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Abstract

Office space in Britain is the most expensive in the world and regulatory constraints are the obvious explanation. We estimate the 'regulatory tax' for 14 British office locations from 1961 to 2005. These are orders of magnitude greater than estimates for Manhattan condominiums or office space in continental Europe. Exploiting the panel data, we provide strong support for our hypothesis that the regulatory tax varies according to whether an area is controlled by business interests or residents. Our results imply that the cost of the 1990 change converting commercial property taxes from a local to a national basis – transparently removing any fiscal incentive to permit local development – exceeded any plausible rise in local property taxes.

JEL classification: H3, J6, Q15, R52.
Keywords: Land use regulation, regulatory costs, business taxation, office markets.

1 Introduction: The Problem in an International Perspective[1]

The cost of constructing a m^2 of office space in Birmingham, England, in 2004 was approximately half that in Manhattan[2]. This is not very surprising since Birmingham is a struggling, medium sized city on the flat plains of the British Midlands and Manhattan is big, topographically constrained, prosperous and highly dynamic. If we were looking for an American equivalent to Birmingham, maybe, St Louis, Missouri would pop up. When we couple the cost of construction with the costs of occupation of that same m^2, however, we do get a shock. In the same year, the total occupation costs per m^2 were 44 percent higher in Birmingham than they were in Manhattan (KingSturge, 2004). Something very odd must be going on. The obvious anomaly is the intensity and restrictiveness of land use controls in the UK and this paper sets out to investigate the economic costs of these restrictions and what drives them.

In the past few years US urban economists have become interested in the analysis of land use regulation and concerned about increasing regulatory restrictions influencing the supply and costs of housing[3] and perhaps sorting between cities[4]. Glaeser *et al* (2005) for example conclude that regulatory restrictions increase housing prices in the most tightly constrained metro areas by some 50 percent and by considerably more in Manhattan. This is potentially of concern because not only is the effective tax substantial but it has been rising over time. However, no researcher has yet reported a significant effect of regulatory constraint on the costs of commercial space in the US. This is no great surprise given the fiscal incentives to local communities to allow commercial development.

The situation in the UK, however, is several orders of magnitudes more restricted. This is partly because land use regulation in the UK takes the form of universal growth constraints: and growth constraints applied not just to the total area of urban land take for each city but individually to each category of land use within each city. So urban 'envelopes' are fixed by growth boundaries but within these envelopes the area of land available for retail, offices, warehouses and industry is all tightly controlled. Although not entirely inflexible, Greenbelts surrounding cities have been more or less sacrosanct since they were established, out of town retail is effectively prohibited[5], and local planning authorities have been extremely reluctant to expand the area zoned for commercial space. There are, moreover, a raft of preservation designations and height controls on buildings. The present pattern of regulation was essentially set in aspic in 1947 so has been in place for two generations.

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[1] We thank Robin Goodchild, Colin Lizieri, Tsur Somerville and John Clapp for helpful comments and suggestions. We are grateful to Robin Goodchild courtesy of Jones Lang LaSalle, Peter Damesick from UK CB Richard Ellis and Simon Rawlinson from Davis Langdon for kindly providing data. Gerard Dericks provided excellent research assistance. The remaining errors are the sole responsibility of the authors.

[2] This uses the ratio of Birmingham office construction costs to those in London from Davis Langdon (see Section 3 of this paper), the ratio of Davis Langdon's London construction cost estimates to those from Gardiner and Theobald to apply to Gardiner and Theobald's construction cost data for New York offices to estimate figures on a comparable basis for both Birmingham and New York.

[3] See, for example, Brueckner (2000); Evenson and Wheaton (2003); Glaeser and Gyourko (2003); Glaeser *et al* (2005); Mayer and Somerville (2000); Mayo and Sheppard (2001); Phillips and Goodstein (2000); or Song and Knaap (2003).

[4] See Gyouko *et al* (2005).

[5] On two different grounds: to maintain the economic strength of city centres and to reduce car use. Whether either objective is actually served by this policy and, in so far as it is, at what cost – is unclear.

Any reluctance of local communities to allow expansion of commercial space may be at least significantly explained by the fact that they have strong tax incentives not to. Taxes on commercial real estate (the business rate) accrue to national not local government (and account for some 5 percent of national tax revenues) but local authorities have to provide services to commercial property. The only interesting (and for us, useful) exception is the City of London which, when the 'Uniform Business Rate' (UBR) was introduced, was granted a unique exception and allowed to retain up to 15 percent of revenues raised. In addition to the property tax implications, there are other costs to local voters associated with development. Together, these generate very strong NIMBY pressures. As the retiring political head of the planning authority for one of the office locations analysed in this paper said when asked what had been his major achievement in office:

> [our main achievement was that] "…not a single new major office development has been approved. We managed to keep development down." (*Reading Chronicle, 1989*).

As we argue below, with the important and helpful exceptions of the City of London and London Docklands, the only incentive for local communities to permit commercial real estate development is local voters' fears of unemployment.

A further factor is that constraints and growth controls in the UK have been being applied since 1947. The nearest equivalent form of regulation in the USA, in Portland Oregon, still much less restrictive than applies in the UK, has been in force only since 1973. Because regulatory constraints only affect new construction (at least directly – as we see in the UK they produce strong incentives, if tight enough, to induce conversion of older stock to denser occupation) they only influence real estate prices progressively over time. As was noted in Cheshire and Sheppard (2005) their impact on housing prices only began to be observable from about ten years after they were introduced, that is from 1955 or so.

The result is that the economic effects of land use regulation are orders of magnitude greater in the UK than they are in the US. Using data for 1984 and with quite conservative assumptions, Cheshire and Sheppard (2002) estimated that the net welfare costs[6] of restrictions on land supply in a prosperous community in southern England, Reading, were equivalent to nearly 4 percent as an annual income tax. In 2003, at the outer boundary of permitted development in Reading, housing land was some £3,000,000 per hectare (Cheshire and Sheppard, 2005). A few feet away agricultural land, not within the urban envelope, was worth perhaps £7,500 per hectare. As Muellbauer (2005) commented, such price distortions are 'grotesque'. The constraints on the housing market have become so significant that the British Treasury and the Department of Communities and Local Government (formerly the Office of the Deputy Prime Minister) have now commissioned two separate enquiries (Barker, 2003; 2004 and 2006a and b).

Office space in London (KingSturge, 2003 to 2005) is not just more expensive than anywhere else in the world; it is some three times as expensive as the next most

[6] Net in the strict sense that benefits were also quantified and so the measure was the excess value of total costs over benefits expressed in terms of equivalent income variation.

expensive city in Europe, Paris, and more than three times as expensive as in Manhattan. Even more telling, perhaps, are the costs of office space in British provincial cities. Birmingham was the next most expensive European city after Paris, and Glasgow, Edinburgh and Manchester were all more expensive than Manhattan; office space costs almost twice as much in any of those smaller and not very prosperous British cities as it does in San Francisco – a city which not only is highly prosperous and has some of the tightest regulatory constraints on housing in the US but also has topographical constraints on land supply. Office space in Birmingham cost 124 percent more than in fast growing, twice as big and land strapped Singapore.

The story in the retail sector seems to be even more extreme. The most important determinants of land prices in a city, in the absence of regulatory restrictions, will be the size of the city and its income level. Other factors, such as differences in expected rates of urban growth, topography and transport systems, may also play a part, as will environmental qualities or the quality of local public goods such as schools and security (see, for example, Gyourko and Tracey, 1991). So if we want to find a worthwhile indicator of the role of regulatory restrictions we should try to standardise for such differences. Cheshire and Sheppard (1986) provided evidence on land prices in US comparator cities, matched as closely as possible with UK cities (Reading and Darlington) for all except environmental and local public goods. Land prices for all use classes (except industry in deindustrialising Darlington) were orders of magnitude higher in the two UK cities. The most extreme case was the most expensive retail land in the prosperous UK city (Reading) compared to its US counterpart (Stockton, CA). In Reading the most sought after land available for retail use cost almost 250 times as much per acre as its equivalent in Stockton.

To date there has been rigorous quantification of the economic effects of land use constraints on the UK housing sector but not for any category of commercial property. The purpose of this paper is to address this gap in our knowledge and investigate the costs of land use regulation for commercial property in the UK in a rather more rigorous way than is possible when just comparing the rent and occupation cost data provided by real estate intermediaries.

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 difficult to offset for the normal factors such as city size etc, that urban economic theory tells one should be expected to influence the price of land and space. Furthermore, if we want to estimate the economic impact of any measured increase in space costs resulting from regulation, we would need to go a second step – not included in this research. We should estimate the impact on output, employment and incomes generated by the increase in space costs produced by regulatory constraints. Then offset those costs against any benefits regulation produced.

In the context of the residential sector, a theoretically rigorous methodology was set out in Cheshire and Sheppard (2002) for estimating both the gross and the net costs of regulatory restrictions on the supply of residential land and so the net welfare cost these had. This 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 urban space and consequent supply of planning amenities. Because the analysis built up from observations of individual households it was also possible to estimate the distributional consequences of land supply restrictions and the trade-off between planning produced amenities and private space.

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.

We estimate here, just the first of these elements: a measure of the total cost of regulatory constraints on the price of office space expressed as a 'tax' – that is as a percentage of construction costs. To do this we adapt the methodology first developed and applied to the Manhattan condominium market by Glaeser *et al* (2005). The value of this measure and its interpretation is the subject of section 2 of this paper. The Glaeser *et al* (2005) methodology has the considerable attraction that it is intellectually coherent, resting on established microeconomic theory, and it is not too demanding with respect to data and estimation techniques. 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 and may miss certain types of cost that regulation imposes. It is an aggregate measure of the gross cost of regulatory constraints limiting the height of buildings and – more indirectly – the supply of land for the use in question. So it reflects the costs of restrictions on land supply, space by floor area ratios or height restrictions, or common forms of conservation designation. It does not, however, capture costs imposed by 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 in both production and consumption, the effects on output or welfare can only be estimated if both the benefits and the extent of substitutability are known. So the regulatory tax estimates are a lower bound estimate of a gross cost of land use regulation in any location.

Glaeser *et al* (2005) report their results for Manhattan apartments as a price to construction cost ratio (rather than as a quasi-tax rate; regulatory tax to construction cost). For the most recent year they had data for, 2002, this ratio was 2.07. In our tax-rate measure, this would translate to a value of 1.07. They also investigated 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

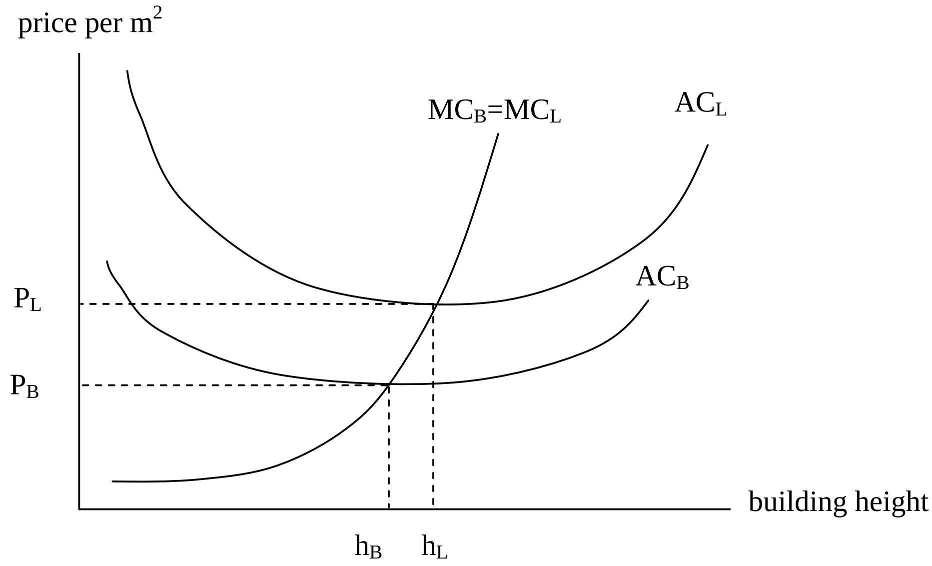
New York urban area as a whole (it was much higher in Manhattan itself than it was in the New York metro area) although it was still substantial in the New York area. However, in 10 of the 21 urban areas investigated there was no measurable impact of regulation on house prices. Nor was there any indication of a 'regulatory tax' on office property in Manhattan. This provides some standard against which to evaluate the results for office property in the British cities reported below.

2 An Interpretation of the Regulatory Tax (RT) as a Measure of the Costs of Restrictions

The key idea of the Regulatory Tax (RT) 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. Marginal cost rises with building height, so in the absence of restrictions on heights, buildings should rise to a point where the marginal cost of adding an additional floor equals its market price. If building higher is less profitable per m^2 than building over a greater area, we still 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. Any gap between the observed market price and the marginal construction cost can be interpreted, therefore, 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.

This is illustrated in Figure 1 which depicts the cost curves of representative competitive developers in (by assumption) two unregulated markets; one relatively prosperous and 'attractive' office market, say, London (L) and one less prosperous and 'attractive' market, say, Birmingham (B). For illustrative convenience, we assume that the marginal (construction) cost curve is identical in both markets implying that wages, materials and other variable costs do not vary regionally. We also assume – quite reasonably – that buildings of a given type have an optimal floor plan to height ratio (given the price of land).

Figure 1: A Developer's Cost Curves without Space Restrictions



In a competitive market P=MC=AC and is given. The demand curve that the firm faces is flat. The regulatory tax RT is P-MC=0 in both cases.

In Figure 2, we illustrate the economic rent of land for the two markets.

Figure 2: Land Rent

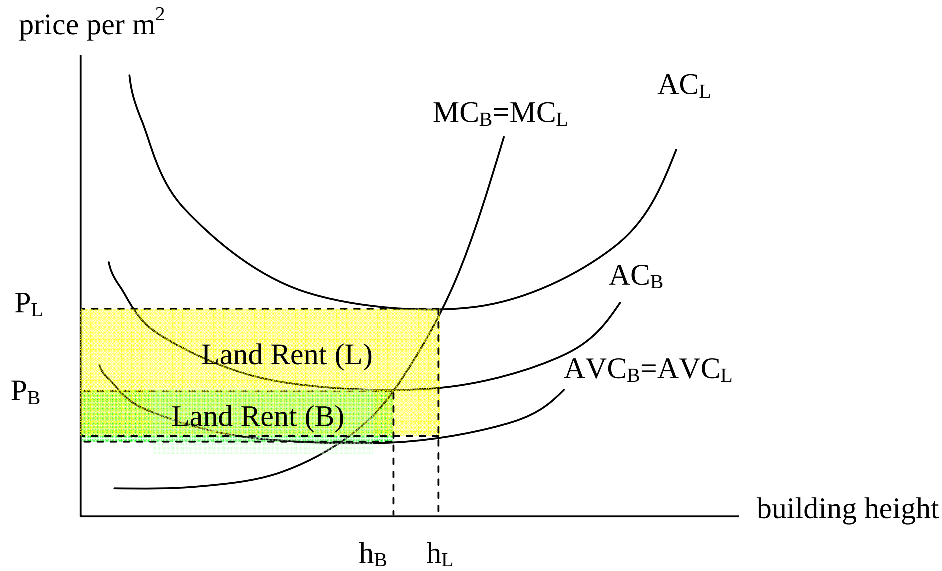


Figure 2 additionally depicts the average variable cost curve, AVC, which covers all inputs except land. The average cost curves, AC, additionally include the costs of the fixed factor, land. The differences between the price and the average variable costs at the optimal building height can be interpreted as land rents (subject to site preparation and infrastructure costs). The illustrated cost curves imply that building heights will be higher, and so MC will be also higher, in London. Underlying 'pure' land values are relevant in the sense that, given different input costs, the optimal capital to land ratio will be different in different markets. The land rent is greater for London than for

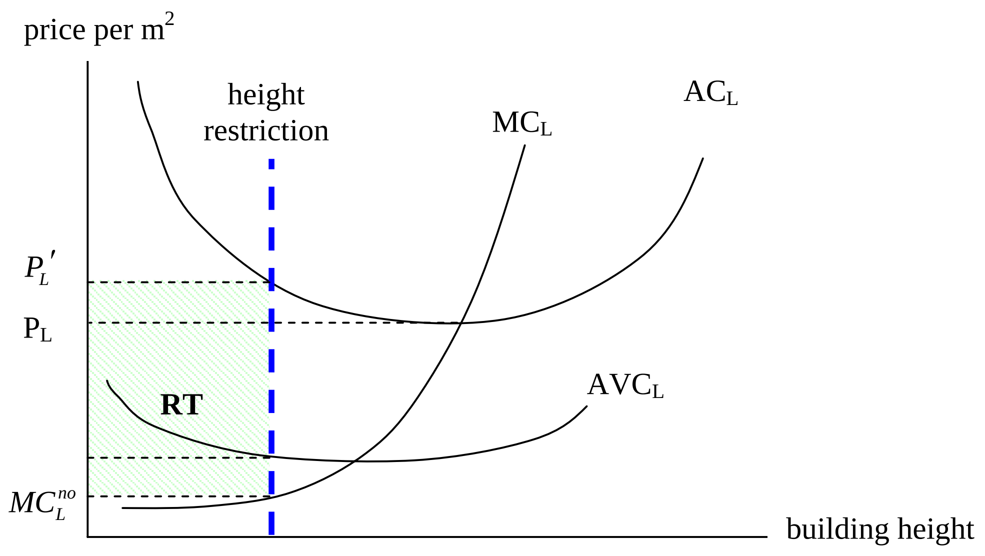
Birmingham so buildings are higher but the difference in land rents between the two markets does not affect the value of the RT. In the absence of restrictions, RT will be zero. This, indeed, is on of the attractions of the RT measure. Since land costs are an element in fixed costs, they never affect the measured RT. Since land costs are difficult to measure and it is considerably more difficult still to estimate any impact of land use regulation on the cost of land, the RT measure of the costs of regulation entirely avoids a difficult problem.

We can think about this in more detail by considering two cases. Case F is the unregulated situation while Case R is the regulated one.

Case F: Suppose we have an unregulated world with a competitive development and office market and the cost of an additional floor rises with building height: then building heights rise until, per m^2 Marginal Cost of Construction (MC)=Marginal Revenue(MR)=Average Cost of Construction (AC)=Price(P)=Average Revenue (AR). In such a market, therefore, the price per m^2 includes all costs for a given building: construction + land + normal profit. Suppose we then add a hypothetical additional floor. The MC per m^2 is higher for this additional floor than for the existing highest floor but price is not. The 'land' is already paid for in the existing building, part of fixed costs and included in AC. There is, then, no appreciable RT.

Now consider the regulated world of Case R in which there is a constraint on building heights. We have an existing building and a competitive development and office market, but it is no longer true that building heights rise to the point at which MC=MR. They could profitably be higher but this profit is capitalised into the price paid for land so profits are still 'normal'. Land is a fixed cost included, therefore, in average costs. If we now add a hypothetical floor to an existing building, there is no extra land cost – these are already 'paid for' in the existing building and included in AC. The marginal cost is only the extra construction cost but the price reflects the constrained supply, now without land rents having to be paid for, so price exceeds MC and the difference represents the gross cost of regulation - or the RT. This is illustrated in Figure 3.

Figure 3: A Developer's Cost Curves with Height Restrictions (London only)



The fact that the price of the extra space in Case R is higher has nothing to do with paying for the land but reflects the constraint, including scarcity of space. Although the RT measure eliminates the impact of land costs in the current regulated market conditions if the market were unregulated land costs per m^2 would be lower: so the observed MC in a regulated market will differ from those in an unregulated market.

However, not all regulatory constraints are as simple as height restrictions. There may be cases where the specific form of the regulations influences the costs of construction and the shape of the cost curves. Take an extreme example of hypothetical land use regulations. Suppose there were **no** controls on building heights but rigid controls on the amount of land made available for (office) construction and rigid constraints on the size of the floor plan relative to the size of the site. In such a situation there would still be a market demand for total office space and building heights would still rise until the point at which MC=AC=P. So estimated RT would be zero.

This would not mean, however, that the regulatory system imposed no costs. Since costs per floor rise with the number of floors, to get a given total quantity of space, buildings would have to be much higher so the AC and MC curves would, in effect, be shifted to the left and upwards. To provide 36,000 m^2 of space (a large office building) with a floor plan of 1,200 m^2 would imply a 30 storey building and so a height of, say, 100 metres: to get the same space if the restriction allowed only 25m^2 per floor would imply 1,440 stories – a building some 4.75 kilometres high.

Now consider another extreme of hypothetical regulation: suppose that there are no constraints on building or land availability at all, but stringent compliances costs related to, say, permits, but such costs are a function **only** of individual buildings. Once the compliance process has been completed, the agreed building can be constructed with no further compliance costs at all. In such a case, the costs of compliance will appear as a fixed cost and, if the results related to the incidence of Impact Fees are applicable (Ihlanfeldt and Shaughnessy, 2004) will be fully capitalised into land prices. Thus, there could be no impact on marginal costs or on the price of space. There will be a deadweight loss, but this loss will fall uniquely on the price of land although given that the profitability of transferring land from agricultural to urban use will be reduced it could reduce the overall supply of urban land and so have some affect on space costs.

What these examples suggest is that the relationship between measured RT and the actual gross costs of regulation (if these could be measured exactly) is, in principle, a variable one and will depend on the precise form the regulatory constraints take. So long as at least an element of the regulatory constraints takes the form of restrictions on the height of buildings, however, for those types of uses in which vertical space is a more or less perfect substitute for horizontal space, the measured RT will be strongly and positively correlated with the actual gross costs of regulatory constraints. The RT measure will, however, be a **lower bound** estimate of the gross costs because, for example, some of the regulatory constraints may relate to compliance costs or costs of delay.

Need this concern us particularly in the case of British offices? Restrictions on building heights take several forms but are applied in all British markets. In the City of London, for example, no less than eight separate 'view corridors' of St Paul's cathedral (both foreground and background) are protected from building above some 55 metres and five 'view corridors' of the Monument are similarly protected as are four street blocks around the Monument (City of London, 1991). There are, in addition, extensive 'Conservation Areas' within which very limited changes to the external appearance of buildings is possible – obviously including height - and, throughout the City – as in all British cities – there are floor area ratio restrictions, known in the UK as 'plot ratios'. These are set at 5.1:1 in the City (City of London, 1991, para. 16.42). There are, in addition, other regulations affecting the design of buildings which limit height and space within them. Planning policies in London's West End are substantially more restrictive than those in the City, since very large areas – most of Mayfair and Belgravia – are designated Conservation Areas where it is not possible to build higher than the existing structure, where external, and if the buildings are listed (which many are) even internal, alterations are prohibited[7]. Such historic conservation regulations undoubtedly generate amenity values, not included in a measure of RT.

In summary, then, the RT measure of the gross costs of regulatory constraints on buildings is something of a black box in that it will incorporate the cost of restrictions on the supply of land for the use in question and restrictions on building heights. These may arise from various sources but are imposed in all British office locations by 'plot ratio' controls ('floor area ratios' in the US). Since land use planning is a national system in Britain it seems likely that compliance costs and costs of delay do not vary significantly across locations but such costs will not be fully captured in the RT measure and may not be captured at all. So we can conclude that estimated RT values will be strongly and positively correlated with actual gross costs of regulatory constraints but in absolute terms are likely to be lower bound estimates.

3 Data and methodology

Here we discuss the data used to estimate regulatory tax values. The total unemployment rate and service employment growth rate data used in the subsequent analysis are discussed in Section 6 and Appendix G. To estimate the RT we need 'price' and 'marginal construction cost' data. Our empirical analysis builds on the best available data for the British office market and a number of continental European cities. After careful and detailed discussion to agree how best to measure *marginal costs of construction* (i.e., the estimated cost of adding an additional hypothetical floor to an existing building) Davis Langdon estimated time-series data for the agreed definitions by market (per square foot or square metre). Davis Langdon are the leading UK producers of construction cost data for the building industry and produce 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. Gardiner and Theobald (2006) – Davis Langdon's major competitor – provide (average) construction cost data for our sample of continental European cities. Unfortunately, comparable time-series data on

[7] An interesting outcome in the very high end of the residential market in London's West End is a very restricted supply of large floor plan flats. Listed building designation is applied even to internal connecting doors between adjoining structures so it is impossible to construct flats with larger floor plans than existing 18th and 19th Century structures. The result is a large premium per square metre for the few large floor plan flats available.

the market *price* of office space in the sense of capital values is not readily available, only data on rents, yields and rent free periods can be obtained. CB Richard Ellis, CBRE, the largest property consultancy in the UK, provided the relevant data for British markets. Similar data (although estimated on a different basis) were also provided by Jones Lang LaSalle (JLL) for a number of our British locations and all the continental European ones we report estimates for. We used the common British locations to make the best adjustment we can to a common basis.

Only rental not capital values are available because office buildings are treated as income producing assets that are typically leased floor by floor. Given this complication, we need to impute the market price per m^2 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 using the most 'conservative' and 'radical' assumptions which are defensible to estimate capital values. These provide a range of estimates although most of the discussion is in terms of what we regard as a relatively conservative, 'central' estimate. 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 from JLL and Gardiner and Theobald.

Our data for the RT estimates for British office locations come from four different sources. CBRE (which incorporates the former CB Hillier Parker and before that Hillier Parker, 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 and rent-free period data for 14 office locations in the UK (see Table 1 for a list of the markets). Both time-series cover all 14 local markets. Most time-series go back to 1973 with two series (those for the City of London and London West End) reaching back to 1960. CBRE also provided us with total occupation cost data, although only for 2004 and 2005 and 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 1961. Finally, we obtained regional vacancy rate information from the Office of the Deputy Prime Minister (ODPM) and national rental void data from IPD.

The data for the RT estimates for European office locations come from two additional sources. JLL provided us with prime rent and equivalent yield data from 1990 to 2005 (continental European cities) and for 1987 to 2005 (British cities). These allow us to compute hypothetical capital values (so called 'Peter Pan values') based on the assumption that the buildings are permanently renewed. Unfortunately, JLL could not provide us with matching information on voids or vacancies, so we use the ratio of the CBRE to JLL estimated values where we have common locations (for six British locations) to obtain as comparable a set of capital values for all locations, British and continental European. Gardiner and Theobald's (2006) 'International Construction Cost Survey' provides *average* (as opposed to *marginal*) construction cost data back to 1999 so we can estimate RT values from 1999 to 2005. We use the ratio of marginal to average costs from Davis Langdon and Gardiner and Theobald to estimate the hypothetical marginal cost of construction for the continental European office locations. More detail is given in Appendix E.

Imputing Missing Values

Our raw data come 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, in all but three cases, back to 1973. Similarly, the yield data come in various time intervals. The construction cost data are 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.

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. Imputing values of yields could, we believe, have a significant impact on the final estimates of RT. So 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 relative terms.

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 but only for three years. This does allow us to impute missing rental values between 1965 and 1972 but for missing years, we assume a linear trend.

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 in 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.

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

$$RT_{jt} = V_{jt} - MCC_{jt} \qquad (1)$$

where V_{jt} is the market value of an additional square metre of office space in market *j* at time period *t* and where MCC_{jt} is the corresponding marginal construction cost of adding one square metre of 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.[8] According to the equivalent yield model, the property value can be expressed as:

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

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:

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

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.

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

$$V_{jt} = \frac{I_{jt}}{y_{jt}}. \qquad (4)$$

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

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

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

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

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[9] 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.

The RT is computed as the estimated market value per square metre (fully adjusted for rent-free periods and vacancy rates) minus the marginal construction costs estimated from Davis Langdon's data. Rather than reporting the regulatory tax directly, we report a quasi-tax rate, that is the regulatory tax relative to marginal construction cost:

$$RT\ Rate_{jt} = \frac{RT_{jt}}{MCC_{jt}} = \frac{V_{jt} - MCC_{jt}}{MCC_{jt}} = \frac{V_{jt}}{MCC_{jt}} - 1\,. \qquad (5)$$

These regulatory tax rates are reported for all 14 markets and for all time periods with available data (see Figures F1-F4).

The above outlines the way in which we estimated the 'central' value of the RT. Given that the RT 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, we estimated regulatory tax values for three different sets of assumptions. The alternative sets of assumptions are as follows:

1. <u>Upper Bound</u>: 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.
2. Use the fully adjusted prime rent as the basis (as in the central estimate) but assume a 10% premium for top floors.
3. <u>Lower Bound:</u> 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.

4 Results and their Interpretation

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 (as outlined above); 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.

[9] 'Appraisers' in the US.

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 the highest value estimated for Manhattan housing by Glaeser *et al* (2005).

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.

It is immediately clear that the value of the regulatory tax moves with the real estate cycle. This is because real estate prices are substantially more volatile than are construction costs although, of course, one effect of regulatory restrictions would be to constrain supply and so reduce its elasticity 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: the value of the estimated regulatory tax on office space averaged across all British office markets is an order of magnitude higher than the peak observed in the most highly regulated sector of the most regulated market in the US.

It is more revealing, however, to look at the time series data for the individual markets reported in the Appendix Figures F1 to F4 – 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 the Docklands. Until the early 1980s, 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. Even as late as 1981, 22 conservation areas, affecting 28 percent of its land area were designated (Fainstein, 1994). The British property industry was significantly protected from international competition and supply was constrained. The response to the expansion in demand for office space from the 1960s was a rapid rise in prices reflecting the supply restrictions. 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.

Another difference between the City and all other office locations except London’s Docklands – a special case controlled by the Docklands Development Corporation set up in 1981 to regenerate the rundown area of London’s near East End, adjacent to the City, but abandoned by port activity from the 1960s – is that of the political economy of the control on planning. In all locations other than the City (and Docklands), voting, and so political control, rests with the resident adult population. As has been cogently argued by Fischel (2001), depending on rates of owner occupation which are high in the UK, 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 rests with the City Corporation which is controlled by the local business community and its interests[10]. 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.

As is explained by Fainstein (1994) the threat of the deregulation of financial services, actually introduced in 1986, concentrated the City fathers' minds wonderfully.

> "….once the economic benefits of restricting growth ended, attitudes towards physical change easily became more flexible….Financial firms that already possessed space adjacent to the Bank of England benefited from their monopoly position and had no motivation to favour expansionary policies. Financial deregulation and competition changed the stakes. Competitive office development in the nearby Docklands threatened the interests of… the City. If the City refused to accommodate expansion when deregulation was prompting accelerated financial sector activity, firms already located there risked losing their locational advantage as the center of gravity moved eastwards….Once the decision to reverse the previous conservationist attitudes had been made, the City's officers embarked on an active promotional effort. The planning director solicited advice from firms concerning their space needs and encouraged developers…to accommodate them…until the 1980s the City did not have a planning officer but only an architect who concerned himself with design approvals…new developable land was designated…and floor area ratios were modified to…permit an average of 25 percent expansion in the size of buildings." Fainstein (1994, page 40)

The planning system in the City is likely, therefore, to be responsive to the interests of commercial tenants and threats to local competitiveness. Such threats 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 were becoming notably more relaxed. Its Unitary Plan, lodged in 1991 (City of London, 1991), but drawn up in the second half of the 1980s, identified as its first policy "To encourage office development in order to maintain and expand the role of the city as a leading international financial and business centre" (para. 3.19). By the end of the 1980s, there were already large scale modern developments in the City, built to the highest international standards. Broadgate, for example, opened in 1991, provided 3 900 000 square feet (360 000 m^2) of new office space.

Moreover, there was a radical change to the taxation of business property introduced in April 1990. Before then business property taxes (the business rates) had been set by local governments and - subject to standard procedures for 'rate equalisation' across the country - the revenues had accrued to local communities. There was concern in the then conservative government that anti-business, left wing local councils were boosting revenues and attempting to run re-distributive local policies funded by setting ever higher local business rates. This, it was thought, would hinder the long term competitiveness of British business. So in 1990 the UBR was introduced with

[10] This goes back to the ancient privileges of the medieval city and the leverage its tax revenues gave it in negotiating a high degree of independence and local control from the crown.

national rate-setting and with revenues accruing to central government. There was one exception, however, the City Corporation (self-evidently not anti-business!) was allowed to add its own ‘precept’ to collect its own revenues. Thus from 1990 there has been a strong negative fiscal incentive for any local government in Britain, except the City of London, to permit any commercial development.

While the value of the regulatory tax in the City rose during the later 1980s as property values rose rapidly in the boom, 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, where there is political control by residents and a negative fiscal incentive for development, is a market which specialises in sectors other than financial services. It has much stronger planning protection for conservation reasons, with height restrictions which are impossible to breech (unlike in the City where, outside the conservation areas, employing a ‘trophy architect’ has been an emerging mechanism for building higher). As a consequence, the West End has, in contrast to the City, experienced a steady increase in estimated RT with its high value of 1973 exceeded in 2000 and with an estimated value of 7.9 over the past six years – almost twice that in the City.

The pattern outside the London locations is much as would be expected. The estimated RT was much lower until quite recently and in Newcastle in the 1980s was negative for a short time. In a representative, prosperous, satellite centre such as Reading (discussed in more detail in Section 7), 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, Birmingham 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.

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 positive 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.

5 International Comparison of Regulatory Tax Values

In order to put the results for the British office markets into an international context, we also estimated RT values for a number of cities across Europe; Amsterdam, Barcelona, Brussels, Frankfurt, London City, London West End, Milan, Paris City, Paris La Défense and Stockholm. We use essentially the same methodology as described above but different data sources (JLL instead of CBRE and Gardiner and Theobald instead of Davis Langdon) and have to make a number of additional adjustments – described in Appendix E – to compute comparable RT values.

We also report RT values for the two British office markets for which both Davis Langdon and Gardiner and Theobald construction cost data are available– the City of London and London West End. This provides a cross-check on the comparability of our RT estimates for British and continental European office markets. There is a relatively small difference in estimated RT values (average of 1999 and 2005) for the two markets; 4.5 versus 4.9 for the City and 8.0 versus 9.0 for the West End. Overall, the relatively small differences suggest that our estimates for the continental European markets are quite comparable to those for the British office markets.

When we compare our RT estimates for the various European office markets the first result that catches one's eye is the fact that the two London Markets top the 'league table' with the West End's RT estimate of 8.0 (the average of the RT estimates for 1999 and 2005) being more than twice that of any continental European city except Frankfurt with 4.4. Stockholm and Milan also appear to have comparatively high RT values with 3.8 and 3.1. This is consistent with anecdotal evidence for these markets. For example, Milan is a very tightly regulated city with strict height restrictions in place. Not surprisingly, suburban locations have started to develop outside Milan; first Milano 2 and Milano 3 in the late 1960s and 1970s and now Milano Santa Giulia. The latter is being built in a politically independent commune in the southeast part of the urban region of Milan, between Rogoredo and Linate which has been derelict for some years. The area where it is being developed was the location of the now abandoned Montedison factories and Redaelli steel mills. Local politicians there – not surprisingly – are happy to welcome new development projects.

As in London, estimated RT values in Paris differ quite substantially within the metro area; they are much higher in the 'historic' City of Paris, where conservation regulations are tight, than they are in La Défense, a purpose planned new office and commercial centre on the edge of the historic centre. . Finally, the city that we had expected to have the lowest RT is indeed at the bottom of the 'league table'. Belgium is well known to have a flexible land use regulation system which imposes little constraint on supply. In Brussels – despite the rapid increase in demand for office space as a result of the increasing size and influence of the EU institutions - we estimate a low RT of 0.7, although this value is still much higher than that estimated by Glaeser *et al* (2005) for the office market of Manhattan.

Overall, the RT comparison for the 10 European office markets suggests (a) that the British office market is by orders of magnitude more supply constrained by regulation than other office markets in Europe and (b) that European cities generally seem to be subjected to tighter regulatory restrictions on supply and consequently higher RT values than those found in the United States. Below, we turn again to the British office market in an attempt to explain the determinants of its restrictiveness.

6 The Political Economy of Planning Restrictiveness

If the estimated value of the RT really represents a measure of the costs of regulatory restrictiveness – we should be able to model its determinants. As noted above, in areas where there is control of planning policy by local residents – overwhelmingly owner occupiers – we should expect a strong resistance to development. Not only are there short run costs to local residents from large scale construction but there are likely to be environmental costs and losses of amenity values. Benefits – in the form of more jobs or higher wages – are likely to accrue as much to non-residents as to residents given the small size of local government areas in the UK. In addition – re-enforced since the introduction of the UBR in 1990 – there will be a powerful fiscal disincentive; even before 1990, the impact on local budgets of business property development was probably unfavourable because of the high proportion of local revenues coming from central government and rate revenue equalisation across local communities. The only incentive for local residents to allow the development of additional commercial real estate would presumably be falling local economic prosperity. This is likely to be most plausibly formulated as fear of job loss and unemployment.

We should expect the City of London and Docklands to behave rather differently, however, since in these jurisdictions business interests control planning policy. In the case of the City, the planning authority is its unique local governing body, the Corporation of the City of London. This is an historic entity and it has been exempt from all the major reforms of local government in the modern era, in particular from both the Municipal Corporations Act of 1835 and the legislation in 1969 which abolished the 'business' vote. The City is, in effect, a Central Business District with a few thousand residents, so the business electorate (including land owners and property companies but dominated by financial and other businesses located in the City) controls the Corporation which is the planning authority for the area. Business voting power is weighted by the number of employees. The London Docklands Development Corporation (LDDC) was established in 1981. This was a directly appointed body, not an elected and representative one, with the specific brief to regenerate the large – a total of 8.5 square miles - derelict port area immediately to the east of the City of London. The LDDC was responsible for all the major planning for the area until it was abolished in 1998 when planning responsibilities reverted to the local Boroughs of London. However, by then, the whole area had been transformed with the most notable development being Canary Wharf. In total 25 million square feet of office and industrial floor space had been developed.

Given, therefore, their different controlling interests we should expect these two planning authorities to be less restrictive of development, other things equal[11], and

[11] But of course, other things are not equal since the restrictions (in terms of plot ratios, for example)

much more responsive to local economic conditions than resident-controlled planning authorities. For any given (change in the) level of local prosperity, the business controlled LAs would be expected to relax their constraints on development substantially more than would the resident controlled communities. We might, furthermore, expect to observe a change in regulatory restrictiveness as a result of the introduction of the UBR in early 1990, with all other British office locations becoming more restrictive relative to the City of London which, alone, retained the capacity to raise revenues locally from business property.

The best measure of 'local economic prosperity' would seem to be the unemployment rate of residents. Not only is this the most immediately observable and widely reported measure but the fear of job insecurity seems likely to be a concern for voters, and thus an influence on local politicians. It has the additional advantage that it is measurable if with considerably more difficulty than might be imagined[12]. Because of the difficulties of estimating consistent long term time series for local area unemployment rates for our office location, we experimented with four alternative techniques. These are described in Appendix G. Table 5 provides summary statistics of our preferred unemployment rate measure used in the empirical analysis below. The very reassuring outcome, however, was that the basic analytical results were essentially unaffected by the particular series for local unemployment used.

Table 6 shows the results from our first specification, pooling all 480 observations and including both year and location fixed effects. We estimate the following:

$$RT_{jt} = \beta_0 + \beta_1 \times U_{jt} + \varepsilon_{jt} \tag{6}$$

$$RT_{jt} = \beta_0 + \beta_1 \times \left(U_{jt} \times D_B\right) + \beta_2 \times \left(U_{jt} \times D_R\right) + \varepsilon_{jt} \tag{7}$$

Where:

RT = estimated value of Regulatory Tax
U = estimated British Labour Force Survey-equivalent unemployment rate
D = dummies for $_B$, business controlled, and $_R$, resident controlled local government
$_{j,t}$ refer to the location and year

are more or less constant across locations but demand for space is not, so a given restriction is more binding where demand is greater. This is reflected in the larger location fixed effects observed in the City (Table 6) than in other locations.

[12] There are two basic sources of data on unemployment in the UK: survey based data, conforming to ILO norms, available from 1973; and 'registration' data available since the early 20th Century. The problem is that prior to 1999 the sample for the survey based data was too small to give reliable results for local planning authority jurisdictions; and the registration measure is highly sensitive to both the incentives to register and rules governing who is actually counted. As unemployment rose from the late 1970s politicians could not resist manipulating the unemployment figures (registration data is released very quickly and is what the media focus on) by frequently changing both the incentive to register and the rules governing who was counted. Each of the changes had the effect of reducing measured 'registered' unemployment. To estimate unemployment rates for our local government units (representing the Local Planning Authorities) we calculated the ratio of regional survey to registration unemployment rate for each time period and used that to adjust the registration rate for the local area most closely corresponding to the LPA to a quasi-survey based value. To save space we report only one set of results here, for what seem to us to be the most defensible technique. Results for the other sets of estimations are available from the authors.

In Table 6, we show results for two separate versions of the specification stated in equations (7) and (8); in columns 1 and 2 we use values of the local unemployment rate for the actual nearest equivalent planning authority areas for which data could be estimated for the locations outside London but unemployment for the Greater London area as a whole for all five office locations within London. In columns 3 and 4 we use the estimated unemployment rate for the whole Greater London area for just the three office locations in central London, the City, Westminster and Docklands but the local unemployment rate for the relevant Boroughs, Hammersmith and Croydon, for the two more residential, suburban office locations, Boroughs in London, being the local planning authorities. The logic for this is that the workforces and businesses based in London's three central locations operate over a wide area and draw their labour forces from the wider London region; moreover, particularly in the City, there are very few residents relative to employees. As can be seen the results are essentially identical and in subsequent tables we report only those using unemployment rates for Greater London as a whole for the three central London office locations.

The results in Table 6 show a significant negative relationship between local unemployment and our measure of planning restrictiveness – the Regulatory Tax. Moreover, as expected, the estimated value of the parameter is much larger in the business controlled compared to the resident controlled locations: the estimated value of the coefficient is almost three times as great in absolute terms in the business controlled locations (in both specifications reported in columns 2 and 4 of Table 6) and an F-test shows that these values are significantly different in statistical terms. Most location and year fixed effects are statistically significant. A White-test cannot reject the null-hypothesis of homoskedasticity, hence we report normal standard errors.

There are two obvious problems with these results. The first problem is that estimated values of RT become possible at different dates for different locations, with estimates for the first few years only being available for the City and the West End. That is, our sample is unbalanced.[13] Thus, the composition of the sample and the implicit weight of different locations within it change over time. To address this problem we restrict the data in all subsequent specifications, reported in Tables 7 to 10, to the 11 locations for which there is annual data on a continuous basis since 1973 (see Table 1 for a list of these 11 locations and Table 5 for summary statistics of the unemployment rates for the balanced sample).

The second problem is that although we are interpreting local unemployment as a 'supply side' variable, operating on the restrictiveness of planning constraints via the local political process, it could also be interpreted as a 'demand side' measure. As can be seen from Figures F1 to F4 in Appendix F the estimates of the RT are cyclical: the price of office space is more cyclically sensitive than are the marginal costs of construction. We would argue that the real evidence in support of our hypothesis that the intensity of constraints imposed is politically determined and relaxes only under the pressure of unemployment, is not so much that the coefficients across all office locations (columns 1 and 3 in Table 6) are highly significant but that there is much

[13] The RT measures prior to 1973 are also based on imputed values for yields, which are measured with some degree of uncertainty. See Appendix D for details.

greater sensitivity to unemployment in business controlled compared to resident controlled locations (columns 2 and 4 in Table 6). Nevertheless, there is an identification issue. We address this issue by including as direct a measure of demand for office space as we can find, as an additional explanatory variable in our subsequent analysis below (Tables 7 to 10).

The most obvious variable measuring demand for office space is employment growth in office employing sectors[14]. Since we were aiming to measure a demand side variable we constructed our office employment series for Local Authority areas and for each of the five London locations individually rather than using office employment for Greater London as a whole for any of them. There have been three significant changes in industrial classification since 1971 affecting local area employment statistics. To minimise the impact of this we constructed two alternative series: one for a broad definition – all service employment. The second is a narrower definition attempting to exclude sectors such as distribution which are not primarily office employment sectors but once more subject to classification changes. The second measure covers financial services, banking, public administration and ‘other’ services. Fortunately there is a bridge year available for each change in classification so in constructing the office employment index for each location we used this overlap to scale one series to the next. The details of how office employment was estimated are given in Appendix G. Summary statistics for the two measures are provided in Table 5.

Tables 7 to 10 report the results but now fitted only for a balanced sample of 363 observations. The models are as before but now include a control variable for local office employment growth:

$$RT_{jt} = \beta_0 + \beta_1 \times U_{jt} + \beta_2 \times S_{jt} + \varepsilon_{jt} \quad (8)$$

$$RT_{jt} = \beta_0 + \beta_1 \times (U_{jt} \times D_B) + \beta_2 \times (U_{jt} \times D_R) + \beta_3 \times (S_{jt} \times D_B) + \beta_4 \times (S_{jt} \times D_R) + \varepsilon_{jt} \quad (9)$$

where other variables are as before and S equals the local office employment growth rate. Table 7 shows the result without year fixed effects and, then, in Table 8, including both location and year fixed effects. As might be expected the results for the balanced sample are significantly stronger and those with year fixed effects are stronger still. In each table, results are shown for directly comparable models i) excluding and ii) including the office sector employment growth rate as an additional independent variable. The particular results shown here relate to the narrow definition of office employment but those for the broad definition are in all cases virtually the same.[15] Including service employment, whether interacted with business/resident control or not, makes no significant difference to the results with respect to the unemployment variable. The parameter estimates are all but identical – certainly not different in a statistical sense – and there is a numerically substantial and statistically significant difference (at the 1 percent level) in the size of the estimated parameters between business and resident controlled locations in all cases. The results for the office employment growth rate are mainly not significant and, where they are,

[14] Strictly, employment is only an appropriate demand measure if there is a fixed floor space to employee ratio. In reality – certainly in the longer run – there can be substitution – but nevertheless employment in office sectors seems as pure a demand side measure as is available.

[15] Results are available from the authors upon request.

significant only at the 10 percent level either when the office employment growth rate variable is not interacted with the dummy for local control or – where it is – only for resident controlled locations.

Tables 9 and 10 now show the results of testing for the introduction of the UBR in a comparable set of models. As explained above, this change could be expected to have significantly increased the fiscal disincentive to permit development for all local communities relative to the City of London. The new basis for business property taxation came into force in April 1990, although it may have been partly anticipated. We chose the end of 1989 as the break point.[16] There are two obvious ways to test whether this made local communities become relatively more restrictive than the City. We can include a dummy for all markets except the City from the end of 1989. The results are reported in Table 9 for a comparable set of models as discussed in the previous paragraph. Again, as can be seen from comparing the results reported in columns 1 and 2 (where the office sector employment growth rate is not included) with those in columns 3, 4 and 5 (in which the office sector employment growth rate is included) including the office employment growth rate, makes no significant difference to the results for the unemployment variable. Results shown in columns 1 and 3 do not allow for the impact of unemployment on the value of the RT to vary between business and resident controlled locations; those shown in columns 2, 4 and 5 adjust for the type of local control. Compared to previous models we now include an additional dummy for all locations after 1989, implicitly assuming the effect of the change in the fiscal incentive was uniform. The model continues to perform well but we now observe a significant across the board increase in estimated planning restrictiveness in all locations compared to the City of London from 1989, the year of the introduction of the UBR.

The results reported in Table 10, for the same set of models, permit the local response to the change in property taxes to vary across all locations. We see that the City appeared to become significantly less restrictive – as expected – while 6 out of 10 of the other locations became significantly more restrictive. These conclusions are not affected if the office sector employment growth rate is included as a control. For all locations where the sign was negative, it was insignificant, except in Reading. In Reading, however, we observe an apparently anomalous reduction in restrictiveness, significant at the 5 percent level. Reading is an unusual jurisdiction. It is about 60 kms to the west of London and a high speed train service opened up in 1976, with services taking only 22 minutes to the London terminus. This triggered its development as a satellite back office location, producing a large demand shock relative to its then stock of office space. Prices and our estimate of the RT rose quickly in the second half of the 1970s. This expansion was initially supported by the local government. But during the 1980s the Trotskyite left, which strongly opposed office development, took political control. However, the recession of 1989-91 hit the local economy very hard and moderates regained control. Moreover in reaction to the perceived anti-business thrust of local government, the wider region within which Reading then lay – Berkshire in particular – teamed up with local business interests and the University to set up the Thames Valley Economic Partnership (TVEP) in 1991. The explicit intent of this was to make the local area more business friendly and to encourage business

[16] However, results do not change significantly if we choose one year earlier or one year later as break point.

expansion. Perhaps it is the change in political control from radical left to moderate, and the lobbying activities of TVEP, which had some impact in reducing Reading's planning restrictiveness from 1990. The individual location specific post-1989 dummy coefficient is estimating the change in the RT from that date compared to before that date. In most jurisdictions, there could have been factors in the post-1989 period, in addition to the introduction of the UBR, that might have had an influence on planning restrictiveness and so on our estimates of RT. But in Reading, it is plausible to believe these were particularly important which both increased the measure of the RT in the pre-1989 period and may have reduced it in the post-1989 period.

Overall, however, these results seem to provide strong support for the interpretations offered and reinforce our confidence in the RT as a reasonable measure of the impact of planning restrictiveness on the costs of office space. Although demand and supply may not be fully identified, the most obvious direct measure of demand – office employment growth – is hardly significant and, when included in the models, has no impact on the estimated effect of the unemployment variable, designed to measure local political pressures for the relaxation of planning restrictiveness. The strongest evidence for the hypotheses, however, is probably provided by the difference in the estimated impact of the unemployment variable depending on the form of local political control of the planning system. The estimates show that business controlled planning authorities react significantly more strongly to local unemployment than do resident controlled authorities and that fiscal (dis)incentives for local communities have the expected impact on permitting development.

7 Conclusions

The Regulatory Tax measure of the gross costs of land use regulations for occupiers of property seems to be a useful one. Although it will not reflect certain forms of regulatory constraint, such as heavy compliance costs or costs associated with delays and is, therefore, a lower bound measure, the ease with which it can be estimated is a very substantial advantage. In this paper, we provide the first estimates for commercial property and show that for office buildings in British cities it is substantially larger than it is in comparable continental European cities. Despite using different data sources for the international comparison, which includes the City of London and London West End, we get values for the two London markets that are very comparable. The conclusion is that supply in the British office market, like the British residential sector, is highly constrained by regulation and this costs business occupiers a substantial amount. It is, in effect, a tax on office users. Unless space is perfectly substitutable in production, therefore, there will be further costs in terms of output and employment.

We argue that such a level of regulatory restriction – an order of magnitude greater than the peak observed in the most restricted sector, in the most restricted markets in the US – is to be expected given the aims of British planning policy, the form of its instruments, the fragmented geographical scale of decision making (which internalises costs associated with development but not benefits), and the fiscal disincentive to local communities to allow commercial development. In this context we would expect differences in regulatory constraints between those authorities controlled by business interests compared to those controlled by residents. We are fortunate that the historical anomaly of the City of London – controlled by business interests since the middle ages and exempt from all the major reforms of local government of the modern age, allows us to test this proposition. We find strong evidence that business control makes a significant difference to the tightness of regulatory constraints on office building and on the reaction of restrictiveness to local economic prosperity measured by the unemployment rate. Including a direct measure of demand for office space makes no difference to the result, reinforcing our conclusion that we are observing variation in regulatory constraints – the supply side.

It is also possible to test the hypothesis that regulatory restriction responds to fiscal incentives and that, in particular, changes in the incentives to allow commercial development resulting from the introduction of the UBR early in 1990, led to even more restrictive land use regulation. This, again, is because the City of London was in large measure protected from the change and continued to be able to levy its own rate on business property. Again, we find strong evidence that the elimination of any fiscal incentive to permit commercial development was associated with an increase in the value of the RT outside the City of London. By further restricting the supply of office space, costs were increased.

Together these findings support our confidence that the RT measure is really capturing – or at least closely correlated with – the gross costs imposed by land use regulation.

One of the interesting speculations this prompts is about unintended consequences. As discussed above, the 1980s Conservative government perceived left wing local authorities as engaged in a concerted effort to frustrate its efforts to increase incentives, privatise state industries, sell off social housing and reduce the total tax take. To finance these efforts to offset the adverse and regressive impact central government actions were perceived as having, local government was (perceived to be) increasing their tax revenues from the business rate, perhaps as part of a punitive anti-business crusade. Central government's response was to introduce the UBR. This removed control of business property taxes from local communities, effectively turning business property taxes into a national tax. It managed, therefore, not only to eliminate all tax revenue gains to local communities from commercial real estate development but to make this fact perfectly transparent. Nevertheless, local governments continued to have a legal obligation to provide services to local businesses. So it produced a powerful and transparent fiscal disincentive for local communities to permit any commercial development.

Over time, our results suggest, this has restricted the supply of offices and pushed up the value of the Regulatory Tax. The increase in business costs this represents may more than offset any costs that might realistically have been imposed by old-style left wing councils attempting to raise money from local property taxes; especially given the demise of old-style left wing councils that occurred between 1989 and the present.

Indeed, we can quantify this effect because of the fortunate fact that the City of London alone was given a partial exemption from the UBR. Table 11 shows some indicative numbers. We choose an office of 1,500 m^2 – just about enough to accommodate a medium size firm with 200 employees.[17] In the London Borough of Camden in 2005, such a building had a rateable value of £112,250[18] so, with the rate multiple set at 42.6p, that meant the occupants would be paying a UBR of £47, 819 a year. If the RT increased in Camden to the average extent it did across the rest of the country, then the implied increase in its annualised cost was £67,312. Moving to a UBR, to avoid local communities levying extortionate taxes on business, seems likely to have resulted indirectly in a larger financial burden by way of the RT, than the total cost of business rates themselves.

[17] Based on the London Employment Sites Database (Roger Tym & Partners, 2005) the space usage in Inner London is 19 m^2 per office job, suggesting a site of 3,800 m^2 for a medium size firm with 200 employees. Hence, our assumption of 1,500 m^2 is a very conservative assumption, implying that we are underestimating rather than overestimating the regulation induced increase in annualised occupation cost.

[18] 7/8 Greenland Place, London, NW1 0AP.

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Tables

TABLE 1
Investigated UK Office Markets and Data Availability

Office Market	Years with Available Data	14 Market Sample (Unbalanced)	11 Market Sample (Balanced)
City of London	1961-2005	Yes	Yes
London West End	1961-2005	Yes	Yes
London Docklands (Canary Wharf Tower)	*1998*-2005	Yes	No
Croydon (Outer Suburban London)	1965-2005	Yes	Yes
London Hammersmith (Inner Suburban London)	*1991*-2005	Yes	No
Maidenhead (South East)	*1984*-2005	Yes	No
Reading (South East)	1965-2005	Yes	Yes
Bristol (South West)	1973-2005	Yes	Yes
Birmingham (West Midlands)	1965-2005	Yes	Yes
Leeds (Yorkshire and Humberside)	1973-2005	Yes	Yes
Manchester (North West)	1973-2005	Yes	Yes
Newcastle (Upon Tyne)	1965-2005	Yes	Yes
Edinburgh (Scotland)	1965-2005	Yes	Yes
Glasgow (Scotland)	1965-2005	Yes	Yes

TABLE 2
Summary Statistics: Regulatory Tax relative to Marginal Construction Cost

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

City	Estimated Regulatory Tax 1999	2005	Average
London West End	7.62	8.37	8.00
London City	4.68	4.31	4.49
Frankfurt	5.44	3.31	4.37
Stockholm	4.28	3.30	3.79
Milan	2.07	4.11	3.09
Paris: City	2.35	3.75	3.05
Barcelona	2.23	3.16	2.69
Amsterdam	2.12	1.92	2.02
Paris: La Defense	1.41	1.93	1.67
Brussels	0.52	0.84	0.68

Notes: Estimates are based on data provided by Jones Lang LaSalle (JLL), capital value data, and Gardiner and Theobald (construction cost data). The data from JLL are hypothetical capital values based on mid-point yields and prime rent information. The provided values assume that buildings are permanently renewed (so called Peter-Pan buildings). We adjusted the value by a scaling factor to predict actual capital values. The scaling factor is derived by using prime rent, prime yield, vacancy rate and rent-free period information from CBRE. The computation method for the scaling factor is described in more detail in Appendix E. The estimated scaling factor is 0.697. That is, actual capital value = 0.697 * capital value based on the assumption that the building is permanently renewed and ignoring rent-free periods and vacancy rates. The average construction cost estimates from Gardiner and Theobald are adjusted by another scaling factor to get marginal construction costs. The scaling factor is derived by using marginal construction cost information from Davis Langdon. The estimated scaling factor is 0.827. That is, the marginal construction cost of an additional hypothetical floor (excluding fixed cost) = 0.827 * average construction cost (including fixed cost). The computation method for the scaling factor is described in more detail Appendix E.

TABLE 5
Summary Statistics—*Explanatory Variables*

	Obs.	Mean	Std. Dev.	Min.	Max.
Unbalanced Sample					
Unemployment rate in local office market (measure 1)†	480	0.0800	0.0487	0.00685	0.273
Unemployment rate (measure 1)† in markets with business controlled development	53	0.0619	0.0343	0.00871	0.132
Unemployment rate (measure 1)† in markets with resident controlled development	427	0.0823	0.0498	0.00685	0.273
Unemployment rate in local office market (measure 2)‡	480	0.0795	0.0488	0.00685	0.273
Unemployment rate (measure 2)‡ in markets with business controlled development	53	0.0619	0.0343	0.00871	0.132
Unemployment rate (measure 2)‡ in markets with resident controlled development	427	0.0817	0.0499	0.00685	0.273
Balanced Sample					
Unemployment rate in local office market (measure 2)‡	363	0.0908	0.0479	0.0159	0.273
Unemployment rate (measure 2)‡ in markets with business controlled development	33	0.0765	0.0297	0.0187	0.132
Unemployment rate (measure 2)‡ in markets with resident controlled development	330	0.0922	0.0492	0.0159	0.273
Service employment growth rate	363	0.0133	0.0449	-0.142	0.257
Service employment growth rate in markets with business controlled development	33	0.00714	0.0585	-0.115	0.120
Service employment growth rate in markets with resident controlled development	330	0.0139	0.0434	-0.142	0.257

Notes: †The unemployment rate of the Greater London Area (GLA) is used for all five London markets. ‡The unemployment rate of the GLA is used for the City of London, London West End and London Docklands (Canary Wharf). Local unemployment rates are used for Croydon and Hammersmith.

TABLE 6
Explaining the Regulatory Tax—*Unbalanced Sample with Year Fixed Effects*
(Fixed Effects Model, 1961-2005, all Locations)

	Dependent Variable: Regulatory Tax			
Explanatory Variable	(1)	(2)	(3)	(4)
Unemployment rate in local office market (measure 1)†	-11.166 (3.304)***			
Unemployment rate in local office market (measure 2)‡			-10.936 (3.278)***	
Unemployment rate (measure 1) † * business controlled (b_{B1})		-28.369 (6.053)***		
Unemployment rate (measure 1) † * resident controlled (b_{R1})		-10.863 (3.265)***		
Unemployment rate (measure 2) ‡ * business controlled (b_{B2})				-27.881 (6.017)***
Unemployment rate (measure 2) ‡ * resident controlled (b_{R2})				-10.531 (3.241)***
City of London	6.176 (0.303)***	7.288 (0.445)***	6.187 (0.303)***	7.294 (0.446)***
London West End	5.269 (0.303)***	5.323 (0.300)***	5.280 (0.303)***	5.338 (0.299)***
London Docklands (Canary Wharf)	2.067 (0.483)***	3.281 (0.598)***	2.072 (0.483)***	3.279 (0.599)***
Croydon (Outer Suburban London)	0.095 (0.306)	0.110 (0.302)	0.008 (0.321)	0.031 (0.318)
London Hammersmith (Inner Suburban London)	1.088 (0.382)***	1.052 (0.377)***	1.192 (0.374)***	1.156 (0.370)***
Maidenhead (South East)	1.108 (0.426)***	1.089 (0.421)***	1.131 (0.424)***	1.121 (0.419)***
Reading (South East)	1.309 (0.349)***	1.330 (0.345)***	1.325 (0.348)***	1.353 (0.344)***
Bristol (South West)	0.139 (0.329)	0.130 (0.325)	0.153 (0.328)	0.150 (0.325)
Birmingham (West Midlands)	0.979 (0.270)***	0.986 (0.267)***	0.984 (0.270)***	0.993 (0.267)***
Leeds (Yorkshire and Humberside)	0.293 (0.345)	0.287 (0.341)	0.310 (0.343)	0.310 (0.339)
Manchester (North West)	0.979 (0.281)***	0.950 (0.277)***	0.979 (0.281)***	0.949 (0.278)***
Edinburgh (Scotland)	0.929 (0.311)***	0.945 (0.308)***	0.941 (0.311)***	0.962 (0.307)***
Glasgow (Scotland)	1.212 (0.275)***	1.204 (0.271)***	1.206 (0.275)***	1.195 (0.271)***
Year Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*
Constant	-2.668 (0.887)***	-3.156 (0.888)***	-2.681 (0.887)***	-3.172 (0.889)***
Observations	480	480	480	480
Number of locations (unbalanced)	14	14	14	14
Adjusted R-squared	0.75	0.76	0.75	0.76

Notes: Standard errors are in parentheses. *** significant at 1%; ** significant at 5%; * significant at 1%. Newcastle is the omitted location. F-tests reject null-hypotheses $b_{B1}=b_{R1}$ and $b_{B2}=b_{R2}$ with 99% confidence. White-tests cannot reject null-hypothesis of homoskedasticity. †The unemployment rate of the Greater London Area (GLA) is used for all five London markets. ‡The unemployment rate of the GLA is used for the City, the West End and the Docklands. Local unemployment rates are used for Croydon and Hammersmith.

TABLE 7
Explaining the Regulatory Tax—*Balanced Sample without Year Fixed Effects*
(Fixed Effects Model, 1973-2005, 11 markets)

	Dependent Variable: Regulatory Tax				
Explanatory Variable	(1)	(2)	(3)	(4)	(5)
Unemployment rate in local office market[†]	-7.920 (1.930)***		-7.804 (1.932)***		
Unemployment rate[†] * business controlled (b_{B2})		-46.633 (7.236)***		-47.466 (7.236)***	-46.225 (7.333)***
Unemployment rate[†] * resident controlled (b_{R2})		-5.202 (1.918)***		-4.967 (1.918)**	-4.906 (1.919)**
Service employment growth rate			1.689 (1.495)	2.388 (1.438)*	
Service employment growth rate * business controlled					-1.172 (3.715)
Service employment growth rate * resident controlled					3.015 (1.559)*
Location Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*No*	*No*	*No*	*No*	*No*
Constant	2.208 (0.252)***	2.036 (0.244)***	2.162 (0.255)***	1.967 (0.247)***	1.948 (0.247)***
Observations	363	363	363	363	363
Number of locations	11	11	11	11	11
Adjusted R-squared	0.75	0.77	0.75	0.77	0.77

Notes: Standard errors are in parentheses. *** significant at 1%; ** significant at 5%; * significant at 1%. F-tests reject null-hypotheses b_{B2}=b_{R2} with 99 percent confidence in all cases. White-tests cannot reject the null-hypothesis of homoskedasticity. [†]The unemployment rate of the Greater London Area is used for the City of London, London West End and London Docklands. Local unemployment rates are used for Croydon and Hammersmith and all other non-London office markets.

TABLE 8
Explaining the Regulatory Tax—*Balanced Sample with Year Fixed Effects*
(Fixed Effects Model, 1973-2005, 11 markets)

	Dependent Variable: Regulatory Tax				
Explanatory Variable	(1)	(2)	(3)	(4)	(5)
Unemployment rate in local office market†	-11.728 (3.799)***		-11.735 (3.813)***		
Unemployment rate† * business controlled (b_{B2})		-55.317 (7.941)***		-55.445 (7.957)***	-54.041 (8.088)***
Unemployment rate† * resident controlled (b_{R2})		-10.472 (3.603)***		-10.361 (3.616)***	-10.091 (3.627)***
Service employment growth rate			-0.041 (1.635)	0.677 (1.552)	
Service employment growth rate * business controlled					-2.640 (3.753)
Service employment growth rate * resident controlled					1.331 (1.692)
Location Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Constant	3.196 (0.426)***	2.944 (0.405)***	3.198 (0.430)***	2.918 (0.410)***	2.890 (0.411)***
Observations	363	363	363	363	363
Number of locations	11	11	11	11	11
Adjusted R-squared	0.76	0.79	0.76	0.79	0.79

Notes: Standard errors are in parentheses. *** significant at 1%; ** significant at 5%; * significant at 1%. F-tests reject null-hypotheses $b_{B2}=b_{R2}$ with 99 percent confidence in all cases. White-tests cannot reject the null-hypothesis of homoskedasticity. †The unemployment rate of the Greater London Area is used for the City of London, London West End and London Docklands. Local unemployment rates are used for Croydon and Hammersmith and all other non-London office markets.

TABLE 9
Explaining the Regulatory Tax—*Balanced Sample with Post 1989 Dummy*
(Fixed Effects Model, 1973-2005, 11 markets)

	Dependent Variable: Regulatory Tax				
Explanatory Variable	(1)	(2)	(3)	(4)	(5)
Unemployment rate in local office market†	-7.481 (1.880)***		-7.426 (1.884)***		
Unemployment rate† * business controlled (b_{B2})		-46.633 (7.014)***		-47.196 (7.028)***	-46.225 (7.126)***
Unemployment rate† * resident controlled (b_{R2})		-4.724 (1.861)**		-4.579 (1.865)**	-4.534 (1.866)**
Service employment growth rate			0.914 (1.467)	1.612 (1.407)	
Service employment growth rate * business controlled					-1.172 (3.611)
Service employment growth rate * resident controlled					2.111 (1.528)
Dummy variable: Post 1989, all markets except City of London	0.619 (0.136)***	0.629 (0.130)***	0.609 (0.137)***	0.611 (0.131)***	0.606 (0.131)***
Location Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*No*	*No*	*No*	*No*	*No*
Constant	1.880 (0.255)***	1.701 (0.246)***	1.861 (0.257)***	1.663 (0.248)***	1.652 (0.249)***
Observations	363	363	363	363	363
Number of locations	11	11	11	11	11
Adjusted R-squared	0.76	0.78	0.76	0.78	0.78

Notes: Standard errors are in parentheses. *** significant at 1%; ** significant at 5%; * significant at 1%. F-tests reject null-hypotheses b_{B2}=b_{R2} with 99 percent confidence in all cases. White-tests cannot reject the null-hypothesis of homoskedasticity. †The unemployment rate of the Greater London Area is used for the City of London, London West End and London Docklands. Local unemployment rates are used for Croydon and Hammersmith and all other non-London office markets.

TABLE 10
Explaining the Regulatory Tax—*Location Specific Post 1989 Dummies*
(Fixed Effects Model, 1973-2005, balanced sample, 11 markets)

	Dependent Variable: Regulatory Tax				
Explanatory Variable	(1)	(2)	(3)	(4)	(5)
Unemployment rate in local office market†	-5.976 (1.640)***		-5.926 (1.642)***		
Unemployment rate† * business controlled (b_{B2})		-22.187 (6.709)***		-22.533 (6.723)***	-22.144 (6.793)***
Unemployment rate† * resident controlled (b_{R2})		-4.963 (1.677)***		-4.874 (1.681)***	-4.856 (1.683)***
Service employment growth rate			0.872 (1.242)	1.095 (1.236)	
Service employment growth rate * business controlled					-0.134 (3.158)
Service employment growth rate * resident controlled					1.317 (1.345)
City of London * Post 1989	-3.877 (0.362)***	-3.489 (0.392)***	-3.888 (0.363)***	-3.494 (0.392)***	-3.488 (0.393)***
London West End * Post 1989	1.636 (0.362)***	1.612 (0.360)***	1.625 (0.363)***	1.598 (0.360)***	1.595 (0.361)***
Croydon * Post 1989	-0.217 (0.362)	-0.239 (0.360)	-0.212 (0.363)	-0.234 (0.360)	-0.233 (0.360)
Reading * Post 1989	-0.867 (0.360)**	-0.864 (0.358)**	-0.862 (0.361)**	-0.857 (0.358)**	-0.855 (0.358)**
Bristol * Post 1989	0.651 (0.360)*	0.648 (0.358)*	0.646 (0.361)*	0.641 (0.358)*	0.640 (0.358)*
Birmingham * Post 1989	1.201 (0.360)***	1.197 (0.358)***	1.184 (0.362)***	1.175 (0.359)***	1.170 (0.359)***
Leeds * Post 1989	0.823 (0.360)**	0.826 (0.358)**	0.803 (0.362)**	0.801 (0.359)**	0.796 (0.360)**
Manchester * Post 1989	1.341 (0.361)***	1.355 (0.358)***	1.326 (0.362)***	1.336 (0.359)***	1.333 (0.360)***
Newcastle * Post 1989	0.379 (0.362)	0.402 (0.360)	0.372 (0.363)	0.394 (0.360)	0.392 (0.360)
Edinburgh * Post 1989	1.001 (0.361)***	1.014 (0.358)***	0.981 (0.362)***	0.990 (0.359)***	0.985 (0.360)***
Glasgow * Post 1989	0.297 (0.365)	0.331 (0.362)	0.285 (0.365)	0.317 (0.363)	0.315 (0.363)
Location Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year Fixed Effects	*No*	*No*	*No*	*No*	*No*
Constant	1.686 (0.273)***	1.620 (0.272)***	1.673 (0.274)***	1.602 (0.273)***	1.598 (0.273)***
Observations	363	363	363	363	363
Number of locations	11	11	11	11	11
Adjusted R-squared	0.83	0.84	0.83	0.84	0.84

Notes: Standard errors are in parentheses. *** significant at 1%; ** significant at 5%; * significant at 1%. F-tests reject null-hypotheses $b_{B2}=b_{R2}$ with 99 percent confidence in all cases. White-tests cannot reject the null-hypothesis of homoskedasticity. †The unemployment rate of the Greater London Area is used for the City of London, London West End and London Docklands. Local unemployment rates are used for Croydon and Hammersmith and all other non-London office markets.

TABLE 11
Quantitative Effect of Introduction of Uniform Business Rate in 1990 on a Medium Size Office Firm with 1500m^2 Space Usage

	Change in Annual Occupation Cost	
Office Market	in 1989 £	in 2005 £
London West End	56119	84010
Croydon	58906	88182
Reading	44326	66356
Bristol	42710	63937
Birmingham	39120	58562
Leeds	39388	58965
Manchester	45627	68304
Newcastle	53401	79942
Edinburgh	34267	51297
Glasgow	35781	53564
Average (all markets)	44964	67312

Notes: A floor plan of 1500 m^2 is typically considered sufficient for up to 200 employees. The values are calculated by using the coefficient on the dummy variable 'Post 1989, all markets except City of London' reported in Column 5 of Table 9 (most conservative estimate). Market specific estimated regulatory tax rates and marginal construction cost estimates from Davis Langdon are used for 1989 to compute the capitalized value of the effect of the introduction of the Uniform Business Rate in 1990. Market specific yields from CBRE for 1989 are used to compute annualised values.

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 Aldersgate, 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 from 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).

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	

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).[19] 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).

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:

$$\textit{Rent Free Period}_t = \beta_0 + \beta_1 \times \left(\textit{Deviation Trend-Rent}_t\right) + \varepsilon \tag{A1}$$

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:

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

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):

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

[19] 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.

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.

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 matched our 14 local markets to those regions. Next, we used 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 imputed 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 estimated 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 the result of a misspecified estimating equation. Hence, we are very cautious to interpret results prior to 1973. Note that all our results reported in Tables 7 to 11 are based on data from 1973 onwards and that the comparable results in Table 8 (balanced sample with data from 1973 onwards and *with* year fixed effects) are even more supportive of our hypotheses than those results reported in Table 6 (unbalanced sample with data from 1961 onwards and also *with* year fixed effects).

Appendix E: Methodology Used to Compute Regulatory Tax Values for Continental European Cities

We use prime annual rent data and mid-point yield data from JLL for 10 office locations across Europe (including the City of London and London West End) to compute the 'hypothetical' capital value per m^2 of a so called 'Peter Pan building', that is, a building that is constantly renewed. We adjust the value by a scaling factor θ_1 that is derived as follows:

$$\theta_1 = \frac{\sum_{j=1}^{6}\sum_{t=1999}^{2005} \frac{V_{jt}^{CBRE,central}}{V_{jt}^{JLL,Peter\ Pan}}}{6\times 7} = 0.679 \tag{E1}$$

where $V_{jt}^{JLL,Peter\text{-}Pan}$ is the hypothetical capital value per m^2 of a 'Peter Pan building' in office market *j* in year *t* based on data from JLL and where $V_{jt}^{CBRE,central}$ is the estimated actual value of a prime office building in market *j* in year *t* based on data from CBRE (adjusting for rent-free periods and vacancy rates). The six office markets for which we have overlapping data from CBRE and JLL include the City of London, London West End, Birmingham, Edinburgh, Leeds and Manchester.

The hypothetical actual property value $V_{jt}^{JLL,actual}$ for market *j* in year *t* based on JLL data can be calculated as follows:

$$V_{jt}^{JLL,actual} = \theta_1 \times V_{jt}^{JLL,Peter\ Pan}. \tag{E2}$$

We use average construction cost data from Gardiner and Theobald's (2006) publication 'International Construction Cost Survey'. We use another scaling factor θ_2 to get from *average* to *marginal* construction cost. The scaling factor is computed as follows:

$$\theta_2 = \frac{\sum_{j=1}^{2}\sum_{t=1999}^{2005} \frac{MCC_{jt}^{DL}}{ACC_{jt}^{GT}}}{2\times 7} = 0.827 \tag{E3}$$

where MCC_{jt}^{DL} is the marginal construction cost per m^2 provided by Davis Langdon per m^2 (for market *j* and year *t*) and where ACC_{jt}^{GT} is the average construction cost per m^2 provided by Gardiner and Theobald (2006). The value ACC_{jt}^{GT} is the average of a low and a high estimate of average construction costs in a city centre air conditioned office building. The office markets that are used to calculate the adjustment factor θ_2 are the City of London and London West End; this is because the Gardiner and Theobald survey only provides construction cost data for London but not for the other UK office markets.

The hypothetical *marginal* construction cost MCC_{jt}^{GT} for market *j* in year *t* based on Gardiner and Theobald data can be calculated as follows:

$$MCC_{jt}^{GT} = \theta_2 \times ACC_{jt}^{GT}. \tag{E4}$$

Appendix F: Regulatory Tax Estimates for 14 British Office Markets over Time

Figures F1 to F4 illustrate our estimated RT rates for our 14 British office markets over time. The four figures combine markets with relative geographical proximity (i.e., London office markets, South East office markets, Midlands and North office markets, and Scottish office markets). Note that the RT scales (y-axis) of the four figures are different, reflecting the regional differences in the magnitude of RT.

Figure F1: Regulatory Tax (Central Estimate)
London Office Markets

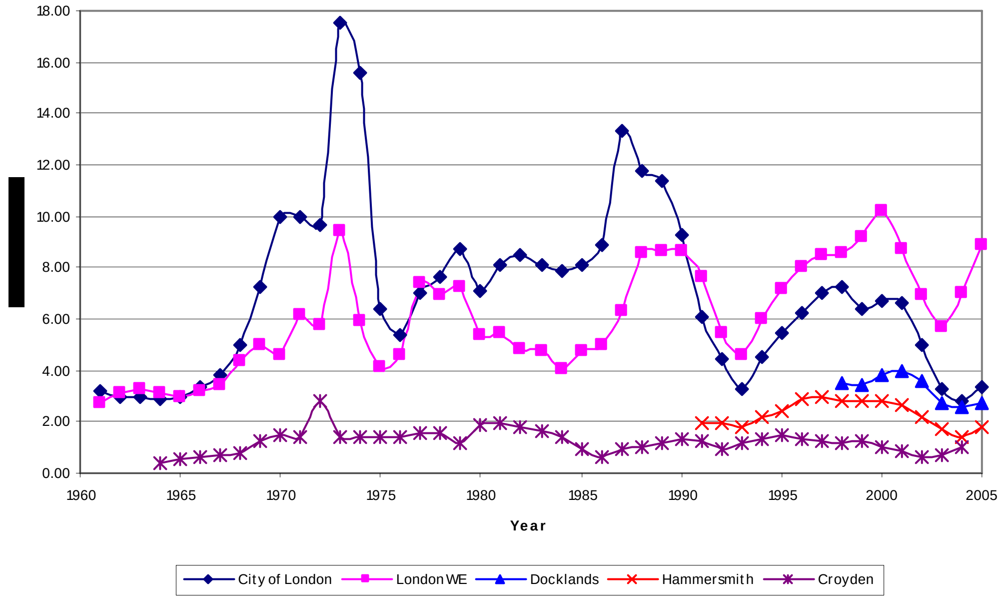


Figure F2: Regulatory Tax (Central Estimate)
South East Office Markets

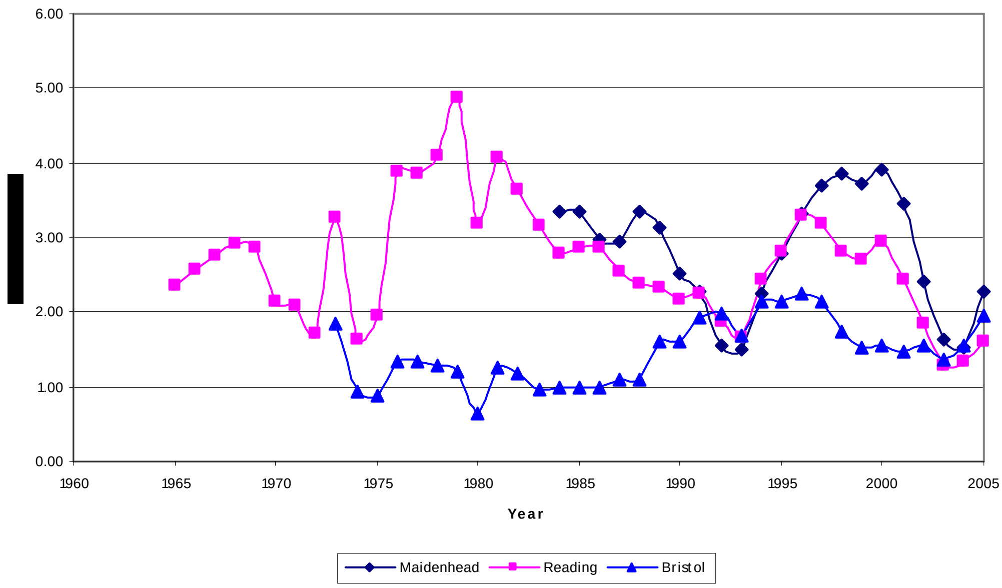


Figure F3: Regulatory Tax (Central Estimate)
Midlands and North Office Markets

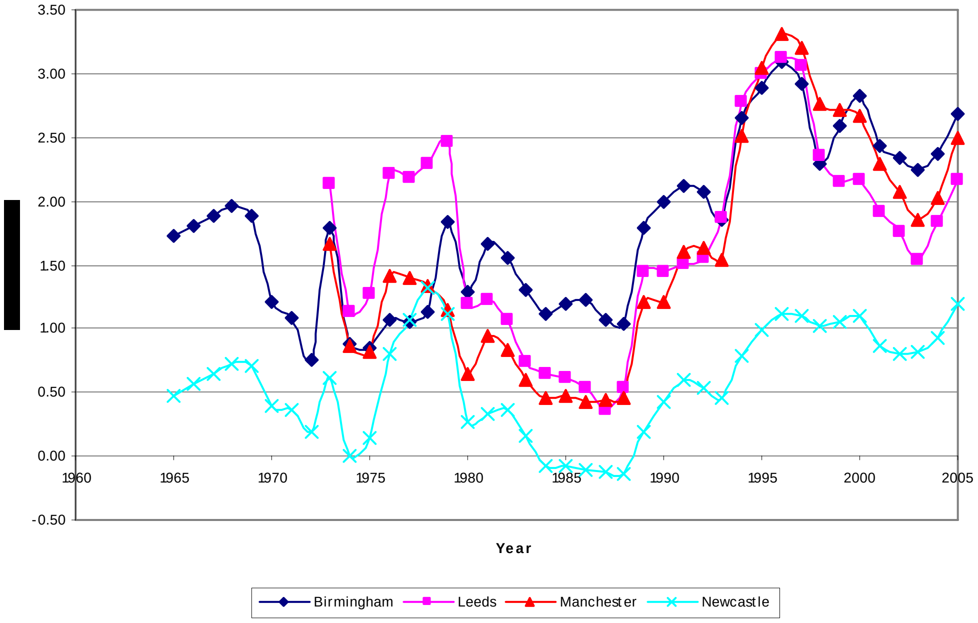
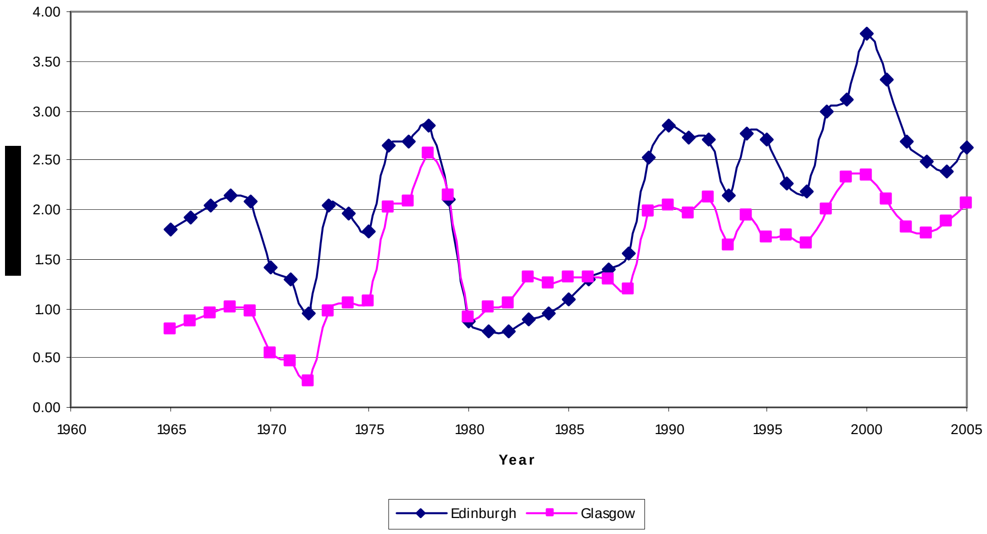


Figure F4: Regulatory Tax (Central Estimate)
Scottish Office Markets



Appendix G: Data Sources and Methodology Used to Calculate the Unemployment and Office Employment Growth Rates

Unemployment Rate

Below we describe the methodology used to compute comparable time series for local unemployment rates based on the available data sources that necessarily contain several structural breaks. First we describe the two primary data sources: the Labour

Force Survey (LFS) (Local and Regional) and the Labour Gazette (Local and Regional). The LFS is, until 1999, not reliable for spatial units smaller than counties. The Gazette and its follow-up publications provide unemployment rates estimates but these are for a different concept: registered or claimant counts. Moreover the spatial units for which these registration based counts were published changed over time, from 'Office Area', to Travel to Work Areas and then to Local Authority areas. Our task therefore was to find a way of converting 'count' based numbers for small areas to a consistent survey based concept. We approached this by calculating the ratio of the survey based to count based values for the smallest area (always Standard Regions) for which both were available and then using this as an adjustment factor to convert the small area count-based values to 'survey equivalents'. We always chose the count-based rates for the areas most closely corresponding to the political administrative areas of the planning authorities controlling our office locations.

The above describes the general principles. We now explain how we computed our unemployment rate time-series in more detail. Finally we briefly describe the methods used to compute alternative unemployment rate time-series used to test the sensitivity of our results with respect to the unemployment rate estimation method.

1. Data Sources

Labour Force Survey Local

This survey provides unemployment rate data for Birmingham, Bristol, Croydon, Hammersmith and Fulham, Leeds, Manchester, Newcastle upon Tyne, Reading, Windsor and Maidenhead, Edinburgh and Glasgow. The precise sources used are:

1999-2003: "Local Area Labour Force Survey, District Area Unemployment rate: all people aged 16+, Mar-Feb" (www.nomisweb.co.uk)

2004-2005: "Annual Population Survey, District Area Unemployment rate: all people aged 16+, Apr-Mar" (www.nomisweb.co.uk)

Labour Force Survey Regional

Prior to the enlargement of the sample, survey-based data were available only at the regional level for Greater London, North/Northeast, Northwest, Southeast, Southwest, West Midlands, Yorkshire and Humberside and Scotland. The precise sources used are:

1973-1977: "Labour Force Survey 1973, 1975 and 1977". Series LFS no.1 Office of population censuses and surveys, London: HMSO. Unemployment rate: all people aged 16+.

1979: "Labour Force Survey 1979" Series LFS no.2 Office of population censuses and surveys, London: HMSO. Unemployment rate: all people aged 16+.

1981: "Labour Force Survey 1981". Series LFS no.3 Office of population censuses and surveys, London: HMSO. Unemployment rate: all people aged 16+.

1983: "Labour Force Survey 1983 and 1984". Series LFS no.4 Office of population censuses and surveys, London: HMSO. Unemployment rate: all people aged 16+.

1984-1991: "Labour Force Survey 1984-1991" Table 5.4 Unemployment rates for people aged 16+, by region of residence, United Kingdom, Spring 1984-91

1992-2003: "Labour Force Survey Quarterly: Old Unreweighted, Government Office Region Unemployment rate: all people aged 16+, Mar-May" (www.nomisweb.co.uk)

2004, 2005: www.nomisweb.co.uk "Annual Population Survey, Government Office Region Unemployment rate: all people aged 16+, Jan-Dec" (www.nomisweb.co.uk)

Labour Gazette Regional

This publication provides data for Greater London, North/Northeast, Northwest, Southeast, Southwest, West Midlands, Yorkshire and Humberside and Scotland.

We used the April 1960-2005 unemployment rates based on registered unemployed and then claimant counts for total unemployed 16+ as a percentage of the total workforce. These were reported in the 'Ministry of Labour Gazette' 1960-1967; continued by the 'Employment and Productivity Gazette' 1968-1970; continued by the 'Department of Employment Gazette' 1971-1978; then in the 'Employment Gazette' 1979-1995; and finally in 'Labour Market Trends' 1996-2005. All five are published by the Office for National Statistics.

Labour Gazette Local

This publication provides data relating to the local authority areas of Birmingham, Leeds, Bristol, Manchester, Reading, Greater London, Edinburgh, Glasgow, Newcastle upon Tyne, Tyneside, North Tyneside, South Tyneside, Slough and Berkshire for the month of April between 1960-2005 collected from 'Ministry of Labour Gazette' 1960-1967; continued by 'Employment and Productivity Gazette' 1968-1970; continued by 'Department of Employment Gazette' 1971-1978; continued by 'Employment Gazette' 1979-1995; continued by 'Labour Market Trends' 1996-2005. A significant discontinuity in the series available for local areas arises from the fact that official reporting of the claimant or registered unemployed changed from the areas of employment offices to Travel to Work Areas (corresponding to one or more office areas) and then, in 1985, to local authority areas. The Labour Gazette under its current title 'Labour Market Trends' is published by the Central Statistical Office.

In 2002 the Gazettes switch from publishing employment rates based on "percent employee jobs and claimants" to "percent workforce jobs and claimants". We attempted to deal with this structural break by multiplying 2002-2005 local area unemployment rates by the following ratio:

$$= \frac{\%\ Employee\ jobs\ \&\ claimants_{April\ 2002}}{\%\ Workforce\ jobs\ \&\ claimants_{April\ 2002}}. \qquad \text{(G1)}$$

April 1981 unemployment rates were missing for all local areas and so this data point was estimated by linearly interpolating the February (March 1981 also missing) and May 1981 values.

Maidenhead and Newcastle-Upon-Tyne underwent a series of adjustments due to discontinuities in data collection areas and methodology:

Maidenhead

To adjust to a survey estimate of the unemployment rate we used the ratio for Berkshire but for early years registration/claimant count data was available only for Slough. We used registration/claimant count unemployment for the local authority of Windsor and Maidenhead when that became available from 1985. Finally, we used the LFS unemployment rate for Windsor and Maidenhead between 1999 and 2005, again with adjustments to make it comparable with Berkshire.

Newcastle-Upon-Tyne

Data for Newcastle-Upon-Tyne was collected for the Tyneside area between 1962 and 1978 (adjusted to make it comparable with Newcastle-Upon-Tyne), then for North and South Tyneside from 1978 to 1984 (again adjusted), then from Newcastle-Upon-Tyne (travel to work areas) between 1985 and 2005 (with no adjustments until 1998). The boundary definition of Newcastle-Upon-Tyne changed to “counties, unitary authorities, local authority districts” in 1999. We make a final adjustment for unemployment rates between 1999 and 2005 to reflect this change in boundary definition.

2. Methodology Used to Compute Local Unemployment Rates Used in the Regression Analysis

We use the Greater London unemployment rate for all 5 London office markets (City, West End, Docklands, Hammersmith, Croydon) in columns 1 and 2 of Table 6 (unemployment rate “measure 1”). For columns 3 and 4 of Table 6 and for Tables 7-10 we use local unemployment rates for Hammersmith and Croydon (unemployment rate “measure 2).

We use different methods to compile consistent unemployment rate time-series for (i) local office markets outside London and (ii) the inner-London office markets of Hammersmith and Croydon. The methods are described below.

Local Office Markets outside London (“Local Areas”)

We use *actual* LFS local area (not including Intra-London areas, see below) from 1999 to 2005.

Hypothetical LFS local area unemployment rates between 1960 and 1998 were estimated by assuming that the ratio between LFS and Labour Gazette regional claimant count/registered unemployment for each year was identical to the corresponding ratio between the hypothesized LFS and Labour Gazette local area claimant count/registered rates. This was done as follows for local area *j* in region *r* and year *t*:

$$Hypothetical\ LFS\ local_{jrt} = Gazette\ local_{jrt} \times \frac{LFS\ regional_{rt}}{Gazette\ regional_{rt}}. \qquad (G2)$$

Prior to 1977, as well as 1978, 1980, 1982 we have no data on LFS regional unemployment. In order to estimate this data the ratios between the regional LFS and Labour Gazette claimant count/registered unemployment rates for the month of

April[20] are calculated for the existing LFS years. For the years in which LFS data does not exist, the April *LFS regional / Gazette claimant count/registration regional* ratios on either side of the missing years are linearly interpolated and then multiplied by the regional Labour Gazette claimant count/registration rates for the missing year to estimate the missing LFS values.

For years prior to 1977, the 1977 LFS / Labour Gazette claimant count/registration ratio is used to estimate hypothetical annual LFS values from Labour Gazette claimant count/registration unemployment rates for 1960-1976.

<u>Intra-London Office Markets</u>

We use *actual* LFS Greater London area or local area unemployment rates from 1999 to 2005.

The Labour Gazette has never produced local area unemployment rates for intra-London areas, and although the LFS began publishing intra-London unemployment rates from 1992, it appears that these statistics are not reliable prior to 1999. Therefore in order to produce intra-London unemployment rates prior to 1999, a hypothetical intra-London unemployment rate was created by multiplying the LFS Greater London (1977-1998) and hypothetical LFS Greater London (1960-1976) unemployment rates with the variation from the mean of intra-London areas in 1999. For example, for intra-London area *j* and year *t*:

$$\textit{Hypothetical LFS intra-London}_{jt} = \textit{LFS Greater London}_{jt} \times \frac{\textit{LFS intra-London}_{1999}}{\textit{LFS Greater London}_{1999}} . \qquad \text{(G3)}$$

We use actual LFS Greater London area unemployment rates from 1978 to 2005. For years prior to 1977, we use the hypothetical LFS values (described above).

We bridge the years 1998 and 1999 (and adjust all years prior 1998) by assuming that the actual LFS values for 1999 and the imputed relative changes in unemployment rates prior to 1999 are accurate.

3. Methodologies Used to Compute Alternative Unemployment Rate Measures

In an attempt to assess the sensitivity of our results with respect to the methodology chosen to compute the unemployment rates, we calculated three sets of alternative unemployment rate measures (again two measures based on different assumptions about the relevant unemployment rate in Hammersmith and Croydon). The first method is to calculate hypothetical LFS unemployment rates for all years but not using actual LFS local area unemployment rates from 1999 to 2005. The second method is identical to the method described above except that hypothetical LFS values are used without bridging the structural break for years prior to 1999. The third method is again identical to the method described above except that for the five London markets and prior to 1999 we use hypothetical rather than actual GLA unemployment rates for the period between 1977 and 1998.

[20] Only April is used for Labour Gazette claimant count/registration unemployment rates because the LFS unemployment survey is generally conducted in April.

Service Employment Growth Rate

We constructed two alternative indexes of total employment in office employing sectors. The first time-series index is based on a broad definition; all service employment in the 1968 industrial classification. The second series is based on a narrower definition which excludes the category ‘distribution, hotels and restaurants’, which is not primarily office employment.

All employment data is derived from NOMIS, which provides data for various geographical levels of aggregation, from 1971 until 2005. There have been three significant changes in industrial classification since 1971 affecting local area employment statistics, with a bridge year available for each classification. We derive employment data for ‘Job Centres as of 1985’ for the time period between 1972 and 1981. The remaining data (1981-2005) relates to the ‘Local Authority District’ (LAD) level.[21] Data for the period between 1981 and 1991 is based on the 1984 SIC, while the remaining data for the period between 1991 and 2005 is based on the 1992 SIC. We used the overlapping years to construct a consistent index. Unfortunately, data is missing for 10 years in total (1979, 1980, 1982, 1983, 1985, 1986, 1990, 1992 and 1994), hence, we had to impute employment numbers for the missing years. We experimented with two alternative methods; using linear approximations and infilling missing years based on national data (since regional data, unfortunately, were also not available for the years with missing local data).[22] It turned out that the latter method, while theoretically more appealing, confronted us with the issue that during some time periods some local markets observed a decrease (increase) in service employment, while the national service employment numbers moved in the opposite direction. Similarly, the imputed local employment numbers can vary significantly if the local employment numbers move only a little over the observed time periods, while the movements at national level over the same time period are significant. Hence, we opted for the former method but should note that results are very similar when we use the latter method and merely use linear approximations for the few time periods with employment movements in opposite directions. Results are available from the authors upon request.

The service employment growth rates can be calculated as follows:

$$S_{jt} = \frac{E^S_{j,t} - E^S_{j,t-1}}{E^S_{j,t-1}} \qquad \text{(G4)}$$

where S_{jt} equals the local office employment growth rate in local office market *j* in year *t* and where $E^S_{j,t}$ denotes the total service employment index.

[21] For 1981 – the overlapping year – we use the Job Centre or a combination of Job Centres that best approximates the employment numbers for the corresponding LAD.
[22] National data is derived from the Labour Gazette.