The Impact of Tax Incentives on Local Real Estate Markets: the Question of Incidence

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Abstract

Research on the impact of property taxes on local real estate markets has a long history in the urban economics literature. However, very few studies have considered this issue in the context of the commercial real estate market or on data from outside the United States. This is surprising as many local and national governments consider property tax exemptions as part of a package of incentives to aid in the regeneration of areas of economic deprivation. A prominent example of this has been Enterprise Zones. However, the impact of such incentives on local real estate markets is often unknown. In this study we use a novel data set, collected by a government agency, of commercial real estate leases. Our data set covers both taxed and tax exempt areas during the operation of the enterprise zone designations in the United Kingdom. This data allows us to investigate the *incidence* of the local property tax savings for properties located in Enterprise Zones. Our findings show that a large part of the tax savings appears to be captured in higher rents charged by landlords.

Key words: tax incidence, property taxes, enterprise zones and commercial real estate leases.
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1 Introduction

There has been considerable interest amongst policy makers in tax incentives to stimulate economic activity in relatively depressed areas. One of the best examples of this is the extensive use in the United Kingdom of Enterprise Zones (DoE, 1995). Recently, the British Government has announced a new wave of such zones with the objective of;

> "…allowing areas with real potential to create the new business and jobs that they need, with positive benefits across the wider economic area. The core offer is around simplified planning and business rates discounts in Enterprise Zone areas, with the capability to develop innovative roles to address specific local economic challenges." (DCLG, 2011).

Despite the popularity of tax breaks as a way of stimulating local economic development a key question has to be how much of any tax break given to companies in policy assisted areas actually benefits their financial position and thus assists local economic development? It is quite possible that there may be powerful incidence affects whereby the tax break simply leads to the company having to pay higher rents for their properties than they would otherwise do compared with comparable properties in non assisted locations.

In this paper we explicitly address the question of the "incidence" of the tax-relief benefit that is captured in the rent paid for properties in Enterprise Zones. Research on the impact of property taxes on local real estate markets has a long history in the urban economics literature since the pioneering work of Oates (1969). Well known studies include Hamilton (1976), Rosen and Fullerton (1977), Haurin (1980, 1981), Wheaton (1984) and Yinger et al (1988). However, very few studies have considered this issue in the context of the commercial real estate market or outside the United States. This is surprising given the extensive use of fiscal incentives as a regeneration tool, particularly in the United Kingdom. The impact of such incentives on local real estate markets is often unknown. This article seeks to help to address this shortfall. It draws upon a unique set of data of commercial real estate leases covering both taxed and tax exempt areas during the operation of the enterprise zone designations in the United Kingdom. It contains 4861 properties and covers a fifteen year period

which includes the end of the tax exempt period and thus allows an investigation into the dynamics of tax incidence. It also provides some useful insight into the efficiency of the pricing of commercial leases.

The article is structured in the following way. Section 2 assesses what has been learned from previous research into rent incidence and capitalisation. It also brings together the findings from research into the impact of enterprise zones where some form of tax incentive has usually been a prominent feature of the policy package. Section 3 provides background information on the structure of Enterprise Zones in the UK. Section 4 presents the econometric methodology used in this article along with a discussion of the results. Section 5 draws together main conclusions.

2 Literature

The starting point for any review of the empirical literature on property tax capitalisation is that of Oates (1969 and 1973). Oates (1969) studied the connection between local property taxes and house values for a set of 53 municipalities in north-eastern New Jersey. The research found that a substantial fraction (around two-thirds) of the property taxes considered were capitalized into house prices. The research also highlighted a number of important econometric issues relevant to tax capitalisation studies, in particular endogeneity between house prices and property taxes. Pollakowski (1973) followed the Oates study with a critical review of the choice instruments used in the estimation of the incidence equation. He showed that the conclusion of Oates study was highly sensitive to the instruments used in the model. Many subsequent studies followed these papers, including Heinberg and Oates (1970), Edel and Sclar (1974), Gustely (1976), Meadows (1976), McDougal (1976), King (1977), Rosen and Fullerton (1977), Dusansky, Ingber and Karatjas (1981), Reinhard (1981). Many of these papers were surveyed by Yinger et al (1988)[2]. Palmon and Smith (1996) sought to improve on previous research on tax capitalisation by obtaining rental-data based estimates of the value associated with housing services. They also tried to reduce bias from amenities and publicly provided

[2] See also King (1973), Church (1974), Wales and Weins (1974), Edelstein (1974), Case (1978), Chinloy (1978), Hamilton (1979), Reinhard (1981), Richardson and Thalheimer (1981), Ihlanfeldt and Jackson (1982), Lea (1982) and Goodman (1983).

services. They found that the degree of tax capitalisation estimated tended to be higher than that observed in previous studies and for all intents and purposes appeared to reflect full capitalization.

More recently, Narwold, Sandy and Tu (2008) have assessed the impact on property values of a programme in the City of San Diego, California designed to encourage owners of historic buildings not to alter the exterior facade. A hedonic pricing model was used to estimate the effect on the value of single-family residences and the results suggested that the tax break led to a 16% increase in housing value.

Stadelmann and Billon (2010) have considered another important dimension and considered the persistence of capitalisation effects and how they are affected by changes in property supply. They used panel data of 169 local jurisdictions from 1998 to 2004 in the Swiss Canton of Zurich. They found significant persistence.

Much of the literature on property tax capitalisation considers the impact of local taxes on residential house prices. However, both Wheaton (1984) and McDonald (1993) adopted a hedonic approach to modelling a commercial rental equation using tax payments in conjunction with property characteristics. Wheaton regressed rent on a set of exogenous property characteristics and a variable representing the tax payment, which is a function of the property tax rate.

In a study closely related to the present article, Bond et al (1996b) used data that was obtained from the Investment Property Databank (IPD) for a panel of 2,964 institutionally owned rented commercial properties in England and Wales for the six-year period 1987-1992. As the authors admit, there were a number of difficulties with what their data actually measured. Two measures of property rents were available from the IPD; gross rents passing and estimated rental value (ERV). The ERV is an estimate of what the property can be let for to a new tenant on a standard institutional lease on the open market at a specified date each year (Bond et al, 1996a p. 28). The authors recognise that this should enable the variable to reflect the wide range of factors that are important in determining rents and change therein; namely property type, size, location and use restrictions. The gross rent data is the actual rent received by a landlord (but in a specific month, which necessitates the assumption that that month is not atypical) and changes in this over time ideally should be the variable that can be collated with

changes in rates. However, during the period of the Bond study a standard institutional lease only triggered a rent review every five years, and with an upward-only review clause. For this reason it was necessary to use the indicator of ERV. The ERV also had advantages in that it was based on the assumption that properties were let to new tenants and thus did not suffer from transitional relief effects. ERVs assumed 100% occupancy.

A significant limitation of the study was that it was not able to control specifically for how the incidence effects of rate changes on rents might be affected by either differences in the quality of properties or variations in the geography of local property market activity across England. There are, for example, significant variations in the buoyancy of property market activity by location. The study sought to control for the impact of changes in national economic conditions on rental movements over time. A proxy for the effect of more regional factors was derived using unemployment data. Since the authors had little information on the quality of the properties analysed it was not possible to allow for changes in this directly, although the evidence suggested that such changes over the study period were likely to be small.

Enterprise Zones

One of the most extensive applications of tax-based incentives designed to stimulate predominantly local economic development has been in enterprise zones. Enterprise zone policy has been used in many countries, most notably the United States, The United Kingdom and in the Far East. There has been an extensive body of research into the impact of the policy in the United States. Examples include the work of Papke (1993, 1994), Boarnet and Bogart (1996), Engberg and Greenbaum (1999), Bondonio and Engberg (2000), Lambert and Coomes (2001), Boarnet (2001), HUD (1997), O'Keefe (2004), Greenbaum and Engberg (2004), Rogers and Tao (2004), Busso and Kline (2008), Krupa and Noonan (2009) and Hanson (2009). The work by Hanson is of particular interest in that it compared areas that received enterprise zone assistance to those that qualified but did not receive the assistance. OLS results indicated that there was a statistically significant impact of the programme on employment.

Bondonio and Engberg (2000) assessed the job creation effects of enterprise zones. The evidence suggested that the effects were relatively limited and, interestingly, not sensitive to the amount of incentives available. They examined the problems posed for econometric analysis by selection bias. The areas chosen to be enterprise zone sites are inevitably those with quite severe economic problems and are thus not in any statistical sense randomly selected. In the analysis they control for the geographic scale of the policy coverage. In further work Bondonio (2002) and Greenbaum and Enberg (2004) considered the causes of the relatively low impact of the enterprise zone policy on economic performance. They found that positive enterprise zone effects arose through the attraction of new firms to the enterprise zones but that these gains tended to be offset by policy-induced closure of existing businesses in the local area.

More recently Bondonio and Greenbaum (2006) considered the economic impact of the enterprise zone policy further by understanding how the net change in key economic variables reflected the impact of new firm opening, the closure of firms and the expansion and contraction of existing firms. They also sought to identify which aspects of the enterprise zone policy appeared to work best attracting and retaining investment. Billings (2007) draws upon establishment-level micro-data to assess relative differences in establishment and employment outcomes for establishments in EZ areas in Colorado compared to those outside the zone, but in close geographical proximity. The study adopts a number of different specifications including Propensity Score Matching. The results of the research indicated that EZ incentives appear to increase the level of employment in on-zone establishments relative to their off zone counterparts.

Perhaps of most relevance to the current research is the article by Landers (2006). Landers examined the effects which enterprise incentives had on industrial and commercial property values using a hedonic price model applied to property sales data from Cleveland, Ohio. The data extended over the period 1984 to 1993, the period when the policy was applied in Cleveland, Ohio and neighbouring areas. The study controlled for structural and spatial factors. The findings suggested that EZ designation did have a positive impact on EZ property prices in some areas, although the effect was mixed and appeared to diminish if new zone sites are designated nearby.

In the United Kingdom the National Evaluation of Enterprise Zones (Department of Environment, 1987 and 1995) used data drawn from the records of the District Valuation Offices (based on beacons of property activity). This evidence was complemented by survey work with companies on and off the zones and an extensive body of interviews with local property agencies and those responsible for the management and marketing. Where possible, movements in rents where tracked through time for similar properties both on and off zone by broad property type and across a number of different types of zone. Valuation Offices were asked to produce these data. Rental data for properties of a broadly similar type were thus nested, or averaged; and the procedure was inevitably somewhat crude. The research objective was to ascertain the impact of commercial de-rating on commercial rents for properties in EZs and any variation in the impact through the life-cycle of the zone from designation (ten years relief) to de-designation (when the ten-year relief was exhausted). A number of zone locations were chosen because the expectation was that the degree to which changes in rate relief would be reflected in changes in rents would depend upon the relative economic buoyancy of the local property market concerned - a view that was borne out by the empirical findings. The zones in Northern Ireland were of particular interest because there had been some degree of industrial and commercial de-rating since the late 1920s.

A number of interesting findings emerged from the EZ research. There was clear evidence that the availability of rate relief made premises on-zones relatively more attractive compared to similar properties off-zone. For near-accessible areas (many of which were typical of the round-two EZs) the evidence pointed to some 40%-50% of the benefits of the rate relief going to the occupiers with the rest being eroded by internalisation into rents. The degree and timing of the internalisation varied considerably by type of zone.

Other research in the United Kingdom has considered the impact of capital allowances on investment in buildings on enterprise zones. It concluded that such incentives were probably the most important element in the policy package offering an increase in the rate of return to investors of somewhere between 7.7 and 8.7% relative to the base case (Bennet, 2000). Research by Potter and Moore (2000) showed that tax incentives and improvements in basic infrastructure were responsible for attracting

inward investment that generated around a third of the jobs in the zones by the end of the zone designation period. A study by Bromley and Morgan (1985) was critical about the ability of enterprise zone incentives to produce long term lasting effects on the location of industrial investment.

3 Enterprise Zones in the UK

3.1 Introduction

Enterprise Zones (EZs) have been a significant feature of the UK's urban regeneration policies since the early 1980s. EZs were geographically defined areas designated as regeneration sites for a period of ten years in the 1980s and 1990s. The main incentives available to companies on Enterprise Zones were:

- *Local authority rate exemption.*

Industrial and commercial property (including retail) in Enterprise Zones was exempt from local authority rates (but not from water service charges). The local tax in England is the national non-domestic rate (NNDR) and it is calculated by multiplying the rateable value of each property by a national rating multiplier (a figure set by the government each year). A property's rateable value represents the amount of rent it could reasonably fetch in the free market. Rateable values are reviewed every five years; the most recent revaluation was carried out in 2005. The rate of NNDR is adjusted by central government every year to ensure that the revenue raised from the property stock increases with the retail price index.

In the UK, NNDR are collected by billing authorities (district and London borough councils, the Common Council of the Isle of Wight Council and the Council of Scilly). Since 1990, businesses have been assessed differently to domestic properties. Businesses are given a rateable value to which is applied a Uniform Business Rate that determines the business rates liability. The Uniform Business Rate is set nationally for each country in the United Kingdom. In England and Wales, rateable values are assessed by the Valuation Office Agency (VOA). In England the Uniform Business Rate is set by the Department for Communities and Local Government. In Wales by the Welsh Assembly and in Scotland rateable values are assessed by the Scottish Assessor and the Business Rate by the Scottish

Government. Except in the City of London where special arrangements apply, the rates are pooled by central government and redistributed to local councils according to the number of people living in the area.

The policy measure itself remained unchanged over the life of the policy but the value of the incentive varied across zones according to differences in the local rate burden (rate poundage). The introduction of the Uniform Business Rate in 1992 ensured that the value was equalised across the country.

Other benefits available to companies on British Enterprise Zones have included:

- *Enhanced capital allowances*

Enhanced capital allowances at the rate of 100% for the year of expenditure were available against corporation tax (income tax in the case of the self-employed) for capital expenditure on industrial and commercial buildings (including hotels) but excluding the cost of land.

- *Simplified planning regime*

A separate detailed planning regime was prepared for each zone but each regime set out the types of development for which planning permission was deemed to be granted, that is where there was no need for an application. Thus, activity on the zones was exempt from the standard Town and Country Planning regime.

- *Exemption from Development Land Tax (DLT)*

Development value realised from disposals of interest in land on Enterprise Zones within ten years of the zone's designation was exempt from paying DLT, which had been levied at the rate of 60%. However, DLT was abolished from 19 March 1985, and so only projects that commenced before that date benefited from the exemption. Moreover, this incentive could not have been very significant given that a substantial proportion of land in EZs was owned by local authorities or other public-sector agencies.

- *Exemption from industrial training board levies*

The impact of this measure was relatively limited since in the 1980s most of the Training Boards (covering some two-thirds of the labour force) were abolished. The exceptions were construction, road haulage and engineering. Moreover companies that were deemed to undertake responsible training (e.g. apprenticeships) were not subject to the levy at all. Exemption in Enterprise Zones thus ceased to have any significant impact except for construction firms that carried out no training at all.

- *Speedier administration*

Enterprise Zone authorities were required to deal with planning and other decisions with the minimum of delay and often within fourteen days.

- *Customs facilities*

Applications for 'inward processing relief' and general and private customs warehouses were processed as a matter of priority and the criteria that applied to decisions on private customs warehouses outside Enterprise Zones were relaxed.

- *Reduction in statistical requirements*

Businesses within Enterprise Zones were excluded from the scope of compulsory government statistical requirements, with the exception of the Census of Employment.

The locations of Enterprise Zones differed in size and character. Some Enterprise Zones consisted of several dispersed sites, often across several local authority areas. Some EZs were located in the old industrial areas of inner cities whereas others were in more rural locations. Some had to address the problems left behind by declining industries such as coal mining or ship-building. The original EZ programme came to an end in late 2006 but more recently HM Government has announced twenty two more zones (DCLG, 2011) although the package of incentives on offer is somewhat different to the original zones with no capital allowances available for investment in buildings.

As properties in EZs received full relief from NNDR, EZs can act as a useful control group against which to assess properties with similar characteristics in nearby areas, but receiving no rate relief. Due to a lack of rental data for EZs during their designation period, the main focus of this research is on the period of adjustment occurring once an area ceased to have EZ status. For this research twelve

EZs were chosen, as displayed in Table 1 below and shown in Figure 1, in order of the year they first acquired zone status.

TABLE 1 HERE

FIGURE 1 HERE

The data for the research came from the Valuation Office Agency (VOA) in England through a mix of digital mapping techniques and requests from local VOA offices. The quantity of data relating to each EZ depended on the size of the EZ (i.e. the number of different properties), the size of the off-zone (i.e. how many comparable properties there were in surrounding areas) and the length of time since de-designation (i.e. how many valuations have taken place).

4 Methodology

4.1 Introduction

This section outlines the methodology adopted in the research. In order to answer the key research questions outlined in the Introduction we required an econometric approach that allowed an assessment of how prices (rents) varied with key property characteristics. A hedonic approach was adopted and this section outlines the methodology chosen to model the degree of capitalisation in national non-domestic business rates. The selection of methodology was, to a reasonable extent, driven by the data available for the research, in the sense that once the characteristics of the dataset were explored it became clearer how to proceed. The equation specification and estimation procedure are also discussed, along with any potential difficulties encountered.

4.2 Background on tax capitalisation

The standard approach to dealing with property tax in the literature examines the extent to which tax differences are captured in property values. Yinger et al (1988) provide a useful explanation of the standard approach to tax incidence. Following Yinger et al, we define the annual tax payment as *T*, and the effective tax rate as *t* and the value of the property as *V*, that is:

$$T = tV \tag{1}$$

A property is assumed to provide *H* units of occupancy services with an annual rental of £R per unit of occupancy services. The value of the property will be given by the sum of expected future discounted net rental payments (rent less the tax paid). For a given user cost of capital (*i*) and assuming no rental growth and that rent is paid in perpetuity, it can be shown that the expression for value is[3]:

$$V = \frac{RH}{i+t} \tag{2}$$

Equation 2 is based on complete capitalisation of the property tax. In some cases it may be argued that full capitalisation of the tax is unlikely. As outlined in Section 2, the arguments for partial capitalisation are typically based on imperfect information, supply factors, or expectations of future tax changes (Yinger et al 1988). If the degree of capitalisation is given by β, the equation for property value can be re-written as:

$$V = \frac{RH}{i+\beta t}. \tag{3}$$

The coefficient β has the interpretation that it measures the impact on value (V) of a £1 increase in the present value of the stream of future tax payments[4]. So for instance, a β of 0.4 would imply that for every £1 increase in the present value of property taxes, property values would fall by £0.40.

Estimation of the capitalisation model is carried out using a non-linear maximum likelihood procedure, though Yinger et al discuss linearisation of the model. Palmon and Smith (1998) give an overview of the nonlinear estimation method. For the value equation above Palmon and Smith present a corresponding econometric specification of the form:

$$V_j = \frac{F(Z_{ij})}{\bar{i} + \beta\, t_j}, \tag{4}$$

[3] See section 2.1 of Yinger et al 1988 for a more complete explanation. The zero rental growth assumption can be easily relaxed. We also ignore the impact of depreciation in this example.

[4] It can be shown this is equivalent to $V = \frac{RH - \beta T}{i}$.

to enable estimation of the capitalisation parameter. In this speciation $F(Z_{ij})$ is a hedonic function for property rental, Z_{ij} are locational and structural property characteristics and $\bar{i}$ is a net after-tax user cost of capital. They refer to this model as the capitalisation model. Palmon and Smith also present an alternative model called an amenity model, of the form,

$$V_j = \alpha + \sum_{i=1}^{N} \gamma_i Z_{ij} + \beta t_j , \qquad (5)$$

which allows property taxes to be just one of the characteristics that impact upon property values. Although such models are not the primary focus of the Palmon and Smith study, the research recognises that these models have been commonly used in capitalisation studies. Early examples of the amenity value model include the original empirical contribution by Oates (1969). The theoretical basis for such models is based on Tiebout (1956); Zodrow (2001) provides a more recent discussion of the main competing theories of local property taxation.

In the context of the present research, the amenity model is also of particular interest as it is the basis on which studies of capitalisation in the commercial property market are most often conducted. While the capitalisation model has been employed extensively in studies of tax incidence in the residential property market, the data sets available to researchers of the commercial property market often do not contain the information to implement the capitalisation model. Transactions in commercial property markets tend to be infrequent, leading to difficulties in obtaining an adequate data set of property values for analysis. This is one of the reasons why the major studies published to date on this topic tend to focus on rental values rather than property values, even though the standard theoretical model is based on capitalisation in property values (see Wheaton 1984, and McDonald 1993, 1996). Wheaton (1984) states that the research, by using rental values, is analogous to studies of corporate income tax that seeks to determine whether the burden of the tax is placed on owners or users of capital. An increase in gross income implies that the incidence of the tax is borne by the users of the capital. A reduction in income implies that the owners of the capital bear the tax. There are obvious differences in the implementation of commercial property tax as opposed to income tax, and this is demonstrated by the different econometric specifications used to assess tax incidence.

In Wheaton's paper, the econometric specification chosen is dependent on the assumptions made about exogeneity of tax payments. In the case of the UK where tax payments are based on assessed rental values with only occasional revaluation, it may be legitimate to assume exogeneity. This question is discussed below. Wheaton specifies a hedonic model and estimates the incidence parameter using a two least squares approach.

Before continuing it is useful to discuss the linkage between the amenity (or hedonic) model used by Wheaton, expressed in annual property rent, and the standard capitalisation model shown in equation 3 above. As discussed above, equation 3 can be equivalently expressed as

$$V = \frac{RH - \beta T}{i} \tag{7}$$

Recall that this is based on the assumption of a constant rent being received in perpetuity. Multiplying through both sides of the equation by the user cost of capital *i* gives:

$$iV = RH - \beta T\ . \tag{8}$$

In a competitive equilibrium the left hand side variable can be viewed as being equal to the effective market rent (market value multiplied by the user cost of capital), because, unless property owners earn at least the cost of capital employed, they will withdraw from offering rental services[5]. Likewise if above-market returns are received by landlords, competitive activity will increase the supply of property on the market and the market rent will fall to the equilibrium level *iV*.

The first term on the right-hand side of equation 8 is a measure of standardised rental payments for the property. Empirically such a standardised rental payment can be obtained by using a hedonic function to control for property level heterogeneity. As all terms in the equation relate to the total value for the property, to aid comparison between properties it is possible to divide each side of the equation by a measure of property size. This yields an equation for market rent per square unit of area measured:

$$R^* = \frac{iV}{H} = R - \beta T^* \tag{9}$$

[5] The model implies no real rental growth. This may be realistic in the empirical application in this study as rents are typically fixed for five years. The tax incidence study uses data on properties where the leases originated in the period 1990-2000.

Where R^* is the market rent per square unit of space, and R is as defined above and T^* is the tax payment per unit of space. Econometrically the model can be estimated as per the first equation in equation 6 above,

$$R^*_j = a + \sum_i b_i X_i + \beta T_j^* + \nu_j. \quad (10)$$

MacDonald (1996) provides additional theoretical discussion on tax incidence in the commercial property market, by re-expressing the simple valuation model, to consider the role of supply and demand factors in tax incidence.

4.3 Enterprise zone tax savings calculation

An important difference between this study and previous research is the nature of the tax relief regime for the EZs. Even though NNDR was standardised across regions after 1990, the EZs enjoyed (among other benefits) a zero rate of NNDR. By using a version of equation 10, it is possible to estimate the tax incidence parameter to examine how the rents differed between on and off-zone regions while holding property specific attributes constant.

As the research is particularly concerned with how the benefits of the EZ structure were divided by landlords and tenants, instead of using a tax-payment variable as indicated in equation 10, we focus on a tax savings variable derived for on-zone properties. The interpretation of the model is similar, though the sign of the tax-savings variable is expected to be the opposite of the sign for the tax-payment variable.

A further complication is that the benefits of the tax savings available under the EZ structure occurred over many years. It was also known in advance when the benefits of the EZ would cease. In theory it would be possible to estimate a version of equation 10 for each year to examine tax incidence. However, commercial property leases in the UK typically have a fixed rental payment for five years followed by a review to adjust lease payments to current market levels[6]. Because of this five-yearly fixed rental pattern, using cross-section regression techniques for individual years may give a misleading picture of tax incidence, as the initial rent for a lease will capture expectations of the tax

[6] Usually these reviews do not allow rents to fall should the current market level be lower than the existing rental payment. This is known as an upward only rent review.

savings to be received in future years as well as the current year. To overcome this problem, the present value of the tax savings over the life of the EZ are calculated for each property receiving the EZ benefit. These tax savings are then apportioned over the life of the lease to ensure the tax-savings variable is comparable to the annual lease payment. To understand this concept, consider the following example.

Property A is a commercial property located in an EZ. A tenant signs a new lease on the building for L years, there are N years remaining on the life of the EZ (assume N < L). The rent is fixed for the life of the lease and the tenant pays a rent of R_A^* per year per unit of space occupied. The tenant occupies H units of space, giving a total annual rent paid to the landlord of HR_A^*. The rateable value of the property is HR_A^V based on the observable characteristics of the property and the values assigned to those characteristics. Assume that an NNDR tax rate of t would be payable if the property had not been in an EZ. The present value of the tax savings available to the tenant by taking property A in the EZ compared to an identical property outside of the zone is given by the expression:

$$TTS_A = \sum_{i=1}^{N} \frac{tHR_A^V}{(1+d)^i} \tag{11}$$

In equation 11 d is an appropriate discount rate and TTS_A is the total tax savings over the life of the EZ for property A. As rent is typically expressed per unit of space occupied, the total tax savings variable can also be standardised in this way.

$$TTS_A / H = \sum_{i=1}^{N} \frac{tR_A^V}{(1+d)^i} \tag{12}$$

Over L years of the lease the tenant of property A makes a total payment of:

$$Total_A = LHR_A^* + (L-N)tHR_A^V \tag{13}$$

The extent to which rents differ between on-zone and off-zone properties, however, will depend on the degree to which the tax savings are captured by the landlords or tenants.

5 Model specification and Estimation

The data available for this research were derived from lease payments of properties on and off the EZs. As explained in the literature review, many previous studies have addressed the issue of tax

incidence using data on the sale price of properties to gauge the extent to which tax was capitalised in that price. In the present research, in order to examine tax incidence using lease payment data rather than property sale prices, a hedonic regression approach has been adopted similar to that of Wheaton (1984) and McDonald (1993). However, this study differs from these studies' approach in two important respects, Firstly, the data available for this study cover a wide range of time periods and secondly, the NNDR tax rate can change from year to year.

The dependent variable was the rental payment per unit leased area, deflated by the retail price index because the rents were observed over a number of years and so some form of inflation-adjustment mechanism was held to be necessary. The leased area is treated as homogeneous, although it is noted that it might be possible to disaggregate this into the different types of space used (for example workshop, showroom, office, etc).

The variable ATSPM2 measuring the inflation-adjusted tax savings that arise from a property being on an EZ is critical in determining the degree of capitalisation. So for any rent (on or off-zone) starting after the EZ lifetime this means that the resulting tax saving is zero. The formula for calculating the variable is shown below:

$$ATSPM2_i = \frac{\sum_{t=1}^{n} \frac{(NNDR_t \times (TOTVAL_{it}) / RPI_t)}{(1+r)^t}}{ELT_i \times TOTAREA_i} \quad (14)$$

In equation 14, for any given rental observation (i) over a given time period (t=1..n), where n refers to the number of years over which tax savings are possible:

- $NNDR_t$ is the non-domestic business rate for a particular year, taken from http://www.voa.gov.uk/business_rates/rating-multipliers.htm.
- $TOTVAL_t$ is the value of the property at any given period in time (although the data are such that this value is assumed to hold for the lifetime of the tax saving calculation).
- RPI_t is the value retail price index at time t, used to deflate the property value.
- r is the real discount rate, assumed to be 5% as mentioned earlier.
- TOTAREA is the total area of the property to which the rent and value applies.
- ELT is the effective lease term that is associated with the rental payments.

The specification estimated with the tax saving variable is shown by equation 15:

$$CURRENT_i / TOTAREA_i = \alpha + \beta * ATSPM2_i + \sum_{j=1991}^{2006} \gamma_j RC_j + \sum_{i=1}^{N} \delta_i CHAR_i + e_i \quad (15)$$

Here, the value of β now measures the degree of capitalisation of NNDR within rents.

5.1 Estimation issues

The time period of the EZ lifetime is taken account of in the calculation of the tax saving variable, and so the full set of EZs is used for this estimation.

In studies of capitalisation a typical concern is whether the tax-payment variable is exogenous in the incidence equation. It is generally believed that both variables will be jointly determined, with tax payments being an explanatory variable for property value and property values being an explanatory variable for tax payments (as the tax payment is typically determined by property values). In addition, in published studies on the US residential property market, the situation is further complicated by local government financing arrangements, where property taxes are typically used to fund local public services (such as schools). In this case high property taxes in a local area may be associated with high property values because of the perceived provision of higher service levels in those areas.

In the current research, however, these issues are not likely to be relevant. In the first case, the potential tax savings associated with a property on an EZ will be determined by the VOA valuation of the rental income for the property. As previously discussed, there is not always a close association between the valuation and the rental income recorded. Furthermore, the VOA assessment is not frequently revised, leading to even more difference between the current market rental and the assessed rental value. A further supporting factor is that for those observations off the EZ, the recorded tax savings amount will be zero. Finally, local financing arrangements are different between the US and the UK. For example, in the UK, while the yield from business rates is hypothecated to local authorities, it forms only a part of the revenue local authorities receive and the total amount received is determined by a grant system. Therefore, the endogeneity concern about market values being influenced by a higher level of public service provision in the EZs is unlikely to hold. Hence, it is acceptable to treat the tax savings variable as exogenous. Interestingly, a similar conclusion was

reached by McDonald[7] (1993) about the exogeneity of property taxes. Given the assumption of exogeneity of the tax-savings variable it was considered acceptable to use ordinary least squares (OLS) to estimate the model parameters.

5.2 Pre-estimation data filtering

Due to the fact that, on occasion, the rent commencement and lease commencement dates for a given rental observations were different, an effective lease term was calculated whereby the gap in time between lease and rent commencement (assuming that the lease commenced before the rent) was subtracted from the original lease term.

In addition, limits were imposed on the lease term and rent paid indicators where it was felt that they exceeded reasonable values. Rental observations were restricted to only those with a lease term between 12 and 360 months, as anything beyond 30 years could effectively be seen as a freehold property while anything below a year could display unsuitable properties. For the dependent variable, it could be argued that the acceptable limits were different across the EZs as the areas are in different parts of the UK and would therefore be expected to exhibit different distributions. However, in practice this adjustment was not undertaken as additional judgement would have been required depending on the sector in question, and furthermore regional price deflators were not available to make a proper adjustment of rent according to local price pressure. Instead, an upper limit of around £1000 per m^2 and a lower limit of around £10 per m^2 was imposed, which seemed to remove the majority of problem cases.

The rental data were restricted to those rents commencing from 1990 onwards because the data on NNDR taxes is only available nationally from that period. Prior to this, taxes were localised and it proved too difficult a task to collect this information from the various local authorities, although a future study could investigate this further.

In order to minimise the effect of locational differences affecting the comparison, the off-zone area was defined as tightly as possible. For this reason, the off-zone areas contain only properties whose postcode sector is consistent with the on-zone area.

[7] McDonald also confirmed this finding with a Wu-Hausman test, which provides a test for endogeneity of explanatory variables.

5.3 Results of econometric estimation[8]

The following sections show the results of econometric estimation undertaken in the research, following the methodology described above.

To begin with, the on and off-zone areas were pooled together in one regression covering all zones and all sectors[9]. This had the advantage of increasing the number of observations to the maximum available, but the disadvantage of not being able to distinguish differential effects by area or sector.

Table 2 present the results of key coefficients from the tax saving variable (equation 15).

TABLE 2 ABOUT HERE

From Table 2, it can be seen that the value of the tax saving coefficient is at the upper end of the expected range of values and indicates that essentially all of the benefits of the EZs were captured in the rental payment made by tenants (the actual coefficient in the all-sector regression is 1.06, which has been shown to be not significantly different to unity). The remaining coefficients appear plausible and the level of explanatory power of the model is acceptable given the nature of the sample used (Adjusted R-squared 31%, F statistic = 54.7).

The size of this tax effect has been tested against a number of specification changes in the model, and it is reasonably robust. There is evidence of heteroskedasticity in the model and accordingly all standard errors reported are the White's heteroskedasticity consistent standard errors. Alternative specifications (not reported) allowed for changes in the term structure of lease payments. However, it was found that such effects were small and a coefficient restriction test of equality for the coefficients of the effective lease term could not be rejected.

Another interpretation of this result is that other benefits associated with EZs, not accounted for by the NNDR savings, may be responsible for this larger than expected price effect. For instance, property owners in EZs benefited from capital allowances. If the size of these allowances were comparable to the size of the NNDR savings, and assuming that the benefit was completely captured by the landlord,

[8] All results were generated using the EViews 5.1 software.

[9] The retail sector was not included in either specification because it was more prone to extreme rental values which could not be accounted for by the available characteristics.

then, in theory, the benefit from the tax saving and the capital allowances may give rise to a coefficient of the size presented above. One difficulty with assessing the impact of the capital allowances on rents is that the benefits from such allowances will be highly dependent on the marginal tax rate of the property owner. Without detailed information on marginal tax rates of property owners it is difficult to quantify such an effect. Therefore, we note as a general caveat that the some of the other benefits of EZs (such as relaxation of planning controls or capital allowances) may impact on the results. However, the ability to quantify such effects remains limited by the nature of the data available in this study.

5.4 Robustness Checks

As a robustness check we develop the regression results further by exploring a set of sub-sample regressions to isolate any possible differences in the characteristics between on-sample and off-sample properties and the time in which the lease commenced. To control for the possibility that off-zone properties may be older than on-zone properties constructed during the removal of planning controls, the model presented in Table 2 is re-estimated using only properties constructed during the 1980s (which is during the time that the enterprise zone was operating). The results, shown in Table 3, indicate an incidence coefficient of 0.82, which is lower than before but still statistically significant. The cost of the sub-sample regression is the smaller sample size, as by restricting the regression to only properties constructed during the 1980s, the sample falls from 4861 to 2214 observations.

TABLE 3 ABOUT HERE

As a further check, and using a more tightly defined inclusion criteria, we again only focus on properties constructed during the 1980s, and we further restrict the sample to include only leases which commenced during the operation of the enterprise zones. In our sample that reduces the sample to only those leases originated in 1990 to 1993. The number of properties in the sample is now limited to 203, which is well below the sample size of the previous regressions. Results are shown in Table 4. It is also important to note that not all zones had leases commencing in those years. For this narrowly

defined sample the incidence variable has a coefficient of 0.59. This is lower than the other estimates, however, it remains statistically significant at the 10% level.

TABLE 4 ABOUT HERE

6 Conclusions

The evidence presented in this article suggests that reductions in local property taxes as part of a local area regeneration package feed through to changes in property rents. The average capitalisation effect obtained was not significantly different from 100%, implying that all of the local tax exemption benefits accrue to the owners of the property. This is an important finding that should be considered carefully by policy makers if they wish to use tax-based incentives to stimulate local economic development.

These results can be compared with the findings of earlier research undertaken as part of an Evaluation of the Enterprise Zone Experiment (Department of Environment, 1987, 1995). These earlier studies used a different methodology to that adopted in the current study. The 1987 study sought to identify whether rents on zones were higher than rents off-zone but was only able to allow for property type in a fairly limited way. After a somewhat hesitant start rents on-zone tended to move to being about 27% above their off-zone equivalent after about three to four years. The 1995 study probed this issue further and found that, in general, rents in the zones tended to converge to their off zone equivalents as the zones came to the end of their ten-year life.

The research has examined the effect of NNDR on rents at a time when properties in EZs received a full exemption from paying NNDR. This means that all the effects on rent identified using the tax-saving variable are effectively one-sided – it has not been possible to identify any effects of the NNDR being increased. A priori there seems no reason to expect symmetry not to exist, but of course this cannot be tested empirically without an extension of the work to include the origination of EZs and not just their end period. That would be a study looking at whether a cut in NNDRs is appropriated by landlords rather than whether a rise in NNDRs can be passed on.

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Appendix

TABLE 1: ENTERPRISE ZONES SELECTED FOR THE RESEARCH

Enterprise Zone	Start Year	Total Number of Sites	Sites Used in the Research
Dudley	1981	1	One
Workington	1983	5	Five
Middlesborough	1983	1	One
NE Lancashire	1983	7	Seven
Rotherham	1983	1	One
Delyn	1983	1	One
Wellingborough	1983	1	One
NW Kent	1983	5	One (No. 2)
Telford	1984	5	Five
Milford Haven	1984	7	Seven
NW Kent	1986	7	Three (Nos. 2, 6 and 7)
Sunderland	1990	3	Two (Nos. 1 and 2)

The table above shows the Enterprise Zones chosen for evaluation in this study. The first column highlights the name of the zone. The location of these zones is highlighted in Figure2. The second column shows the year that the Enterprise Zone designation began. The Third column shows the total number of sites within each area that received zone designation. Finally, the fourth column shows have many of the sites within each Zone, and which of the sites were included in this study.

FIG 1: LOCATION OF ENTERPRISE ZONES

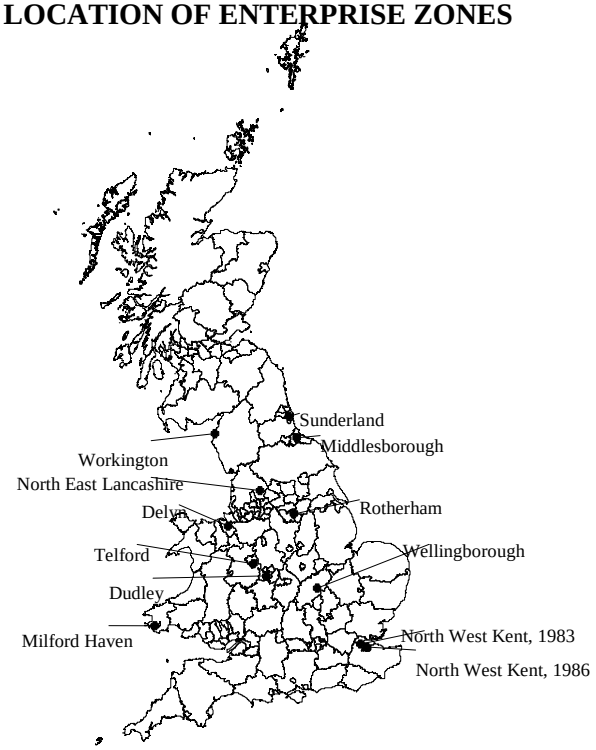

Table 2
ALL SECTORS EXCEPT RETAIL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	77.68	4.92	15.78	0.00
ATSPM2	1.06	0.21	4.93	0.00
ELT	0.46	0.09	4.90	0.00
DELYN	-13.85	4.10	-3.38	0.00
DUDLEY	2.85	2.37	1.20	0.23
MILFORDHAVEN	-38.39	3.78	-10.16	0.00
NELANCS	-16.98	2.76	-6.15	0.00
WORKINGTON	-16.91	3.27	-5.17	0.00
WELLINGBOROUGH	-8.37	3.78	-2.22	0.03
ROTHERHAM	-13.25	2.49	-5.32	0.00
SUNDERLAND	-10.41	3.09	-3.36	0.00
MIDDLESBOROUGH	-23.17	2.94	-7.87	0.00
TELFORD	-4.36	3.31	-1.32	0.19
WSALE	3.52	1.77	1.99	0.05
OFFICE	42.78	1.89	22.64	0.00
OTHBUT	112.08	3.71	30.18	0.00
TENANT	0.91	1.96	0.46	0.64
RENTED	5.23	2.37	2.21	0.03
OTHTEN	3.36	3.85	0.87	0.38
P1970	-19.08	2.23	-8.54	0.00
D1970	-10.87	3.69	-2.94	0.00
D1980	-6.02	1.87	-3.21	0.00
D2000	14.53	4.44	3.27	0.00
TOTAREA	-0.01	0.00	-6.68	0.00
TOTAREA^2	0.00	0.00	5.35	0.00
R-squared	0.3121	F-statistic		54.6824
Adjusted R-squared	0.3064	Prob(F-statistic)		0
S.E. of regression	47.9137			

ATSPM2	Annual tax saving per m^2 NPV[10] of real tax savings (annualized over the period tax savings could take place) for on-zone rents starting during the live zone period. Divided by effective lease term and area as with the dependent variable.
ELT	Effective lease term, measured in years Adjusted as explained in Section 4.3 below.
NELANCS… MIDDLESBOROUGH	Area dummy variables. Postcode dummies were considered, but they were too numerous and in earlier estimation attempts did not add much to the explanation
WSALE… OTHBUT	Business use dummy variables
TENANT…OTHTEN	Type of occupancy dummy variables
P1970… D2000	Age of property dummy variables
TOTAREA	Total area of property. The square of this variable was also added to capture the possibility of non-linearity in the relationship.

[10] A real discount rate of 5% is assumed for all NPV calculations. This is higher than the 'realistic' estimate of 3% reported by Yinger et al, although is not uncommon in other studies. Also, most of the studies in Yinger et al were US-based, where real interest rates have been historically lower. The estimate of 5% was made by looking at an average of UK real interest rates over the period 1990-2005.

Table 3
ALL SECTORS EXCEPT RETAIL
Sample Contains only Leases on Properties Constructed in the 1980s

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.54	10.05	8.11	0.00
ATSPM2	0.82	0.30	2.72	0.01
ELT	0.43	0.16	2.72	0.01
DELYN	-20.35	1.93	-10.53	0.00
DUDLEY	-2.64	3.41	-0.78	0.44
MILFORDHAVEN	-32.00	2.42	-13.20	0.00
NELANCS	-19.20	1.87	-10.29	0.00
WORKINGTON	-11.99	3.85	-3.12	0.00
WELLINGBOROUGH	-7.03	1.57	-4.47	0.00
ROTHERHAM	-16.15	2.99	-5.40	0.00
SUNDERLAND	-11.05	2.12	-5.22	0.00
MIDDLESBOROUGH	-16.45	2.72	-6.05	0.00
TELFORD	6.67	5.27	1.27	0.21
WSALE	0.89	1.74	0.51	0.61
OFFICE	22.92	2.32	9.89	0.00
OTHBUT	232.09	21.97	10.56	0.00
TENANT	-1.45	1.67	-0.87	0.38
RENTED	2.47	3.20	0.77	0.44
OTHTEN	-4.22	3.68	-1.15	0.25
TOTAREA	-0.01	0.00	-7.02	0.00
TOTAREA^2	0.00	0.00	4.81	0.00
R-squared	0.50	F-statistic		60.36
Adjusted R-squared	0.49	Prob(F-statistic)		0.00
S.E. of regression	34.64			

Table 4
ALL SECTORS EXCEPT RETAIL
Only Leases Commencing in 1990 – 1993 and Year of Construction equals 1980

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	50.94	4.71	10.81	0.00
ATSPM2	0.59	0.34	1.73	0.09
ELT	0.25	0.19	1.32	0.19
DELYN	-5.95	6.89	-0.86	0.39
NELANCS	-7.34	6.33	-1.16	0.25
WELLINGBOROUGH	9.66	5.70	1.70	0.09
ROTHERHAM	7.86	5.20	1.51	0.13
MIDDLESBOROUGH	-0.14	5.45	-0.03	0.98
MANUF	-6.31	3.71	-1.70	0.09
OFFICE	42.32	6.93	6.11	0.00
TOTAREA	-0.01	0.00	-3.10	0.00
TOTAREA^2	0.00	0.00	2.87	0.00
R-squared	0.34	F-statistic		8.76
Adjusted R-squared	0.30	Prob(F-statistic)		0.00
S.E. of regression	20.57			