01

WHY PAY TO BE THERE?

Office Rent and the Location Variable

01.1

Jake Desyllas
Bartlett School of Graduate Studies 1-19 Torrington Place University College London Gower Street London WC1E 6BT tel: +44 171 504 5611 fax: +44 171 813 2843
email: j.desyllas@ucl.ac.uk http://bartlett.ucl.ac.uk/desyllas

0. Abstract

This paper presents a study of office location rent patterns in Berlin since reunification. Theories about the determinants of spatial variation in office rents are discussed with reference to this empirical case. A methodology was developed to isolate the spatial variable in rent price and to represent the patterns that these location rents form in the city. Representing this data has revealed a dramatic process of spatial reorganisation in the Berlin office market: prime rental values shifted from the West Berlin to the East in the seven years since reunification. This provides evidence of rent patterns in a period of dynamic change against which models of changes in location advantage that might explain such a process can be tested. The paper presents axial map models of Berlin before and after reunification and shows how the shifting the pattern of location rents can be seen to relate to changes in the spatial structure of the city that occurred with reunification.

1. Introduction

Why do office companies pay more rent for certain locations? A number of generalised explanations have been offered in the past, such as local external economies arising from agglomeration, the need for face to face contacts in business transactions and the friction of distance as a cost in convenience to employees and customers for travel purposes (O'Hara, 1977; Clapp, 1980; Fraser, 1993; Krugman, 1995). The problem with such general explanatory frameworks has always been how to translate them into the actual spatial differences in location advantages within a city, and how these in turn are translated through the market into patterns of rent. Rent prices can differ very significantly not just from a town's edge to its centre but also from street to street. How could location advantages for a firm such as the potential for easier face to face contact translate into differences at the fine scale of buildings on streets in order to explain such rent patterns? The difficulty with forming such models has been confounded by the fact that very little empirical research has been undertaken into the representation of office location rent patterns in cities. There is a lack of evidence about rent patterns that models of location advantage can be tested against.

This paper presents a study of location rent patterns in Berlin using a database of 435

office leases for the period 1991 to 1997. A methodology was developed to isolate the spatial variable in rent price and to represent the patterns that these location rents form in the city. Representing this data has revealed a dramatic process of spatial reorganisation in the Berlin office market: prime rental values shifted from the West Berlin to the East in the seven years since reunification. This provides evidence for one example of rent patterns in a period of dynamic change against which models of changes in location advantage that might explain such a process can be tested. The paper presents axial map models of Berlin before and after reunification and shows how the shifting the pattern of location rents can be seen to relate to changes in the spatial structure of the city that occurred with reunification.

2. What is Location Rent?

To answer the question of why tenants pay more for some locations, accurate empirical data is required on what tenants are actually paying and how much of the rent is for the location itself. Early mathematical modelling of rent and location attempted to ignore these "thorny definitional problems that abound in the theory of rent" (Alonso, 1964) and to concentrate on a more abstract exposition how the market processes might function. However, as soon as an attempt is made to test models with reference to any empirical rent data, these issues must be confronted.
Table 1 below shows the different kinds of rent price data that have been analysed in previous studies. The lower the type in the table, the more closely it reflects the actual cost to the tenant of renting a space.

Table 1: Types of Rent Data

The majority of published office rent studies have used asking rents, as can be seen in the summary of previous studies in Table 2 of the appendix. This is the easiest rent data to obtain because it is advertised and therefore available in the public domain. It is used as a proxy for what tenants are actually prepared to pay because it is expected to correlate with achieved rents. However, especially in cases of falling markets like Berlin, asking rents can be very misleading. In a recession landlords may have to accept rents much lower than the asking price because tenants are able to dictate terms in an over-supplied market (Cash, 1995). As Webb has noted, the asking rent is 'essentially supply side information that does not necessarily reflect specific transactions between a lessor and a lessee' (Webb and Fisher, 1996). The asking rent may reflect more about the hopes and negotiation strategies of landlords than it does about the price that tenants are really prepared to pay.

Because there are such problems using asking rent as a proxy for the actual price that a tenant has paid for an office location, lease data was used in this study. Data on the actual rent price written into contract once negotiations between a real landlord and a real tenant have been successfully concluded (termed headline rent) is much more difficult to obtain as it is confidential and highly sensitive informationi. Landlords, in particular, are often reluctant to release detailed information about their dealings with individual tenants, lest it affect the balance of their negotiating power (Wheaton and Torto, 1994). Consequently there are far fewer published articles that use head-

line rents (Brennan et al., 1984; Wheaton and Torto, 1994; Webb and Fisher, 1996). This study uses lease data obtained from property consultants Jones Lang Wootton Berlinii.

There are other types of rent price data that reflect the real cost of a lease to the tenant more closely by adjusting for incentives in a lease. The property profession is still debating the most appropriate practices to be adopted in valuing lease inducements and no common practices have yet emerged (Davidson and Darlow, 1993). Both consideration and effective rents have been calculated for the leases used in this study. A statistical analysis showed that some individual leases may vary greatly in the difference between effective and headline rent but for the sample as a whole the headline rent is a good proxy for effective rental value to tenants (Desyllas, 1998a).

2.1 Isolating Location Rent

Once a sample of transaction rents has been obtained, there remains the question of how much of the rent is a premium for location as distinct for the amount paid for other factors such as the quality of the unit, characteristics of the building and provisions of the lease?

Since the 1970s there have been many empirical studies that have used Multiple Regression Analysis (MRA) as a technique used for building and testing models of the variables that determine office rentsiii. The attempt has been to demonstrate through statistical inference the hedonic price of various spatial and non-spatial variables in the determination of rent. Table 2 in the appendix shows the variables that have been used in the MRA of published studies. In this way, MRA provides a model of how much rent an office space would command in the market given a certain space at a certain location under certain lease conditions. The technique is used in this study to isolate the part of rent that is attributable to location and then to test models of a location variables that would predict this location rent.

2.2 Non-spatial variables tested

The main non-spatial variables tested in this study were the date that the lease was signed ('leasebeginmonthcode' in the tables of the appendix), the size of the floorspace for the unit ('floorspacem2'), the length of contract ('contractlength')and the quality of the building ('buildqualitydummy'). Table 3 shows the correlation matrix for the main lease variablesiv in the sample of Berlin rents. By far the strongest correlation is that of the time variable (month of lease begin) determining rent negatively at R=-.592. None of the other correlations are as strong, although the time variable does exert an influence on both floorspace and contract length as can be seen in the p values of Table 4.

Regression analysis demonstrated that of the non-spatial variables, the factor of time (the month and year that a lease began) exerts by far the greatest influence on rent. In this sample it was in fact the only non-spatial variable that showed a systematic and significant influence on rent price in either stepwise or multiple regression (Desyllas, 1998b). The importance of the time variable can be seen in the falling trend in real rent prices with the recession is shown in Figure 1. There has been a

dramatic halving of rents in real terms over just 6 years.

Figure 1: Berlin's Falling Office Rents

To undertake an analysis of location in rental contracts is to attempt a cross-sectional analysis of data that is essentially time series dependent. In order to understand the spatial organisation, this time aspect must be accounted for. The period 1991 to 1997 corresponds to the downturn in the office market cycle exhibiting typical characteristics of a move from a landlord to tenant dominated market (Bond, 1991). although the market itself is cyclical, the trend for this period has been fairly linearly negative in Berlin.

To analyse the part of price that can be said to reflect location preference, the rent price relative to the market average at the time a contract was settled is the relevant measure, as opposed to the rent price per-se. There are a number of ways of calculating this, one of which is just to take a simple linear regression of rent against time, shown in Figure 2. Time can be said to explain around 35% of the variability in price on this linear model. Figure 2: Linear regression of rent against time

A statistical expression of a contracts price relative to the time trend is the residual of the above relationship between rent and time. This has been used as a method of establishing a relative price to the market average, which also takes into account the differences in the number of cases per year. Once a relative price is established, it can be used to display the distribution of rent prices according to location.

There are a number of other factors that might exert a systematic influence on rent price but that did not prove to be statistically significant in the Berlin case. It would seem reasonable to expect a lowering of the per square metre price with the size of the letting owing to economies of scale, yet no such effect was found in the sample. The MRA showed that the floorspace size was not a significant variable in the determination of rent. The only significant (but very weak) correlation with floorspace size of letting was that of lease length: the larger the letting, the more likely it is to be a longer lease. As can be seen in Table 4, even this relation was very weak.

One of the most surprising results was that 'new-build' (specifically designed office space completed since reunification) did not command a premium over 'old-build' (office space in an older building, either an renovated older office or a converted building). In fact, on average, leases in older buildings were DM 0.80 above the time trend and new buildings were DM 0.40 below. The pattern is similar with the median values and it is not changed if the earlier years are excluded. There is not a clear relationship, but it appears that newer buildings are being let slightly lower than older ones, perhaps because the developers are under more time pressure and are thus adjusting to the falling market faster (Desyllas, 1998a).

The length of the lease (the number of years that a tenant is obliged to stay) was also not found to exert a significant influence on rents. There is a weak but statistically significant negative relationship between lease length and time: eases were on aver-

age shorter in the period 1995 to 1997 than 1991 to 1994, reflecting the tenants ability to obtain flexible terms in the falling market.

2.3 Untested Variables

There are a number of variables that might potentially play a role in determining rent levels that it has not yet been possible to test. Most obvious are the many variables relating the state of the interior fit-out, for example, air conditioning, lighting, availability of support services and the security of the building. Many of these may be autocorrelates of the building quality variable as newer buildings are likely to have better facilities. But there are other variables that might be significant, such as those relating to micro-scale spatial questions: -The internal division of the space- the layout of open and cellular spaces -The flexibility of the footprint for adaptation to tenants uses -The scope for expansion (e.g. floorspace per floor) -The quality of views of the surroundings from the building

The costs involved in effectively testing such variables have always hindered their use in MRA for any more than a very small study.

3. Representation of Location Rents

Multiple regression has been used to derive comparable 'location rents' from a heterogeneous sample and this data can now be used to create representations of what the pattern of location rents actually looks likev.Very little published research on representing office rent patterns exists. With the exception of Brennan's study of rent patterns in a small part of the Chicago CBD (Brennan et al., 1984) none of the academic studies of office rent data have attempted to represent the spatial pattern of rents from their study sample. The emergent spatial pattern of location rents has been ignored as a question for research, perhaps because assumptions about the spatial pattern of rent have been taken to be fact rather than a hypothesis worthy of testing. Consequently very little has been done to attempt to represent what location rent patterns actually looks like in published academic studies.

The bulk of representations of rent patterns that do exist come not from the academic field but from commercial property consultants, Examples of which for Berlin are shown in Figure 3 to Figure 6.

Figure 3: Eureal Representation of Berlin Office Rents

Figure 4: Engel & Völkers Representation of Berlin Office Rents

Figure 5: Müller Representation of Berlin Office Rents

Figure 6: Jones Lang Wootton Representation of Berlin Office Rents

Although these are graphic representations of rent, they were generated for marketing purposes and consequently the methodology used is variable and usually not explained. Their function is only to provide an overview of location trends. Thus it is often unclear how (or if) other factors have been controlled for.

3.1 Level of aggregation

All the maps of location-rent in Berlin produced by commercial real estate companies have adopted an area-based approach, whereby the pattern of location rents is split into a number of distinct areas within which values are considered comparable. The problem with this approach for representation is that finer scale spatial differences will be hidden by the area means and any change in the pattern of location rents will not be represented unless the areas chosen are very small. Splitting up the city into also requires arbitrary judgements to be made about boundaries (Gallimore et al., 1996)vi.

For this study, building average location rents were used as the lowest possible level of aggregation in order to capture the pattern of rent at as fine a spatial scale as possible. In total, the 435 leases are distributed in 187 buildings, giving an average of 2.3 leases per building. Figure 7 shows a map of the street network of Berlin with the location of the buildings with leases in the entire sample. As can be seen, the geographical spread is much better North-South than East-West as many of the outer districts of the extreme West and East are not represented by the sample.

Figure 7: Buildings Containing Leases in the Study Sample

3.2 Visualising Rent Data

The few academic studies that have attempted to represent rents have used isarithmic maps as the method of data visualisation whereby the rent values are converted into a continuous three dimensional surface, as in Figure 8 (Brennan et al., 1984).

Figure 8: Brennan's Office Rent Surface for the Chicago CBD

Isarithmic mapping is normally used in cartography when the focus is on the attribute values at points on a truly continuous distribution, such as land elevation. The appeal of this technique for rent maps has been that it allows 'cartographic induction', whereby a continuous surface of location rents is extrapolated from a limited sample of points in a similar fashion to the derivation of gradients such as land surface slope and temperature variation in natural systems (Robinson, 1995).

For this study, such surface extrapolation was considered inappropriate for rent patterns in the urban realm because it assumes an isotropic surface in the city (the measure of distance does not vary with the direction from a point). In systems where networks are involved, such a buildings facing onto streets, an antiisotropic condition exists (Laurini and Thomson, 1995). This means that transforming rent point data into a continuous isarithmic surface will tend to obscure the fine scale spatial properties of the pattern.

In this study, rather than extrapolate a complete surface of what rents might be for the whole city , the attempt has been to keep the empirical data separate from the model of what rent unsurveyed locations would command. A choroplethic method of data visualisation is used to represent rent values in a colour scale at the actual building locations for which data is available. This was deemed most appropriate because it allowed for the purest representation of the spatial organisation of rent

data with the least distortion to the spatial objects of buildings and their locations. Chloropleth maps do not attempt to insert inferences into the presentation in the way that isarithmic maps do (Robinson, 1995).

Figure 9 shows the pattern of location rentvii of the entire sample for all years together in a greyscale where higher rents are darker. There is a surprisingly clear global structure to the spatial pattern of rent data, with lighter points around the periphery of the map rising to darker in the main streets of the two centres. The lease data might be expected to produce a more chaotic pattern as there is more random individual variation the more detailed and disaggregated the data. Yet there are very few real outlyers to this patternviii.

Figure 9: Location Rents in Berlin 1991-1997

As well as showing the two peaks of office rent in the Western CBD and in Mitte that were already seen in the property agents reports, the choropleth representation picks out even finer scale differences from street to street- such as the concentration of top values on the two prime streets in these areas- Kurfürstendamm in the West and Friedrichstraße in the East- and the marked fall-off in values in their side streets. Variations along the streets can also be detected, such as the higher values in the middle of Kurfürstendamm and Friedrichstraße compared to the ends.

3.3 Spatial change over time

Having generated a location-rent map for the whole period 1991 to 1997, it is also possible to investigate the spatial changes within the period. The year 1995 is seen as a turning point in the location of prime rents as this is when the Eastern core overtook the West (Jones Lang Wootton, 1995). In order to represent the mean building rents in the two periods, the average values of leases per building were recalculated. This led to a new aggregation for the period 1991 to 1994 of 122 contracts in 80 buildings and for the period 1995 to 1997 of 313 contracts in 193 buildingsix.

When the sample is split into two periods, the process of change becomes much clearer. In the earlier period (Figure 10) the Western centre is predominant as the main rent 'hot-spot'. However, the latter period 1995 to 1997 has a markedly different pattern of rents: the western peak in values has disappeared almost completely and there is much more of a monocentric pattern focusing on Friedrichstraße and Gendarmenmarkt in the Eastern centre of Mitte. (Figure 11).

The use of more accurate data has allowed the spatial pattern of rents to be more clearly defined and has made explicit the reorganisation of rent values that has taken place since the fall of the wall: Downtown has moved from West to East Berlin.

Figure 10: Location Rents in Berlin 1991-1994

Figure 11: Location Rents in Berlin 1995-1997

4. Modelling the Location Variable

The representation of location rents has shown distinctive and non-random spatial

patterns. It is these patterns that a model of the location advantages must seek to reflect. What spatial variable can be invoked to account for these patterns?

The oldest idea to capture the spatial variable is simply the aerial distance from the town centre. As made explicit by Alonso, nearness to a central point is not meant to actually represent location advantage itself, rather it is a proxy for a generalised accessibility to all business locations that may be important to business activity: 'Though not all employment, shopping et cetera are at the centre, this will be the point of greater accessibility to these activities. The centre of a city is analogous to the centre of gravity of a physical object' (Alonso, 1964) p134 The sky distance from a central point has been by far the most widely used spatial variable in modelling the accessibility influence of accessibility on rent, as can be seen in Table 2. Yet sky distances from a central point have the disadvantage that they always provide uniform spatial patterns of rent declining in concentric circles. Rent patterns do not appear as uniform concentric rings, as can be seen from Brennan's representation in Figure 8 and the Berlin data shown in Figure 3 to Figure 6.

Where street based distances from a central point have been tested on the same data as sky distances, they have generally been found to be more accurate predictors of rent differentials (Clapp, 1980) as they capture some of the network properties of the streets that are actually used by people but they still tended to provide a fairly uniform monocentric decline in values. Such a simple spatial model did not seem sufficient to capture the complexity of location advantage in rents nor to mirror the actual spatial patterns that rent values produce.

In response to the failure of distance from a central point to capture the complexity of rent patterns, a number of attempts have been made to find spatial variables that could mirror the spatial patterns of rent. The most widely used alternative has been to use the kinds of area variables that were seen in the representations of Figure 3 to Figure 6 as dummy (binary) variables in the regression analysis. Thus the importance of location in rent determination is measured in the MRA using a series of binary variables for areas of the city and cases are given either a 1 or 0 value depending on whether they are inside each area or not. The technique is descriptive rather than analytic because the areas cannot be said to provide an independent variable as the definition of areas is arbitrary (Gallimore et al., 1996) and highly dependent on the actual data themselves. Area dummies also fail to provide a universal methodology for use as a spatial variable because the definition of areas is always quite specific to the rent patterns found in individual cites.

For the Berlin study, the use of purely spatial measures of the configurational properties of the street grid have been tested as measures of accessibility from all streets to all others in the system. Models of the street system as a network of axial lines have been constructed and the space syntax measures of integration (Hillier and Hanson, 1984) have been calculated. Figure 12 shows the pattern of accessibility before reunification in greyscale, where two centres (shown most darkly) can be clearly discerned. Figure 13 shows the difference in reunified Berlin's spatial structure: the core of integration has shifted to Mitte in former East Berlin.

Figure 12: Axial Map of Divided Berlin (Global Integration)

Figure 13: Axial Map of Reunified Berlin (Global Integration)

The similarity in the shift of prime rent values to the shift of spatial integration in the street network provides an explanatory framework for the transition process that is taking place in reunified Berlin. The pattern of location rents in West Berlin mirrored the configurational structure of the Western city before reunification. With reunification this structure has disappeared and the street grid has formed a new spatial structure with the most integrated core in the Eastern district of Mitte around Friedrichstraße. This is also the area to which prime rents have moved.

This transition process is reflected statistically when the integration values for divided and reunified Berlin are used in MRA for rent determination. Table 5 in the appendix shows the multiple regression for West Berlin leases (r squared=.663, p=<.0001). The strongest variable in the determination of West Berlin rents is time, with a negative relationship determining rents (t=-22.031, p<.0001). The second strongest variable is the integration values from divided Berlin, which correlate with rents positively (t=6.145, p<.0001). Other non-spatial variables and reunified integration are not significant for Western rents. Thus the rents in West Berlin have been falling steadily through time and have been spatially organised around the old pre-unification pattern of integration.

The two variables found to determine rents for leases in East Berlin are integration and time, however, it is the reunified pattern of integration that is found to be most significant (see Table 6 in the appendix). Reunified integration is actually more important than the time variable (reunified integration t=5.539, p<.0001; leasebeginmonthcode t=-3.561, p<.0001. The regression is a messier one but it is highly significant. It may not be possible to statistically model rent determination more closely until the new relationship between location and rent has stabilised because the period under investigation is one of a shift from one equilibrium of spatial structure and rent patterns to another. This shift can be illustrated by splitting the regression analysis of rent with time seen in Figure 2 by area to show only the Western and Eastern centres, as in Figure 14 and Figure 15 below: Figure 14: linear regression of rent with time for the West Berlin CBD area

Figure 15: linear regression of rent with time for the Eastern area of Mitte

The time variable correlates negatively at R squared .767 for the West Berlin CBD but only at R squared .026 for the Eastern centrex. This is because the Eastern centre held out against the recession in rent values to a great extent as it grew in importance as a location for business. This finding also cannot be explained by oversupply in the Western centre relative to the East because the largest concentration of new office development is in the East itself and the Western centre has been characterised by smaller infill projects.

5. Conclusions

The changes in the spatial structure of the street grid that occurred with reunification are the precursor to the shift in rental values that has occurred since the fall of the

wall. This means that the emergent pattern of location rents seems to relate to a truly independent location variable (the purely spatial characteristics of the street grid) and changes in the spatial structure are followed by changes in the pattern of location rents.

How should this measure of the generalised accessibility of each street to all others in the city translate into a theory of why firms will bid more for an office on a more integrated street? A social theory to explain this relationship between the rent pattern and the spatial structure needs to address the question of why people pay more for certain locations. What is required is a mechanism to explicitly link individual actors with the spatial pattern of location advantages required for their social interaction and from this the rent patterns that they give rise to when bidding for office space on the market. Although the patterns of rent that emerge from social interaction are unintended and complex, it is ultimately real individuals that are doing the interacting that gives rise to them.

The hypothesis is that the emergent macro-structure of rents in the market is related to the spatial configuration of the street system through the effect that it has on a myriad of specific location criteria for individual firms. When many individual firms make complex location decisions based on accessibility to specific places important to their business, the pattern of demand that emerges mirrors the general configurational structure of the street grid. This is because the purely configurational properties of the street grid as a spatial system will tend to influence more specific accessibility decisions: a location that is strategic with respect to the whole city is likely to be more strategic to more specific places important to more individual businesses. What has happened in Berlin is that a huge change in the strategic value of the Eastern centre with respect to the whole city has filtered through to affect the complex decisions of more and more individual firms who are prepared to bid higher rents to be there.

It would be possible to test spatial theories about the relative importance of specific location criteria by constructing configurational models of accessibility that are more specific than the generalised integration of the axial map. For example, rather than the accessibility to all streets, there could be a model to test the importance of accessibility for commuting that would have all houses in the city as the relevant locations for accessibility. This could be tested against a model where only accessibility to other office buildings was calculated as relevant, or to shopping facilities, or train stations, and so on.

The axial map model of the street network is an explicit model of the spatial system used by real people that has proved powerful for pedestrian movement prediction. It does also seem to reflect important aspects of Berlin's spatial reorganisation, but there may be other models that are relevant for theories of rent. The most obvious omission for is the public transport system which at least is thought to be very important to rents. Similarly, there may be other measures of accessibility, even of a configurational kind, that are more appropriate for rent studies than the graph depth measure of integration used in axial maps. Universal metric distance is an obvious candidate to be tested against integration as a predictor.

Whatever the criteria that are to be tested, there has to be not only a measure of accessibility but also an explicit model of the spatial system through which the accessibility is calculated. The vague definition of what the spatial system within which accessibility is to be measured was often a real weakness of rent studies using both the aerial distance and the area dummy variable techniques: it is often not clear from the model how people are thought to move about and therefore the vague notion of nearness does not translate into a social theory about what people do in cities. This lack of a spatial model has prevented theorists of rent from linking microeconomic theories of location needs for firms with the macro behaviour of the rent patterns as they can be seen in the city. As Krugman has noted; Like geologists who could not really look at where mountain ranges are located because they had no model of mountain formation, economists avoided looking at the spatial aspect of economies because they had no way to model that aspect (Krugman, 1995) Linking the phenomena of rent patterns with models of how individuals are interacting in the market to give rise to them requires spatial models of the pattern of location advantages. What rent theory now needs is to rigorously test competing models with respect to evidence the real spatial patterns of rent found in cities.

The greyscale graphics used in this paper can be viewed in colour at http://www.bartlett.ucl.ac.uk/berlin

Acknowledgements
I would particularly like to thank Jones Lang Wootton for the provision of rent data and their helpful support of this research.

Appendix
Table 2: Published research on office rents
Table 3: Correlation Matrix for Lease Variables
Table 4: Fisher's r to z (p-values) for Lease Variables

Table 5: Multiple Regression for West Berlin
Table 6: Multiple Regression for East Berlin

Bibliography

Alonso, W. (1964). Location and Land Use: Towards a General Theory of Land Rent. Cambridge Mass, Harvard University Press.
Bond, S. (1991). "Rental Valuations with Inducements: An Update." Journal of Property Valuation and Investment 12.
Brennan, T. P., R. E. Cannaday, et al. (1984). "Office Rent In The Chicago CBD." Journal of the American Real Estate & Urban Economics Association 12(3): 243-260.
Cash (1995). "Der Teuerste Schweinezyklus aller Zeiten." Cash(5).
Clapp, J. (1980). "The Intrametropolitan Location of Office Activities." Journal of Regional Science August: 387-399.
Davidson, A. and C. Darlow (1993). Rental Equivalent Tables and Lease Incentives. Estates Gazette, London.
Desyllas (1998a). The Changing Pattern of Location Rents in the Berlin Office Market. Reading, College of Estate Management.
Desyllas, J. (1998b). When Downtown Moves. Cutting Edge, Leicester, Royal Institute of Chartered Surveyors.
Dunse, N. (1996). The Application of Hedonic Analysis to UK Office Markets: A Case Study of Glasgow.
Engel & Völkers (1996). Büroflächen Berlin: Fakten und Trends.
Eureal (1994). Büromarktbericht 94/95.
Fraser, W. D. (1993). Principles of Property Invetment and Pricing.
Gallimore, P., M. Fletcher, et al. (1996). "Modelling the influence of location on value." Journal of Property Valuation and Investment 14(1): 6-19.

Glasscock, J., Jahanian, S and Sirmans, C (1990). "An Analysis of Office Market Rents: Some Empirical Evidence." Journal of the American Real Estate & Urban Economics Association 18: 105-119.
Hillier, B. and J. Hanson (1984). The Social Logic of Space. Cambridge, Cambridge University Press.
Hough, D. K., C. (1983). "Can 'Good' Architecture Meet the Market Test ?" Journal of Urban Economics: 40-55.
Jones Lang Wootton (1995). City Report Berlin, Jones Lang Wootton Research.
Krugman, P. (1995). Development, Geography and Economic Theory. London, MIT Press.
Laurini, R. and D. Thomson (1995). Fundamentals of Spatial Information Systems. San Diego, Academic Press.
McDonald, J. F. (1993). "Incidence Of The Property-Tax On Commercial Real-Estate - The Case Of Downtown Chicago." National Tax Journal 46(2): 109-120.
Mills, E. S. (1992). "Office Rent Determinants In The Chicago Area." Journal of the American Real Estate & Urban Economics Association 20(2): 273-287.
Müller (1997). Office Market Germany, Müller International Immobilien GmbH. O'Hara, D. J. (1977). "Location of Firms within a Square Central Business District." Journal of Political Economy 85(6): 1188-1207.
Robinson, A. (1995). Elements of Cartography, Wiley.
Sivitanidou, R. (1995). "Urban Spatial Variations In Office-Commercial Rents - The Role Of Spatial Amenities And Commercial Zoning." Journal Of Urban Economics 38(1): 23-49.
Vandell, K. and J. Lane (1989). "The Economics of Architecture and Urban Design." Journal of the American Real Estate & Urban Economics Association 16: 235-20.
Webb, R. B. and J. D. Fisher (1996). "Development of Effective Rent (Lease) Index for the Chicago CBD." Journal of Urban Economics 39(1): 1-19.
Wheaton, W. C. and R. G. Torto (1994). "Office Rent Indices And Their Behavior Over Time." Journal Of Urban Economics 35(2): 121-139.

Notes

i For this reason, all type 2 or higher rent data has been made anonymous in this study. ii For a detailed analysis of the lease data used in this study, see (Desyllas, 1998) iii (Clapp, 1980; Hough, 1983; Brennan et al., 1984; Vandell and Lane, 1989; Glasscock, 1990; Mills, 1992; McDonald, 1993; Sivitanidou, 1995; Dunse, 1996) iv As can be seen from the note at the bottom of the table, some cases are missing because not all variables were available for these leases. The sample size declines further when the more obscure lease variables are included. For this reason, the less relevant lease variables (such as option time) have not been included for the purposes of this paper. v Although MRA has been used extensively to model rent determinants in studies of office rents, it has not previously been applied to generate a comparable 'location rent' for representation purposes. This technique was used for residential sales prices in Stafford in a study by Gallimore (Gallimore, Fletcher et al., 1996), although a very different graphic representation technique was applied to the data. vi It may be possible to use a more objective method of area definition if morphological characteristics were used as the unit definition, for example the street segment. vii This is the residual of the correlation shown in Figure 2 viii The most notable outlyers to the pattern of rents are some below average rents in Mitte on Friedichstraße itself. The most notable positive outlyer is in the extreme West of the distribution. This along with around 3 other leases that seemed unusually high have been checked and they have no factors in common. ix These smaller sub-samples led to smaller average numbers of leases per building: 1.5 and 1.6 compared to 2.3 for the whole sample. x It must be noted that there are many more values for the Western centre during the early period when rents were much higher (reflecting the fact that so little new or refurbished office space was ready in East Berlin in the early years) however the finding remains if the earlier period is excluded.