Planning Regimes and Property Investment

John Henneberry and Fotis Mouzakis

REFIG WP 2004-07
Planning Regimes and Property Investment

John Henneberry\(^1\) and Fotis Mouzakis\(^2\)

**Abstract**

Recent research by Henneberry et al (2004) used a conceptualisation of a local property market to develop a full structural econometric model for analysing the impact of planning on local business rents and on the behaviour of the wider local economy. A significant relationship between the ‘tightness’ of the planning regime and the level of business rents and of local economic activity was identified. Given this finding, it would seem logical to suppose that planning policy may affect the performance of property investments. However, the form and outcome of this relationship may be far from straightforward. This is because planning seeks principally to regulate land use (occupation) not property ownership and cost / worth (investment). It is also because one element of performance is capital gain, which results partially from yield shifts that may, in the short term at least, depart from rent trends. Little is known of the behaviour of planners and investors – and therefore of these elements of the property market – in this regard. It may be perverse to a degree. For example, planners wishing to encourage new development may readily grant planning permission – increasing property supply, competition for occupiers by providers and risk, thereby reducing the potential for rental growth – and consequently inhibit development.

This paper examines the possibility of a relationship between planning policy and the performance of investment in commercial real estate. First, it extends the established theory relating to tenant and investment markets by liking directly investment pricing with the proposed fundamental variables of commercial property industry, i.e. planning, development and finance costs and the performance of other asset classes. Then, empirical evidence will be sought relating to the proposed theory on the nature of the impact the planning regime on initial yields and total returns. Data for the 50 largest office markets in the UK will be analysed. The econometric examination, including the use of panel data techniques, allows for heterogeneity in the markets, thus avoiding possible bias in the results. The supporting to the proposed theory and statistically robust results of this study also benefit from the development of a new database for the study of property markets and planning. It offers data of better quantity and quality than those used in previous studies.

**Key words:** planning regimes, rental impact, panel data, business property

---

1. Department of Town and Regional Planning, University of Sheffield, Western Bank, Sheffield, S10 2TN. Tel: +44 (0) 114 2226911 Fax: +44(0) 114 2722199; E-mail: j.henneberry@sheffield.ac.uk
2. Faculty of Finance, Cass Business School, City University, 106 Bunhill Row, London, EC1Y 8TZ. Tel: +44 (0) 20 7040 8212 Fax: +44 (0) 20 7040 8881; E-mail: f.mouzakis @city.ac.uk

*An similar version of this paper was presented in European Real Estate Society conference in Milan, 2-5 June 2004*
1. Introduction

Over the last twenty years the private sector has assumed the role of the predominant supplier of buildings in Britain. In 1977 roughly half (49%) of construction new orders were made by the private sector; by 1998 the private sector accounted for more than three-quarters (79%) of all new construction orders (Henneberry and Rowley 2000). In parallel with the increase in the relative importance of private property development there has occurred a similar growth in the rented sector of the non-residential property market at the expense of the owner-occupied sector. Callender and Key (1996) estimate that around 45 per cent by value of the UK commercial and industrial property stock may be held by investors of which about half (24 per cent of the stock) is held by UK institutions.

As Ellison (1998) observes “... such a significant shift in the composition of fixed capital investment has important consequences for the property sector.” (page i) Private sector construction activity is much more volatile than that in the public sector. The marked boom and slump in private development which occurred during the last major property cycle is absent from public development trends. The reduction in the public sector’s relative and absolute contribution to building production has also diminished its stabilising effect on overall development trends. The basic dynamic of building production is set by the private sector. At the same time as the public sector’s direct influence on property market behaviour has diminished, there has been a growing interest in its indirect impact on the market, through the planning system.

At least two perspectives have developed. The first is specific but positive. It considers how planning and other related policy might be used to encourage more private sector investment in urban regeneration (Adair et al 1999). The second is general but negative. It argues that restrictive planning policy, through its constraint on building supply and consequent impact on business rents, is detrimental to UK productivity (McKinsey 1998; DETR 1998). In this paper we try to combine elements of these two perspectives by developing a general model of the impact of the planning system on commercial property investment. A better understanding of this
relationship may help to produce more appropriate policy support for property investment.

2. Planning’s impact on the returns and risks of investment property

Needham and Lie (1994) argue that there have been few theoretically rigorous studies of the effect of public regulation of property supply on property returns, risks and prices because of the absence of an appropriate analytical framework. They offer one. It is based on the conceptualisation of the property market as a set of three interrelated components: the user market, the investment market and the development market (Keogh 1994). Each is a trading arena where the interaction of demand and supply determines prices and where adjustment decisions are made by the key actors. Public regulation of supply in any one of these markets will feed through to the other markets. For example, planning constraints which affect prices in the user market (rents), will also affect prices in the investment market and, consequently, in the development market (through changes in yields and capital values). More than this, however, the character of public regulation may affect investment property risk and hence the returns demanded of it. If planning control is exercised inconsistently and unpredictably, then property supply and prices will alter similarly, increasing investment risk and required return. Conversely, if public regulation of property supply is applied steadily for a long period, it will have a predictable effect upon prices, reducing investment risk and required return.

From this base, a simple analytical framework is developed. It has two dimensions. The first relates to the nature of public regulation and covers the regulative stance (whether it tends to stimulate or restrict supply) and the application of regulation (whether it is steady / predictable or changeable / unpredictable). The second relates to the effects of public regulation on property prices (whether these are raised or lowered) and on investment risks and returns (whether these are increased or decreased). The two related elements of regulation and effect are independent. Thus, regulation that stimulates / restricts supply will reduce / increase prices without necessarily affecting risks and returns. Similarly, steady / changeable regulation may
reduce / increase risks and returns without affecting prices. This framework is summarized in Table 1.

### Table 1: Needham and Lie’s Analytical Framework

<table>
<thead>
<tr>
<th>Nature of regulation</th>
<th>Effect of regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Property supply</td>
</tr>
<tr>
<td></td>
<td>stimulated</td>
</tr>
<tr>
<td>Regulation steady</td>
<td>Type A</td>
</tr>
<tr>
<td>Regulation changeable</td>
<td>Type C</td>
</tr>
</tbody>
</table>

**Effect of regulation**

| Prices | Low | High |

Source: Needham and Lie (1994), page 204, Table 2

They present a number of case studies to provide an initial test of the framework. One covers the UK office market, focusing on London. This market is classified as Type D, because of the contrasting effects of Office Development Permits (1964-1979) and subsequent relaxation of control over office development in the City and London Docklands (and through the introduction of B1 in the Use Classes Order)\(^1\). However, no further, more detailed empirical analysis was undertaken. Before proceeding to such an analysis, consideration must be given to the formulation of investment yields.

### 3. The Determinants of Investment Yields

The initial yield \((K_p)\) on property is traditionally derived from the following equation:

\[
K_p = R_{fn} + RP - gp + d
\]

\(^1\) The retail sector (not covered by Needham and Lie) might also be considered to be Type B, because of the succession of restriction, the ‘Ridley boom’ in out-of-town development, followed by renewed restriction in the form of the sequential test.
where \( R_{fn} \) is the nominal risk free rate derived from the conventional gilt market; \( RP \) is the risk premium for property; \( gp \) is the anticipated average rental growth in perpetuity; and \( d \) is the depreciation in perpetuity (Ball et al 1998). The risk free rate is a national factor determined by economic fundamentals quantified by movements in the conventional gilt market. Depreciation is also a national factor which will vary by property type and sector.

The risk premium is added to the risk free rate and is determined by investor’s perceptions of property risk. Relative changes in investor sentiments toward property compared with other investment media will therefore lead to yield movements (Ball et al 1998). Because of the basic character of the asset class, a risk premium will attach to all property. However, the premium is property specific (Fraser 1993). It will take into account factors such as market stability and liquidity, location, transport networks, service provision and tenant quality, many of which are particular to local property markets. The level of the premium will depend upon the individual investor and the analysis undertaken (Rowley and Henneberry 1999). Whatever the risk premium, its combination with the risk free rate will provide the base yield for a market. This will result, for example, in prime office yields for Newcastle being set 2% higher than yields for offices in London’s West End in 1998 because of differences in market characteristics such as stability and liquidity. Risk premiums are fairly constant and will change gradually over time as investor’s perceptions of markets change. Such perceptions will alter as market characteristics become more favourable to the investor.

That element of the initial yield attributable to anticipated rental growth (\( gp \)) should vary from property to property. If investment analysis is conducted at a more aggregated level, then growth expectations should at least reflect the varying characteristics of local (urban or regional) property markets. The growth discount should reflect the anticipated rental growth over the life of the investment but, in practice, the period of such anticipation will depend upon the nature of the market and the decision-making behaviour of investors (Rowley and Henneberry 1999).
A key feature of yields is, therefore, that they are composed of a combination of national and local components. The risk free rate relates to national interest rate fluctuations. The depreciation rate relates to physical – aspatial – characteristics of property. The general character of property relative to other investment media is a national determinant of the property risk premium. Similarly, the expectation of growth in returns from property as general asset class is a spatially undifferentiated influence on expected rental growth. In addition, there is a set of factors that are specific to local property markets and affect both the risk premium and expectations of rental growth. These include the structure and performance of the underlying local economy, location, the quality of local infrastructure and services and – crucially – the balance between demand for and supply of business accommodation. Planning policy affects the latter. A relation between the character of the local planning regime and property investment (performance, yields and prices) should, therefore be expected. And that relation has been outlined by Needham and Lie (1994).

4. Evidence for a Potential Planning Effect on Property Investment

Little attention has been paid to planning in the modelling of the behaviour of the business property market (Blake et al 2000 is a partial exception). Henneberry et al (2003) describe an initial attempt to explore this subject area. They focus on the effect of planning on the supply and price of business space across local property markets at a particular time. Figure 1 provides a context for the analysis.

The demand, supply and price variables presented in the Figure are national measures. These are the sum of their local equivalents. The planning system is articulated primarily through local implementation of policy within national and, increasingly, regional guidelines. Consequently, we may understand ‘the national’ through ‘the local’.
The national equilibrium price of business space (P) at any time is determined by the extant national demand for (D) and supply of (S) such space. These, in turn, are the aggregates of all local supply / demand / price relationships with regard to space. Individual local property markets may be distributed along the curve Ra, relating rent to agglomeration benefits, unless planning or other local factors affect this relationship. The operation of local property markets and, inter alia, of planning’s role and effect within them, was the subject of a cross-sectional study. The study identified a local effect of planning that was consistent with theory. As planning regimes become tighter and the percentage of planning decisions that are approvals decreases, so the local supply of space decreases. Lower levels of supply of space are associated with less local economic activity and higher rents.

In the model, rent is the main value variable. Henneberry et al (2003) assume that capitalisation rates (more specifically, initial yields on new developments) accurately discount expectations of rental performance, thus avoiding the complication of including capital market influences in the analysis. Therefore, the relation between planning regimes and investment performance, yields and prices has yet to be examined. However, given the link between planning, the supply of space and rents described above, there is clearly potential for a planning effect on investment to be
identified. This effect should be in line with reviewed theory. That is, restrictive planning regimes should result in high property investment prices and low yields, with permissive regimes having the opposite effect\(^2\). This significant local component will contribute with other local and national influences to determine property investment yields.

5. Modelling Strategy

Given the above, a pragmatic starting point for the modelling strategy is Henneberry et al’s (2003) theoretical model. This takes the form of a system of simultaneous equations. In it demand for development is driven by local economic activity, mediated by space utilization (equations (i) and (ii), Box 1); supply of new space is determined by developers’ submission of planning applications, mediated by the local planning regime – with the former being a response to rent levels (equations (iii) and (iv), Box 1); and rent is determined by the balance between local demand and local supply, with adjustment to rent levels in other market sectors also having an influence (equation (v), Box 1).

The estimated system of equations in Box 1 was formalised using the following standard notational conventions:

- Scalar variable symbols are written in italic font.
- Matrix and vector symbols are in bold font.
- Variable symbols are in upper case using an index \(i\) for the observation.
- Coefficient symbols are in lower case.

\(^2\) We are not yet in a position to explore the possible effect of the predictability / stability of planning regimes.
Box 1: Simplified Functional Form of Henneberry et al’s (1993) Model

**Demand**

Local Economic Activity = \( f (+\text{Industrial Structure, } + \text{Local Supply of Space, } + \text{Urbanisation Economies, } + \text{Localisation Economies, } - \text{Rent}) \) (i)

Space Utilisation = \( f (+\text{Rent, } + \text{Local Economic Activity, } - \text{Local Supply of Space}) \) (ii)

**Supply**

Local Supply of Space = \( f (+\text{Planning Applications, } + \text{Planning Regime, } - \text{Relative rents of other sectors}) \) (iii)

Planning Applications = \( f (+\text{Rents, } - \text{Costs, } - \text{Planning Regime, } + \text{Local Economic Activity}) \) (iv)

**Rent**

Rent = \( f (+\text{Local Economic Activity, } - \text{Space Utilisation, } - \text{Local Supply of Space, } \pm \text{Relative rents of other sectors}) \) (v)

The proposed system of equations can be written as \( Yc + Xb = u \) where \( Y \) and \( X \) are endogenous and exogenous variable matrices respectively. Each matrix has as many rows as observations and columns equal to the number of endogenous and exogenous variables: that is, 5 and 8 (including the intercept term), respectively. Coefficient matrices \( c \) and \( b \) have columns equal to the number of equations and endogenous variables in the system (to achieve completeness) and as many rows as the variables in each group: that is, 5x5 and 8x5 respectively. Every row of \( Y \) and \( X \) consists of the vectors of the two groups of variables \( y_i = (Y_i, T_i, S_i, P_i, R_i) \) and \( x_i = (1, I_i, U_i, L_i, C_i, G_i, X_{1i}, X_{2i}) \). Where \( E = \) local economic activity, \( T = \) space utilisation, \( S = \) local supply of space, \( P = \) planning applications, \( R = \) rent; and where \( I = \) industrial structure, \( U = \) urbanisation economies, \( L = \) localisation economies, \( C = \) developers’ costs, \( G = \) planning regime, \( X_1, X_2 = \) relative rents in other sectors. The matrix \( u \) contains the disturbance terms for the five equations.
If $c_{AB}$ and $b_{AB}$ are the elements of $c$ and $b$ respectively, with $A$ indicating the dependent variable and $B$ the associated right hand side variable and $a_i$ is the intercept term in the first row of $b$ (i.e. $a_i = b_{i1}$), then the system of equations can be written without the use of matrix expressions as

**The HMM system of equations**

(i) 
$$E_i = a_Y + c_{YS}S_i + c_{YR}R_i + b_{YU}U_i + b_{YL}L_i + u_{1i}$$  

(ii) 
$$T_i = a_T + c_{TY}E_i + c_{YS}S_i + c_{TR}R_i + u_{2i}$$  

(iii) 
$$S_i = a_S + c_{SP}P_i + b_{SC}C_i + b_{SC}G_i + b_{SXI}X_i^1 + b_{SXL}X_i^2 + u_{3i}$$  

(iv) 
$$P_i = a_P + c_{PY}Y_i + c_{PR}R_i + b_{PC}C_i + b_{PC}G_i + u_{4i}$$  

(v) 
$$R_i = a_R + c_{RY}E_i + c_{RT}T_i + c_{RS}S_i + b_{RX}X_i^1 + b_{RX}X_i^2 + u_{5i}$$

It is a complete system with all equations satisfying rank and order conditions for identification. In it, the investment market is bypassed for the purposes of simplification. Expected returns from investment in new development and existing buildings were associated with the level of rents and substituted out in the structural equations.

This study takes a closer look at the relation between planning policy and property investment, an important aspect of property market behaviour and asset performance. The assumption of rationality in investment markets suggests that investors price assets by discounting their expectations for future income and also by requiring a premium for risks arising from market volatility and uncertainty in their expectations. It is, therefore, the anticipated future stream of rent that drives the capital value of property assets. While the current rent may be observed, the certainty of any rent projection decreases rapidly as its period extends. The strongest tool available for forming a view of future rents is an analysis of the fundamentals of tenant markets within a framework of economic theory. That is, an assessment of the drivers of demand and supply and influences upon them. It is these fundamentals that determine investment pricing, and by which all market rents, capital values and development initiatives are affected through interpretation. This implies, by extension, that by linking directly the determinants of current rents with the investment market the information structure that underlies the formation of investment views may be distinguished from the de-facto information structure that determines rents. It is
worth noting the difference between this approach and the standard approach of analysing investment markets on the basis of rental history.

The first step is to substitute out developers’ demand approximated by planning applications (iv) in the equation of supply of space (iii) and this subsequently in the rental equation (v) to have a direct expression of the formation of expectations for rental growth that is anticipated in investment markets. The structure of this equation needs not to be the same with the structure of a similar form for the determination of current rents in HMM, as the former determines the formation of views for future stream of rents whereas the latter of present ones. The demand side of the tenant market, i.e. the local economic activity, is not the focus of this study because issues of endogeneity between industrial output and tenancy markets may well not be expected to play a major role in the formation of investors’ views. Also, this study does not include space utilisation and relative rents among the explanatory variables for the purposes of simplicity. As it was suggested by the statistics of HMM study space utilisation is rather expected to affect short term adjustments of the tenancy market and be of reduced relevance in long term income focus of investors. Relative rents address the issue of alternative use of space and their role may well be looked at in the future.

The result of these changes is to define / reduce the fundamental determinants of both capital values and market rents to the following: planning regime, development costs and demand for space as expressed by economic activity. Additional influences on the capital values of office property investment are included: the performance of other investment sectors such as the equity and bond markets. Alternative capital market indicators have been considered in other recent studies such as Tsolacos et al (1998).

Since investment yields isolate the relationship between current income and capital values they offer a convenient analytical angle to isolate the differences in the structure of pricing between investment and tenant (user) markets.

Using the theoretical predictions of Needham and Lie (1994) – that were supported by empirical findings of Henneberry et al (2003) - the expected direction of relationships between the fundamental determinants and property yields may be specified. The flexibility of the planning regime, measured by the proportion of planning decisions
that are approvals, is directly related to the supply of space, although the relationship is weakened by the inverse strategic effect of speculative applications (which are greater in restrictive planning regimes), captured in the equation of developers’ demand (vi). Relaxing the simplification of using rents as the driver of demand in HMM, the supply of space is directly related to yields because taking in account the development lag an increase in the former would reduce both current and forthcoming rents and therefore would tend to increase yields. The planning regime should therefore have a positive relationship with yields. A similar effect should be expected for development costs. High development costs reduce developers’ profitability and imply lower supply, higher future rent and lower current yields. A development boom may be treated by investors as a signal of future supply growth and consequent rent decline. Then we would get a direct relationship between development costs and yields. Another aspect of development cost not discussed by Henneberry et al (2003) is the cost of finance expressed by interest rates.

Demand for occupation, expressed by the economic output of the sector, needs to have a positive relationship with capital values, providing investors follow some naïve pattern of expectations. In practice, this would be less valid on the infrequent occasions that economy has reached a turning point and this has been foreseen by investors. Analysis of Consensus Forecasts suggests that about 3% of economic down-turns is predicted by the forecasts. Investors’ portfolio strategy and the resulting arbitrage among different asset classes suggests that the performance of alternative capital markets will be directly related to property investment yields. One implication arises here when we consider the double nature of a bond yields index, as an investment asset class and also as an indicator of with interest rates. The former category would consider a variety of terms with a long term average, especially under the influence of institutional demand. When it comes to financing development projects interest rates could well be focused on shorter in average term as the one captured by the index used in the study. As the two influences are opposite there might be an issue of representation and some ambiguity in the final effect. Finally, a persistence effect needs to be included so that stochastic trends, behavioural aspects and adaptive processes in the formation of expectations of property investment markets can be captured.
The relationships discussed above can be summarised as follows:

\[(1) \quad y = f(e^+, g^+, c^+, i^+, f^+)\]

where \(y\) is the yield, \(e\) is local employment in the sector, \(g\) is the planning regime, \(i\) is an indicator of medium term interest rates and \(f\) is a performance indicator of equity markets. The lag structure of this relationship needs to be different from the one that determines current rents, as the one in the focus of HMM study. The investment market with much shorter decision making horizon may well use more up-to-date information about the fundamentals than tenancy market, which relies on industry’s policy on procurement with a longer decision horizon. This suggests we could expecting shorter time lags and higher informational efficiency from investors than from tenants. For example, the long lag between planning decisions and market rents used by Henneberry et al (2003) allowed for the development period. However, investors could well be expected to have more up-to-date information regarding planning authorities’ policies when they estimate the forthcoming shortage of a location’s supply of space. This suggests that shorter lags should be considered for this critical variable. A lag could also be considered in the case of developers’ costs, reflecting delays in information flow. Under these assumptions and keeping the logarithmic-linear structure of Henneberry et al (2003), equation (1) takes the form

\[(2) \quad y_{it} = a_i + b_1 y_{it-1} + b_2 e_{it} + b_3 g_{it-1} + b_4 g_{it-2} + b_5 c_{it-1} + b_6 d_{it} + b_7 f_{it} + u_{it}.\]

The indices \(i\) and \(t\) indicate location and observation respectively, \(a_i\) is an intercept term, \(b_k\) are slope coefficients and \(u_{it}\) is a random term. Note all variables are expressed in growth rates, in the form of log differences. The coefficient of the lagged dependent variable is allowed to vary for every location, permitting a different dynamic adjustment for different locations.

The empirical investigation in this study used and tested a number of alternative approximations for the variables involved in the model. Regarding the dependent variable, three different definitions of office yields and rents were used as provided by IPD. Yields, which relate the capital value to the level of income the property market delivers, indicate the expectations of the investors for future income compared to the
current level of rents. Equivalent yield, which is a level rather than a change measure, focuses on long rather than short term movements. Initial yields focus on new investments. Yield impact (or shift), which is defined as the percent change of yield in standing investments, tends better to reflect short term trends in the market and appears more appropriate for the needs of this study. IPD provides data for all these three measures which will be used and tested in this study. For the yield measures, the central London figures are a capital weighted average of City, West End and Midtown, using weights of 0.45, 0.4 and 0.15 respectively.

As a determinant of economic activity, regional and national GDP in market services and also national total GDP were included. The planning measures were taken from the Planning and Property Database, which has been developed by the authors and is based on ODPM data on planning decisions at local authority level. The index of building cost originates from a study of public sector, non-housing building, by DTI. As for alternative asset market indicators, capital return figures of equities and gilts by Barclays Capital were used (as provided by IPD Long Term Indicators), as well as interest rates as a measure of property finance cost. The data in the study are aggregates for UK regions, excepting Scotland, Wales and Northern Ireland. The panel data set included 19 annual observations of the period 1982-2000 for 9 English regions (some of the series were not available for Scotland, Wales and Northern Ireland). In a number of cases the construction of the set used interpolations to replace missing observations.

6. The Results

Results from some of the econometric tests are presented in Tables 2 - 5. The tests included a range of alternative estimation methods, variable approximations, variables included and lag structures. The modelling decisions balanced statistical evidence - such as coefficient and equation significance, normality of the residuals - and the theoretical acceptability of the results. The preferred model from these tests is presented in Table 2 and is the one proposed in equation (2) above. The tests indicated that the best performing form of the variables were: percent changes, that is shifts, in yields, total returns and rents; and log-differences in all other explanatory
variables. As expected, the IPD yield shift performed better than other measures of yields. The first two lags of planning regime performed the best, although the inclusion of other lags did not change the overall impact of this variable very much. A clash in explanatory contribution between the indices of gilt yields and interest rates took place as expected so the better performing index of interest rates was maintained in the equation and the gilt index was not included. The generally high robustness of the equation in the face of changing variable forms and lags was maintained when trying different estimation methods. Tables 3 and 4 demonstrate that results change little when the selected sector weighted fixed effects GLS estimator was replaced by un-weighted fixed effects OLS and random effects estimators. Finally, it is remarkable that the inclusion of rents in the right hand side of the equation did not have a significant impact on the results and the explanatory strength of the equation.

The selected estimation in Table 2 suggests that the planning regime has a strong, direct relation with property investment yields. Yields tend to drop by about 45% in response to a relative tightening of the planning regime. Increases in sector employment and construction costs were estimated to have similar in strength decreasing impacts of -40% and -37% respectively. The performance of equity markets was also found to have an adverse impact of 17%, reducing property prices when it rises. A persistence coefficient of 27% (for the lagged dependent variable) was estimated when this was restricted to be equal for all regions, shown in the results in table 3. This persistence may be indicating either adaptive expectations in market pricing or behavioural inertia or a combination of both. The equation that kept all slope coefficients common had a near 2 Durbin-Watson statistic, but looking at the residuals separately by region suggested that some persistence might be occurring in the residuals of some more influential regions, such as central London, undetected by the statistic. For this reason the preferred form in Table 2 allows a variable coefficient for the lagged dependent variable. These coefficients presented Table 2 are jointly significant against the restricted case and vary from the high level of 70% for central London, decreasing in level more or less in accordance with market size, to below 20% for the northern regions. Diagrams of the residuals from this estimation are presented in Chart 1. Finally, the impact of interest rates is rather small and positive, against expectation because it is a cost factor, suggesting that the role of this
variable as a competing asset class dominates its influence on development costs. The low value of about 7% for this coefficient could be a result of this conflict. All the variables are highly significant and the overall fit of 39% for an equation in differences does not raise any concerns.

7. Conclusions

Parametric modelling of initial yields is an area that focuses the interest of both academic researchers and private industry analysts, as a predominantly rational tool of pricing. This paper proposes a new theoretical approach for the explanation of investment prices in commercial real estate with planning policy in the central role of the determinants of tenant market equilibrium and investor behaviour. The findings extend those of a series of recent papers that progressively have revealed that planning policy can be modelled, quantified and measured for the construction of more powerful theory in real estate, essential tools for the needs of policy implementation and effective pricing instruments for investment analysis. The statistical and theoretical properties of the empirical study provided clear support to the stated hypothesis, that planning regime and development costs play predominant role in the determination of investment yields. Additionally, comparison of the long time lags Henneberry et al (2003) found to apply in the determination of rents by planning regime with the short lags this study detected for the movement of yields provides a new insight in the forward looking character of investment markets and material for a re-assessment of market efficiency.

There are ways this study could further continue. The indices of interest rates could better be provided separately for different term lengths and similar distinct measurements; bond yields could be empirically examined for the purposes of isolating the alternative investment class from the development cost effects. More and better quality measurement could be provided for testing for several variables of the model. The subject of this study could also be examined in a wider systemic framework, which would reduce concerns about weak exogeneity. The omitted influences of other sector pricing could be taken into account in an extended study of all three market sectors. The use of urban rather than regional data would offer an
improved level of detail. Finally, a more robust microeconomic foundation could improve the precision of the study and outline a further range of hypotheses for testing.
Table 2. Fixed effects, cross-sectional weights

Dependent Variable: YS?
Method: GLS (Cross Section Weights)
Date: 05/29/04   Time: 12:02
Sample: 1985 2000
Included observations: 16
Number of cross-sections used: 9
Total panel (balanced) observations: 144
One-step weighting matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(E?)</td>
<td>-0.400701</td>
<td>0.108829</td>
<td>-3.681945</td>
<td>0.0003</td>
</tr>
<tr>
<td>D(G?(?1))</td>
<td>0.275771</td>
<td>0.090619</td>
<td>3.043192</td>
<td>0.0029</td>
</tr>
<tr>
<td>D(G?(?2))</td>
<td>0.174886</td>
<td>0.086652</td>
<td>2.018264</td>
<td>0.0458</td>
</tr>
<tr>
<td>D(CT?(?1))</td>
<td>-0.373226</td>
<td>0.108260</td>
<td>-3.447484</td>
<td>0.0008</td>
</tr>
<tr>
<td>D(?7)</td>
<td>0.066870</td>
<td>0.035402</td>
<td>1.888859</td>
<td>0.0613</td>
</tr>
<tr>
<td>D(EQ?)</td>
<td>0.170921</td>
<td>0.048485</td>
<td>3.525267</td>
<td>0.0006</td>
</tr>
<tr>
<td>REM--YS(1)</td>
<td>0.069855</td>
<td>0.234204</td>
<td>0.298264</td>
<td>0.7660</td>
</tr>
<tr>
<td>REA--YS(1)</td>
<td>0.223636</td>
<td>0.220986</td>
<td>1.011994</td>
<td>0.3136</td>
</tr>
<tr>
<td>CIL--YS(1)</td>
<td>0.592348</td>
<td>0.224880</td>
<td>2.634062</td>
<td>0.0095</td>
</tr>
<tr>
<td>RNE--YS(1)</td>
<td>0.191339</td>
<td>0.269716</td>
<td>0.709409</td>
<td>0.4794</td>
</tr>
<tr>
<td>RNW--YS(1)</td>
<td>0.131928</td>
<td>0.244945</td>
<td>0.538602</td>
<td>0.5912</td>
</tr>
<tr>
<td>RSE--YS(1)</td>
<td>0.252142</td>
<td>0.244293</td>
<td>1.032132</td>
<td>0.3041</td>
</tr>
<tr>
<td>RSW--(1)</td>
<td>0.264171</td>
<td>0.219902</td>
<td>1.201312</td>
<td>0.2320</td>
</tr>
<tr>
<td>RWM--YS(1)</td>
<td>0.366334</td>
<td>0.209991</td>
<td>1.822643</td>
<td>0.0708</td>
</tr>
<tr>
<td>RYH--YS(1)</td>
<td>0.222087</td>
<td>0.241495</td>
<td>0.919634</td>
<td>0.3596</td>
</tr>
</tbody>
</table>

Fixed Effects
- REM--C  -0.010437
- REA--C  -0.003890
- CIL--C  -0.003713
- RNE--C  -0.018501
- RNW--C  -0.007431
- RSE--C  -0.008983
- RSW--C  -0.013811
- RWM--C  -0.006287
- RYH--C  -0.003730

Weighted Statistics
- R-squared 0.388038  Mean dependent var -0.025904
- Adjusted R-squared 0.270745  S.D. dependent var 0.073939
- S.E. of regression 0.063141  Sum squared resid 0.063141
- Log likelihood 208.6762  F-statistic 3.308286
- Durbin-Watson stat 1.978867  Prob(F-statistic) 0.000011

Unweighted Statistics
- R-squared 0.369734  Mean dependent var -0.025238
- Adjusted R-squared 0.248933  S.D. dependent var 0.072979
- S.E. of regression 0.063246  Sum squared resid 0.063246
- Durbin-Watson stat 1.980003

**Variable names**: YS yield shift, E log of employment in market services, G log of rate of planning decisions approved, I log of interest rates, EQ log of equity market index. D indicates first differences.

**Location names**: EM East Midlands, EA Eastern, IL inner or central London, NE North Eastern, NW North Western, SE South Eastern, SW South western, WM West Midlands and YH Yorkshire and Humberside.
Chart 1. Residuals by region, fixed effects WLS with cross-sectional weights
### Table 3. Fixed effects, OLS

Dependent Variable: YS?
Method: Pooled Least Squares
Date: 05/28/04   Time: 19:28
Sample(adjusted): 1985 2000
Included observations: 16 after adjusting endpoints
Number of cross-sections used: 9
Total panel (balanced) observations: 144

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>YS?(-1)</td>
<td>0.270215</td>
<td>0.104623</td>
<td>2.582760</td>
<td>0.0109</td>
</tr>
<tr>
<td>D(E?)</td>
<td>-0.399214</td>
<td>0.106628</td>
<td>-3.743993</td>
<td>0.0003</td>
</tr>
<tr>
<td>D(G?(-1))</td>
<td>0.259932</td>
<td>0.087201</td>
<td>2.980828</td>
<td>0.0034</td>
</tr>
<tr>
<td>D(G?(-2))</td>
<td>0.131344</td>
<td>0.084104</td>
<td>1.561699</td>
<td>0.1208</td>
</tr>
<tr>
<td>D(CT?(-1))</td>
<td>-0.333532</td>
<td>0.107319</td>
<td>-3.107869</td>
<td>0.0023</td>
</tr>
<tr>
<td>D(I?)</td>
<td>0.059734</td>
<td>0.035624</td>
<td>1.676772</td>
<td>0.0960</td>
</tr>
<tr>
<td>D(EQ?)</td>
<td>0.165784</td>
<td>0.049083</td>
<td>3.377602</td>
<td>0.0010</td>
</tr>
</tbody>
</table>

Fixed Effects

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>_REM--C</td>
<td>-0.005662</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_REA--C</td>
<td>-0.003397</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_CIL--C</td>
<td>-0.008146</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_RNE--C</td>
<td>-0.016234</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_RNW--C</td>
<td>-0.004056</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_RSE--C</td>
<td>-0.008209</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_RSW--C</td>
<td>-0.013845</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_RWM--C</td>
<td>-0.009376</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_RYH--C</td>
<td>-0.003265</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R-squared 0.350373  Mean dependent var -0.025238
Adjusted R-squared 0.274244  S.D. dependent var 0.072979
S.E. of regression 0.062171  Sum squared resid 0.494757
Log likelihood 204.1649  F-statistic 4.602401
Durbin-Watson stat 1.994535  Prob(F-statistic) 0.000001
### Table 4. Random effects, GLS

Dependent Variable: YS?
Method: GLS (Variance Components)
Date: 05/28/04   Time: 19:17
Sample: 1985 2000
Included observations: 16
Number of cross-sections used: 9
Total panel (balanced) observations: 144

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.020687</td>
<td>0.008519</td>
<td>-2.428269</td>
<td>0.0165</td>
</tr>
<tr>
<td>YS?(-1)</td>
<td>0.415990</td>
<td>0.091784</td>
<td>4.532264</td>
<td>0.0000</td>
</tr>
<tr>
<td>D(E?)</td>
<td>-0.191521</td>
<td>0.072568</td>
<td>-2.639187</td>
<td>0.0093</td>
</tr>
<tr>
<td>D(G?(-1))</td>
<td>0.182473</td>
<td>0.072247</td>
<td>2.525667</td>
<td>0.0127</td>
</tr>
<tr>
<td>D(G?(-2))</td>
<td>0.034423</td>
<td>0.067547</td>
<td>0.509623</td>
<td>0.6111</td>
</tr>
<tr>
<td>D(CT?(-1))</td>
<td>-0.341150</td>
<td>0.101620</td>
<td>-3.357104</td>
<td>0.0010</td>
</tr>
<tr>
<td>D()</td>
<td>0.036933</td>
<td>0.035351</td>
<td>1.044763</td>
<td>0.2980</td>
</tr>
<tr>
<td>D(EQ?)</td>
<td>0.200447</td>
<td>0.049131</td>
<td>4.079842</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Random Effects

- _REM--C_: -0.007257
- _REA--C_: -0.096296
- _CIL--C_: -0.053780
- _RNE--C_: 0.180451
- _RNW--C_: -0.076029
- _RSE--C_: 0.028984
- _RSW--C_: 0.111793
- _RWM--C_: 0.022913
- _RYH--C_: -0.110779

GLS Transformed Regression

- R-squared: 0.275898
- Adjusted R-squared: 0.238628
- S.E. of regression: 0.063679
- Durbin-Watson stat: 1.948676

Unweighted Statistics including Random Effects

- R-squared: -1.378054
- Adjusted R-squared: -1.500454
- S.E. of regression: 0.115400
- Durbin-Watson stat: 0.593359
### Table 5. Fixed effects WLS with rental growth

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>YS?(-1)</td>
<td>0.275671</td>
<td>0.103254</td>
<td>2.669830</td>
<td>0.0086</td>
</tr>
<tr>
<td>D(E?)</td>
<td>-0.410734</td>
<td>0.111403</td>
<td>-3.686909</td>
<td>0.0003</td>
</tr>
<tr>
<td>D(G?(-1))</td>
<td>0.281944</td>
<td>0.086723</td>
<td>3.251092</td>
<td>0.0015</td>
</tr>
<tr>
<td>D(G?(-2))</td>
<td>0.158935</td>
<td>0.082245</td>
<td>1.932449</td>
<td>0.0555</td>
</tr>
<tr>
<td>D(CT?(-1))</td>
<td>-0.386415</td>
<td>0.115543</td>
<td>-3.344330</td>
<td>0.0011</td>
</tr>
<tr>
<td>D(D?)</td>
<td>0.053947</td>
<td>0.035169</td>
<td>1.533947</td>
<td>0.1275</td>
</tr>
<tr>
<td>D(EQ?)</td>
<td>0.164682</td>
<td>0.047834</td>
<td>3.442771</td>
<td>0.0008</td>
</tr>
<tr>
<td>RE?</td>
<td>0.053480</td>
<td>0.065065</td>
<td>0.821949</td>
<td>0.4126</td>
</tr>
</tbody>
</table>

#### Weighted Statistics

- R-squared: 0.370339
- Mean dependent var: -0.025950
- S.D. dependent var: 0.073808
- Sum squared resid: 0.490513
- F-statistic: 4.668493
- Prob(F-statistic): 0.000000

#### Unweighted Statistics

- R-squared: 0.354249
- Mean dependent var: -0.025238
- S.D. dependent var: 0.072979
- Sum squared resid: 0.491805
- Durbin-Watson stat: 2.014900
References


