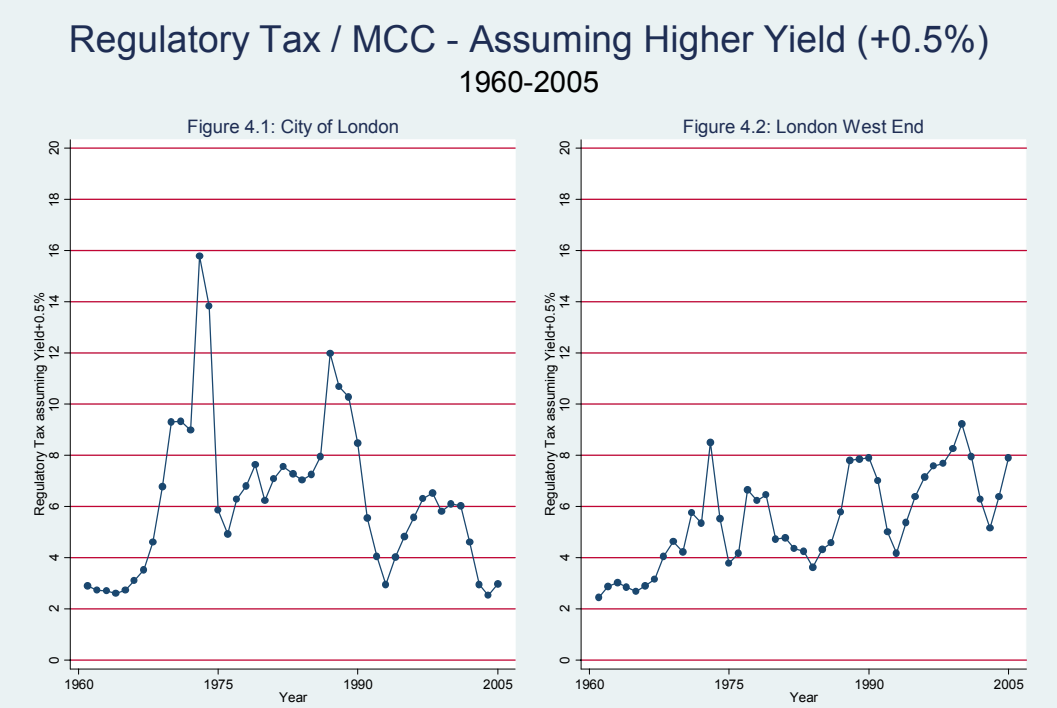


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

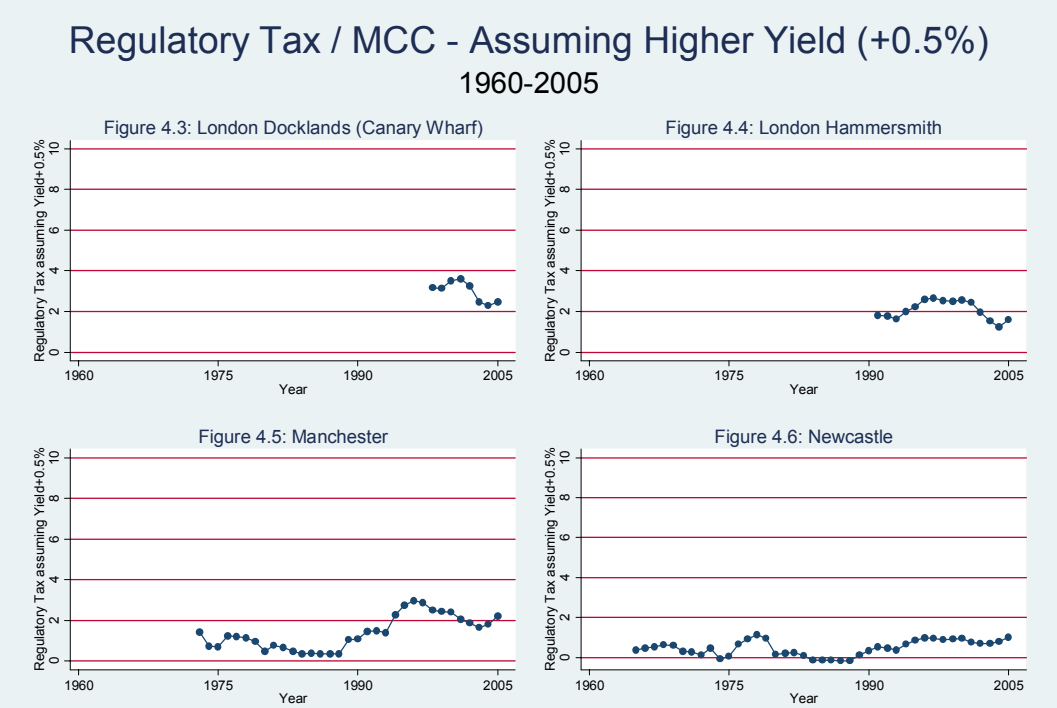


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Figures 4.1-4.14:
Regulatory Tax relative to Marginal Construction Cost— *Lower Bound*
Based on central estimate but assume 0.5 percentage point higher yield

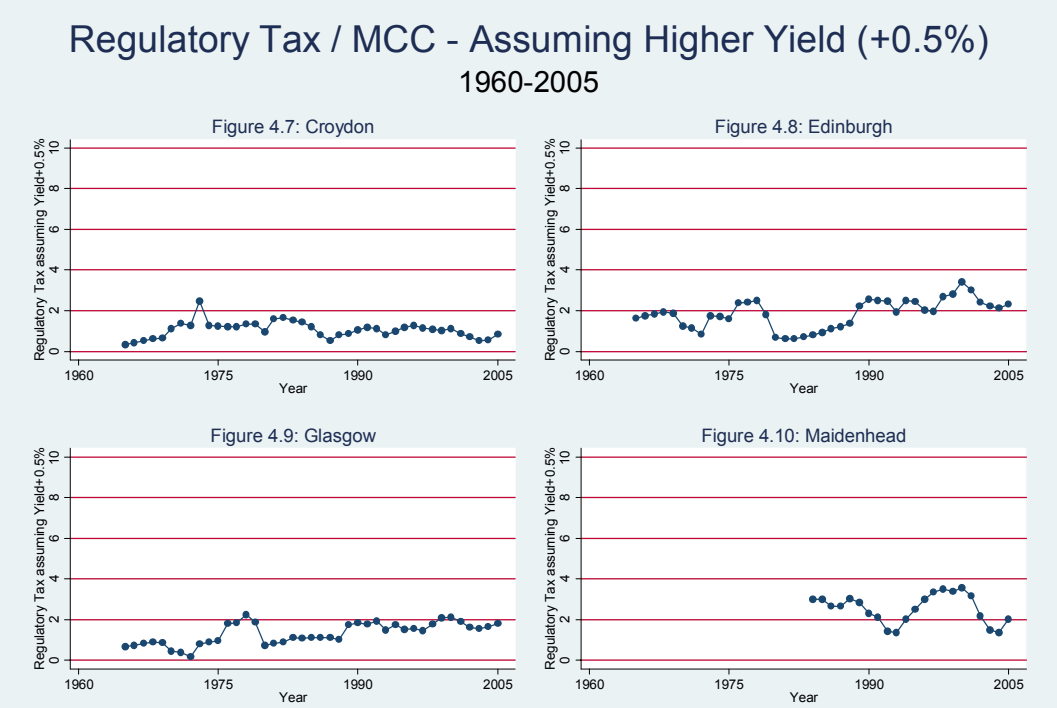


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

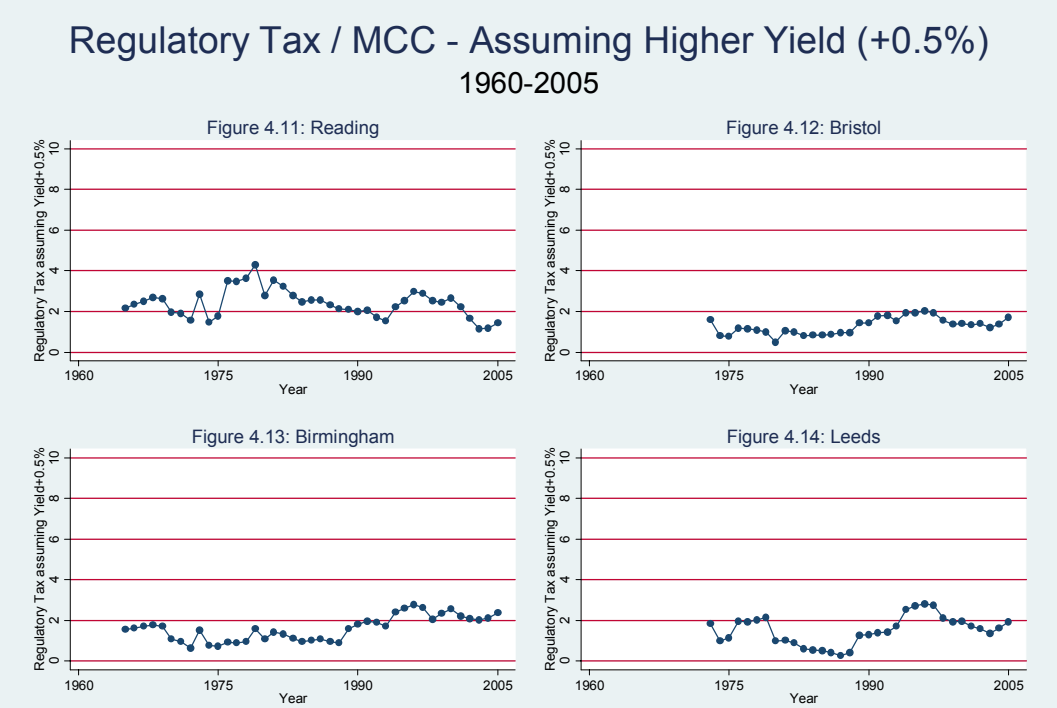


Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Figures 4.1-4.14 (*Continued*):
Regulatory Tax relative to Marginal Construction Cost— *Lower Bound*
Based on central estimate but assume 0.5 percentage point higher yield



Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations



Sources: CBRE, Davis Langdon, ODPM & IPD, own calculations

Appendix

Appendix A: Detailed Description of Methodology to Derive Marginal Construction Cost

We obtained construction cost data from Davis Langdon. The time-series data contains information for all 14 prime office markets and for time periods between 1961 and 2005. The marginal construction costs are derived from a number of past development projects in each of the last five decades (including the 2000s). These projects include a number of London and non-London urban office buildings. The office development projects in London include: P&O, Euston Square (in the 1960s and 1970s), New Bridge St., Appold St. (in the 1980s) and 60 Queen Victoria, Greycoat, Premier Place, 140 Alersgate, 280 Bishopsgate (in the 1990s and 2000s). In addition to these projects, Davis Langdon used their '1994 Cost Model' and their '2004 Cost Model' to derive marginal construction cost for the period 1990 to 2005 as appropriately as possible. The non-London urban development projects include office buildings in Hampshire, Cheshunt, Croydon, Manchester, Birmingham (2 projects) (in the 1960s), Oxford, Bracknell, Halesowen, Warrington, Romford (in the 1970s), Hemel Hempstead and Manchester (in the 1980s) and Cardiff, Harlow and Egham (in the 1990s).[4]

The marginal construction costs (per square meter of office space) were calculated for a hypothetical additional top floor on those buildings using standard industry value assumptions. The cost elements are listed in Appendix Table A-1 below.

Appendix Table A-1: Cost Elements

1 Substucture	3C Ceiling Finishes	5L Communication Installations
Superstructure	**4 F&F Services**	5M Special Installations
2A Frame	5A Sanitary Appliances	5N BWIC
2B Upper Floors	5B Services Equipment	5O Builders Profit
2C Roof	5C Disposal Installations	**External Works**
2D Stairs	5D Water Installations	6A Site Works
2E External Walls	5E Heat Source	6B Drainage
2F External Windows & Doors	5F Space Heating	6C External Services
2G Internal Walls	5G Ventilating Systems	6D External Works
2H Internal Doors	5H Electrical Installations	7 Prelims
Internal Finishes	5I Gas Installations	8 Contingencies
3A Wall Finishes	5J Lift Installation	
3B Floor Finishes	5K Protective Installation	

[4] We also obtained marginal construction cost data from Davis Langdon for a number of business park projects. These projects include: Imperium, Newbury, Wandsworth, Plympton, Plymouth, Powergen, Addison (in the early 1990s) and Oxford, Solent, Admirals Park, B1 Block, RSPCA, Solihull (in the late 1990s). To date we have not used this information in our empirical analysis. However, we may use the data in a subsequent analysis to investigate to what extent construction costs themselves may be influenced by regulation and may further increase our estimates of the 'regulatory tax'.

Based on the above information, Davis Langdon produced various estimating models for (a) London office buildings and (b) non-London office buildings and for the various time periods (i.e., (a1) 1960s and 1970s, (a2) 1980s, (a3) 1990s and 2000s; (b1) 1960s, (b2) 1970s, (b3) 1980s and (b4) 1990s). Since there was no estimating model available for non-London office buildings for the years between 2000 and 2005, we used the model for the 1990s.

Finally, the annual construction cost numbers can be derived by using the above estimating models and applying Davis Langdon's total building cost location factors (for each of the 14 markets; with outer London having a factor of 1) as well as tender price indices between 1961 and 2005. It should be noted that the location factors were only available for 1975, 1980, 1985, 1990, 1995, 2000 and 2005. No location factors were available prior to 1975, however, the location factors vary relatively little over time and hence the location factors for 1975 are used for years prior to 1975. For years with missing location factor information, linear trends are assumed.

Appendix B: Imputing Missing Values for Rent-Free Periods

We obtained *rent-free period data* from CBRE for two markets (the City of London and London's West End) for the years 1993 to 2006. For the remaining years and for the other markets we needed to impute the variable.

A first plot of the data reveals that the rent-free periods at any point in time are not only surprisingly different between the City of London and the West End but their dynamic and their correlation with trends in rents also differ considerably. The negative correlation between the deviation of the observed rent from the trend on the one hand and the rent-free period on the other hand is extremely strong and statistically highly significant for the City (-0.87) but quite low and not statistically significant for the West End (-0.05).[5] These stylized facts are consistent with our observation that the City office market specializes in the financial service sector, which is strongly exposed to general market developments, while the West End specialises in sectors that are more protected from general market trends (e.g. the media, business and legal services) or that may even have anti-cyclical demand for office space (e.g. lobbyists).

[5] The idea here is that if demand for office space is high (markets are overheating and rents are above the long-term growth path), tenant incentives such as rent-free periods will be quite low. On the other hand, if demand for office space is low (markets are in a declining or bust phase and rents are therefore below trend) then developers will tend to offer generous incentives (high rent free periods) to attract tenants.

We acknowledge this difference between the two markets and impute the rent-free periods for the missing years of those two markets using two different estimating equations. The rent-free periods in the City of London for years with missing observations are estimated as follows:

$$Rent\ Free\ Period_t = \beta_0 + \beta_1 \times \left(Deviation\ Trend\text{-}Rent_t \right) + \varepsilon \tag{A1}$$

The adjusted R^2 is 0.73.

In order to estimate rent-free periods in the West End we estimate a different equation that provides a better fit than equation (A1). The estimating equation is as follows:

$$Rent\ Free\ Period_t = \beta_0 + \beta_1 \times \left(Annual\ Growth\ in\ Rent_t \right) + \varepsilon \tag{A2}$$

The adjusted R^2 is merely .087 but within-sample predictions are all in a reasonably narrow band of +/- 5 months, with the majority of predictions being within a band of +/- 2 months.

Finally, for the remaining 12 markets without any rent-free period data we use the following equation that is estimated using all available observations with rent-free periods (i.e., the City and the West End):

$$\begin{aligned} Rent\ Free\ Period_{jt} = \beta_0 + \beta_1 \times \left(Deviation\ Trend\text{-}Rent_{jt} \right) \\ + Dummy\ West\ End + Year\ Dummies + \varepsilon \end{aligned} \tag{A3}$$

The adjusted R^2 is 0.22. Within sample predictions (for the City and West End) suggest that the estimated values may be reasonably good approximations of observed rent-free periods.

The existing imputation method for rent-free periods is merely a first attempt to reliable estimate rent-free periods and is subject to further enhancement. However, as a further sensitivity analysis reveals, our results are quite robust towards measurement errors in rent-free periods. Even if we assume the maximum rent-free period ever observed in the City and in the West End (2.8 years) we still end up with substantial estimated values of the regulatory tax as a percent of marginal construction costs.

Appendix C: Imputing Missing Values for Vacancy Rates

We obtained vacancy rate data for relatively short time-series (from 1999 to 2004) for various U.K. regions (East Midlands, East of England, London, North East, North West,

South, East, South West, West Midland, Yorkshire & the Humberside) from the ODPM. We first geographically match our 14 local markets to those regions. Next we use national void-rent data from IPD (from 1994 to 2004) to impute vacancy rates back until 1994 by assuming that regional vacancy rates moved with the national trend between 1994 and 1998. We then impute the vacancy rates for remaining missing observations using the following estimating equation for all 14 markets:

$$\begin{aligned} Vacancy\ rate_{jt} = \quad & \beta_0 + \beta_1 \times \left(Deviation\ Trend\text{-}Rent_{jt} \right) \\ & + Location\ Dummies + Year\ Dummies + \varepsilon \end{aligned} \tag{A4}$$

The adjusted R^2 is 0.82. For more than 80 percent of the in-sample observations, the measurement error lies well within +/- 1 percentage point; the maximum error is roughly +/- 2 percent points.

Appendix D: Imputing Missing Values for Yields

Finally, we also attempted to impute equivalent yields for years prior to 1973. We obtained equivalent yield data from CBRE for all our 14 markets, typically from 1973 until 2005. Similarly to the above imputation method, we estimate the equivalent yields as a function of the deviation of rents from the trend, location and year fixed effects. The R^2 is 0.62. The predicted values imply that yields were higher in the 1960s and decreased notably around 1973 but this may be a result of a misspecified estimating equation. Hence, we are, at this point at least, very cautious interpreting results prior to 1973. In future research we intend to either collect information on prices of office space (should such data be available) or to collect information on property yields prior to 1972 (we obtained yield information for 1972 from Hillier Parker's 'Investors Chronicle – Hillier Parker Rent Index'), or, should that not be feasible, to improve our preliminary method for imputing equivalent yields. One promising direction is to include interest rates and perhaps other macro-variables as further explanatory variables in addition to the deviation of rents from the trend and location dummies. We also intend to experiment with lagged explanatory variables and to do some more elaborate in-sample and out-of-sample testing. For now, however, our results prior to 1973 have to be interpreted with considerable caution, especially since variations in yields are more influential drivers of regulatory tax estimates than are plausible variations in rent free periods or voids..