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THE APPLICATION OF GIS TO ANALYSE OCCUPIER CHAINS AND PROPERTY MARKET FILTERING

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Executive summary

The project sought to investigate whether Geographic Information Systems (GIS) could enhance the representation and analysis of property occupier chaining data. It exploited an existing dataset of office and industrial occupier chains in Tyne and Wear and used GIS to illustrate, measure and analyse the chaining data more effectively than had previously been possible. We have been able to demonstrate that, although time consuming, it is a relatively straightforward and logical process to translate property occupier chaining data into a GIS.

The resultant GIS representation was able to replicate and verify findings of the original research. For example, it confirmed the accuracy of the original calculation of the distances that occupiers move, but it also revealed that the average distance moved diminished the further that they occur along a chain. Using density mapping, it was possible to identify the location of 'hotspots' of office and industrial market excitation. The mapped data was also able to reveal the hollowing out of Newcastle and Sunderland CBDs.

Rateable Value and VAT registration datasets were used to interpret the origin of occupiers of new office and industrial developments and the location of vacant chain end property. Of the two, the strongest correlation was with VAT registrations within a three year period. This indicator is associated with economic activity and enterprise that would generate new businesses or start-ups that would typically take up small office and industrial units, thus absorbing vacant accommodation and contributing to property market filtering.

The application of GIS to property occupier chaining data was successful. It enhances our understanding of commercial property market dynamics and occupier displacement and can characterise the locations where occupiers relocate from and where property voids are created. The property chaining GIS has potential not only to evaluate the spatial impact of previous property market interventions but to inform the strategies that shape future ones.

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01 Introduction

The data used for this project came from a survey of 250 office and industrial property occupier chains in Tyne and Wear that formed part of the author's PhD (see Greenhalgh 2006). The data collected was analysed without the assistance of Geographic Information Systems (GIS) but it was apparent that GIS may offer an enhanced level of representation and analysis. The purpose of this research, which was supported by a grant from the RICS Education Trust, was therefore to exploit the existing dataset and use GIS to illustrate, measure and analyse the occupier chains more effectively than had previously been possible.

A pilot exercise was undertaken to enter chaining data, for one of the twenty office and industrial developments captured by the original study, into GIS. A methodological approach for processing the data was developed and permitted an estimation of the time required to process the rest of the data.

The work funded by the RICS Education Trust initially comprised data processing, but also required the capture of geospatial coordinates for all points within the 250 chains (approximately 550 points). It was anticipated that the resulting GIS would be capable of capturing the spatial concentration of chain ends and their status to identify locations that are slow to absorb vacant office and industrial property. Ultimately, the research contributes to our understanding of the spatial impact of commercial and industrial property development on local property markets, in terms of the displacement of property occupiers and the operation of market filtering.

1.1 What is the issue being addressed by this research?

Displacement of property occupiers may be caused when new property developments come on to the market and occupiers relocate to the new developments, vacating their old premises in the process. This is not a problem per se, as their old premises may only remain vacant in the short term, before being re-occupied by a new business or organisation. This process is called filtering and operates in most property markets.

It is debateable whether government and its agencies should be concerned about displacement generated by the 'normal' operation of the free market, typified by private sector initiated and funded development activity giving rise to supply that is purchased or occupied by private individuals or firms. Indeed, if a relocating occupier expands and creates net new additional employment, then the creation of a vacant property elsewhere may well be viewed as a 'price worth paying'. However if displacement is caused by developments that have been promoted or assisted by the public sector, then government and its agencies need to pay attention to the potential side-effects of their intervention, one of the most significant of which is occupier displacement.

It was hypothesised that a significant proportion of occupiers attracted to new office and industrial accommodation that had been promoted, or assisted by the public sector, would have relocated from elsewhere in a particular conurbation. Therefore, the majority of the businesses that public agencies claim to have attracted, and many of the 'new' jobs created, have actually been displaced from elsewhere. A further concern was that, through filtering, vacant chain-end properties would be concentrated in locations that were particularly vulnerable to occupier relocation. These, it was hypothesised, are locations that typically suffer from obsolescent building stock, a poor environment, out-dated infrastructure, economic blight and social stigma. Such areas often require social, physical and economic regeneration anyway, without having to withstand the loss of local employers to new, publicly subsidised or assisted developments in competing locations.

By better understanding how occupiers respond to the availability of new accommodation and the likely extent of the side-effects that this may generate, public sector agencies should be better able to develop policies that maximise additionally and minimise negative outcomes. Where a significant level of displacement and occupier chain generation is anticipated, public agencies could deliberate on the potential spatial impact and contemplate taking steps to reduce the negative impact on areas that are not able to sustain such displacement.

1.2 What is the theory that provides the basis for the research?

The use of the chaining technique, to investigate property market filtering, is at the heart of the research. The chaining technique, although well established in the residential property market, has rarely been used in industrial and commercial sectors, and only fairly recently adopted for the study of the impact of property-led urban regeneration. Therefore, the detailed and comprehensive investigation of occupier chains, generated by occupiers relocating to the new commercial and industrial developments, would make an important contribution to our understanding of property market filtering, occupier displacement and the wider impact of public sector intervention in land and property markets.

Previous studies had been confined to a very small sample (Valente and Leigh 1982; Francis and Thomas 2006) or to a single tool of regeneration (Department of the Environment, Transport and the Regions 1998; Deas *et al.,* 1998). The technique facilitates measurement of the strength of the filtering effect within the office and industrial sub-markets in the conurbation and allows the researcher to identify the origin of the office and industrial occupiers that have relocated and the distribution of the chain end properties (see Appendix A for a model representing how occupier chains are generated by occupier displacement and vacant property is absorbed by the filtering effect).

1.3 Why is the research necessary?

Occupier displacement occurs in all property markets, when new accommodation is built and existing occupiers relocate. Although this phenomenon has been acknowledged by practitioners and researchers in the field for some time, there has been little comprehensive investigation of it, and what evidence that did exist was mainly anecdotal in nature. This encouraged the author to carry out an in-depth investigation of the extent and impact of industrial and office occupier displacement using the Tyne and Wear conurbation as a case study.

The research, comprising as it does an extensive and methodical investigation of the response of office and industrial occupiers to the supply of new accommodation in a defined metropolitan area, provides a unique insight into their behaviour and the spatial impact of their decisions. The research concentrated on twenty of the most significant office and industrial developments in Tyne and Wear of the last 25 years, all of which benefited in some way from public sector funding and support, e.g. Enterprise Zone, Urban Development Corporation, gap funding etc. The study offers an insight into the impact of public sector intervention on land and property markets, in terms of the outcomes of direct and indirect investment and the displacement and other side-effects that may be generated.

The end of each chain is significant because this is the final manifestation of the impact of the initial intervention. The chaining technique captures the displacement and additionality generated by policy intervention and leads to effective impact assessment by identifying negative and positive spill-over effects.

Introduction

1.4 How will the research build on work already carried out?

The 20 office and industrial developments in Tyne and Wear, captured by the research, comprise over 500 buildings, totalling in excess of 500 000 square metres (5.5 million square feet) of accommodation on nearly 500 hectares (1200 acres) of land (Figure 1). The developments are occupied by over 800 firms employing over 25 000 people, and the total investment in buildings, plant and machinery exceeds £2 billion (Greenhalgh *et al.,* 2003).

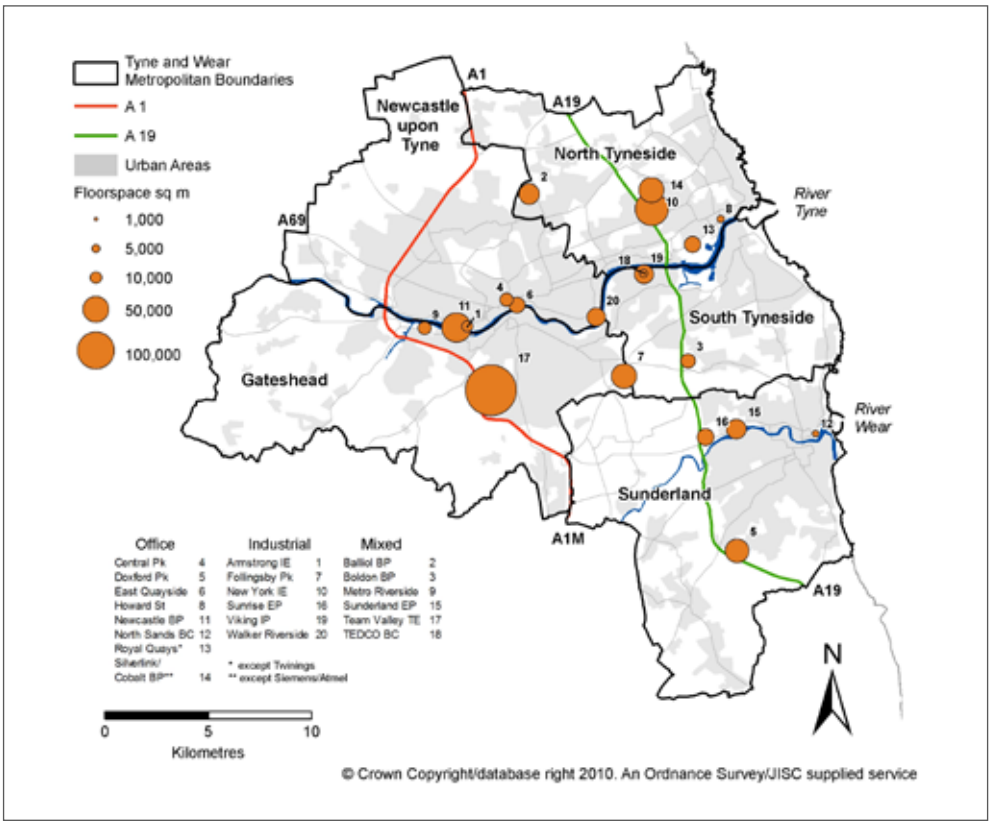
Having ascertained the status and origin of all occupiers of the twenty developments, the chains of firms that were not new to the metropolitan area were investigated to record what had happened to their old premises.

The study of over 500 firms and the investigation of 376 chain ends resulting from 251 occupier chains, across a single conurbation, is probably the most comprehensive exercise of this type attempted in the U.K. to date (Greenhalgh *et al.,* 2003). Application of the chaining technique to a conurbation-wide study of office and industrial occupier displacement is an original piece of research and makes a valuable contribution to our understanding of how occupiers respond to the supply and subsidy of new accommodation.

Having identified the status of all occupiers recorded on the database, it was possible to investigate the chains generated by those that had relocated from elsewhere in the conurbation. Transfers and branch relocations accounted for more than half (52%) of all occupiers captured by the questionnaire and telephone surveys. It was these occupiers that formed the start of the chains.

However, as long as premises are ultimately reoccupied by commercial uses, relocations cannot simply be considered to represent displacement. Only when a chain ends in vacancy can one determine that the intervention has generated negative displacement. The outcome of a move by a business to a property development is not the move itself but the net effect of the completed chain. Pursuing the occupier chains created by the original occupiers quantified the side-effects of supplying new accommodation in terms of market excitation and chain end status. The scale and impact of occupier displacement recorded is significant with over half of all occupiers having relocated and over a third of chains generated by such moves, resulting in vacant property elsewhere in the conurbation.

Figure 1 – Location of Office and Industrial development in Tyne and Wear



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It was recognised in the original research that the spatial distribution between the start of the chain and the end result of a vacancy represents valuable information in assessing the impact of a new development. By plotting the origin of firms on the 20 developments on an ordnance survey paper map, the geographical distribution of premises vacated by relocating firms within Tyne and Wear was recorded, and the distance that they had moved, measured. The average distance of moves for each development and for different types of occupier was calculated, as well as a total of all relocations within the conurbation. In addition, the location of vacant property, at the end of occupier chains, was plotted to identify which areas have been most affected by displacement within the conurbation. It was recognised that additional research to establish any similarities in the characteristics of an area that contains a vacant property could be gained by mapping data over the study area using GIS which is well known for its ability to "add value to data" (Longley *et al.,* 2005). Designing a GIS database using the information generated in the original study, if done well, provides quick and easy access to large volumes of data: the ability to select data based on categories provided; to integrate data and highlight any spatial characteristics observed; to focus on a given area; to edit, update and incorporate more information and; provide tailor made output in the forms of maps, graphs and summary statistics (Heywood *et al.,* 2006).

An approach by which geo-spatial data can be entered into the GIS software to represent the occupier chains was developed and refined using a pilot exercise to model the office occupier chains generated by one small office development. The most time consuming part of the exercise is the conversion of occupier locations, represented by postal addresses, into geo-spatial (easting and northing) coordinates that can be recognised by the GIS software. This has been achieved using postal address and postcode databases that are publicly available. Once all the data has been transferred into GIS it is possible to not only replicate the manual analysis that has already been performed on the occupier chains to see if similar results are obtained, but to pursue analysis that was not possible using manual techniques.

1.5 What is the relevance and applicability of the research?

The research is closely tied to the work that has already been completed. The chaining data already exists in electronic form (MS Excel) and manual analysis of the occupier chains has been undertaken. The application of this data and the use of the chaining technique is a special opportunity to explore the potential of GIS to represent and analyse the nature of the chains recorded in Tyne and Wear. The tangible output of the work is an interrogable spatial database of office and industrial occupier chains across the Tyne and Wear Conurbation. By creating this it demonstrated that the approach enabled the geography of the chains, spatial impact of occupier displacement, and side-effects of property-led regeneration projects, to be investigated and better understood.

The beneficiaries of the work include members of both the professional and academic community, but perhaps most significantly, the public sector agencies and organisations that are responsible for shaping and implementing physical, area based interventions in urban areas that generate occupier displacements. Specifically this could include local authorities, Regional Development and Local Enterprise Partnerships, the Homes and Communities Agency, Regeneration Companies, and emerging City Region bodies.

Introduction

1.6 What is the originality of the research?

GIS has been applied in mapping changing property values (Wyatt 1996 and 1997), vacant properties in Leeds (Katyoka and Wyatt, 2008) and modelling the influence of location on value (Gallimore *et al.,* 1996). It is also used as an auditing tool, for example, listing housing stock and associated information for Local Authorities (Malpass and Mullins, 2002). It has many areas of application in the built environment. This is the first known input of property occupier chaining data of this type into a GIS. Previous research has mainly been qualitative and / or restricted to excel spreadsheets focused on the number of moves rather than understanding the 'forcing' or 'push and pull' factors associated with decision of relocation (see Leishman and Watkins, 2004).

The project:

- converted all chains and nodes to a geo-referenced point location GIS dataset
- provided comprehensive data about each property chain and categorical information linking together occupier chains by:
  - type of move
  - type/nature of business
  - expansion or contraction
- compiled a database allowing a comprehensive interpretation of the data (see Figure 4)
- enabled visual display of the chaining data within geographic context, allowing analysis of associations on locations (see Figure 3):
- calculated the distance of moves for all links in the chains
- represented the
  - spatial impact of a business development; and
  - effects of multiple developments, of different sizes and scale.

In addition, compiling data of this type into a GIS adds value to a dataset such as this. It is not just a static display but can form part of a complex analysis of spatial trends. GIS, as well as providing a means to visualize and display information, can also summarise and integrate a wealth of data highlighting key characteristics of a location (Longley *et al.,* 2005). The data can be integrated with factors that vary spatially within the Tyne and Wear region such as:

1. Commercial and industrial floorspace and rateable values
2. VAT registrations

By identifying the characteristics of vacancies and their locations and developing an index using factors listed above it is possible to understand multiple moves within Tyne and Wear highlighting spatial trends of where a significant number of vacancies are concentrated and consequently where they are likely to be found in response to future developments. Therefore, it is possible to analyse and interpret spatial trends by incorporating other relevant factors into the analysis of the impact of business developments.

The output of this project will be:

- A spatial database of the information that can be added to, updated and developed based on the findings of this project
- Maps of property occupier movements
- Characterisation of urban locations identified
- Method development – developing a quantitative methodology that can be transferred to examine the impact of office and industrial developments elsewhere.

The developmental facet of the research is to come up with new ways of interrogating the data and representing the findings using information technology. The GIS software can insert and strip-out layers of data to represent component parts of the chains e.g. first moves, chains ends etc; additional characteristics can be studied, for example chain ends by status; distance of moves by development or business sector. It is now possible to calculate the distance of occupier moves for all links in the chains rather that just first moves; data characterising occupiers can be attached to develop a typology of locations that are able to absorb empty floorspace or suffer from prolonged concentrations of vacant accommodation. It may also be possible to test the emerging city-region model for Tyne and Wear.

02 Constructing the database

Table 1 – Database fields and description

Field Name	Description
ID	Unique identifier
DEV_	Development from which the chain started
PREV_OCU	Name of previous occupier of the address
TYPE	Type of business (Industrial/Office) for the 1st move. It is assumed that any following moves are the same business type as the 1st move in that chain; there is some scope for change between office and industrial use within the B1 use class although this is fairly uncommon. (I = Industrial; O = Office)
EMPLOYEES	Number of employees at survey date; (Any following moves are designated with the same amount as the 1st move occupiers – may need to address this*). N.B. data is not available for some occupiers.
SIZE	Floorspace (sq m) of premises occupied (any following moves are designated with the same figure – may need to address this). N.B. data is not available for some occupiers.
PREV_STATU	Status of occupier (transfer; branch relocation)
ADDRESS	Point address
EASTING	Easting co-ordinates
NORTHING	Northing co-ordinates
OCCUPIER	New occupier
STATUS	Status of new occupier (transfer; branch relocation)
LINK	Number of the link in the chain (1:4)
CHAIN_NO	Unique chain identifier.
END	If address is the last link in the chain
SAME_ADD	If the previous occupier has moved within the same address, building or development (Yes)
CONSOLIDAT	If the previous occupier had consolidated with other branches to the new address (Yes)

The data has been compiled into three sets of data for use in GIS, the assembling and creation of which are presented below.

2.1 Developments Dataset

These are simply the geometric points of the 20 office and industrial developments in Tyne and Wear and were compiled in a database with X Y coordinates, along with information about each development, before being transferred into GIS software. The dataset also holds information on the type of development (industrial, office or mixed-use floor space). The single point used to represent each individual development was determined as being located at the physical centre of the development as defined by its boundary (in the case of an Enterprise Zone) or the extent of the physical development in the case of all other developments. In some cases, e.g. North Sands, TEDCO the project was the building, but other developments, for example Team Valley South, Silverlink/Cobalt, cover a large area, such that the approximation inevitably introduces some inaccuracy into the movement calculations, although the extent of this is minimal. The accuracy of the calculations would be improved by using precise geometric references for each building on a particular development and associating this with each individual occupier. However, the margin of improvement was so small that it could not justify the time and effort that would have been needed to achieve this.

2.2 Business and Address Dataset

This database comprises geometric points representing the addresses of the origin of occupiers that moved into the new development and of the other properties further down the chain. The internet was used to determine the post codes for recorded business addresses, which were then converted into Easting and Northing coordinates.

The original data was arranged by chain number. Adopting a similar convention would have created difficulties with the organisation of the database within GIS, since movement within a chain can occur at the same address, consolidations can occur from multiple addresses and a vacated space can accommodate more than one new occupier. It was therefore necessary to have a unique identifier/row for each occupier move in the chain along with information on the sequence and nature of the move.

Unless the property had become vacant or had been demolished, each unique identifier/row required information for two occupiers, one that had moved out (PREV_OCU), and the one that had moved in (if any) (OCCUPIER) and the sequence of the move in the chain (LINK). New columns were added to identify whether the business move was made within the same address/building (SAME_ADD), and whether the new address was part of a consolidation (CONSILIDAT). A column identifying whether a particular row was the end of a chain was also created (END), since chain-end status is of particular significance to the study.

Constructing the database

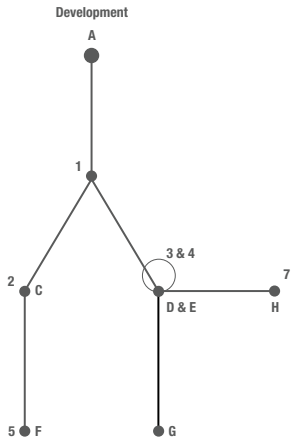
It is worth noting that when chains split, usually due to a consolidation, the only way of distinguishing between addresses of the different sub-chains is to use categories of information provided (consolidation, link number and occupier information) and to visually to refer to the GIS representation of the information as both points (business address) and lines (direction of movement between addresses – see section 2.3). An example of how a chain is represented in the database is shown below (Figure 2).

From the table shown in Figure 2 above it is hard to appreciate the relationship of moves without referring to the visual representation of the chain shown opposite. The chain is started by company A moving into the new development. Company B, then consolidates by moving from two different locations into the space vacated by company A (consolidations can also happen from separate offices at the same address). Within the same building company D moved into the space vacated by B and is represented by the circle in the figure above. The space D previously occupied was then split between G and H and this is where the chain ends. The other sub-chain is less complicated.

In addition, data on the type of business (Industrial or Office TYPE), number of employees and the floorspace available from the original study was incorporated to enhance the opportunities for analysis, however this was limited to only first moves and was not available for all occupiers. A decision was made at the outset of the original research that data would not be collected for all occupiers in all chains as it would be too time consuming, however it would still be possible to revisit occupiers to collect the missing data if it was deemed to be desirable.

Figure 2 – An example of a chain structure

GIS visual representation



Database

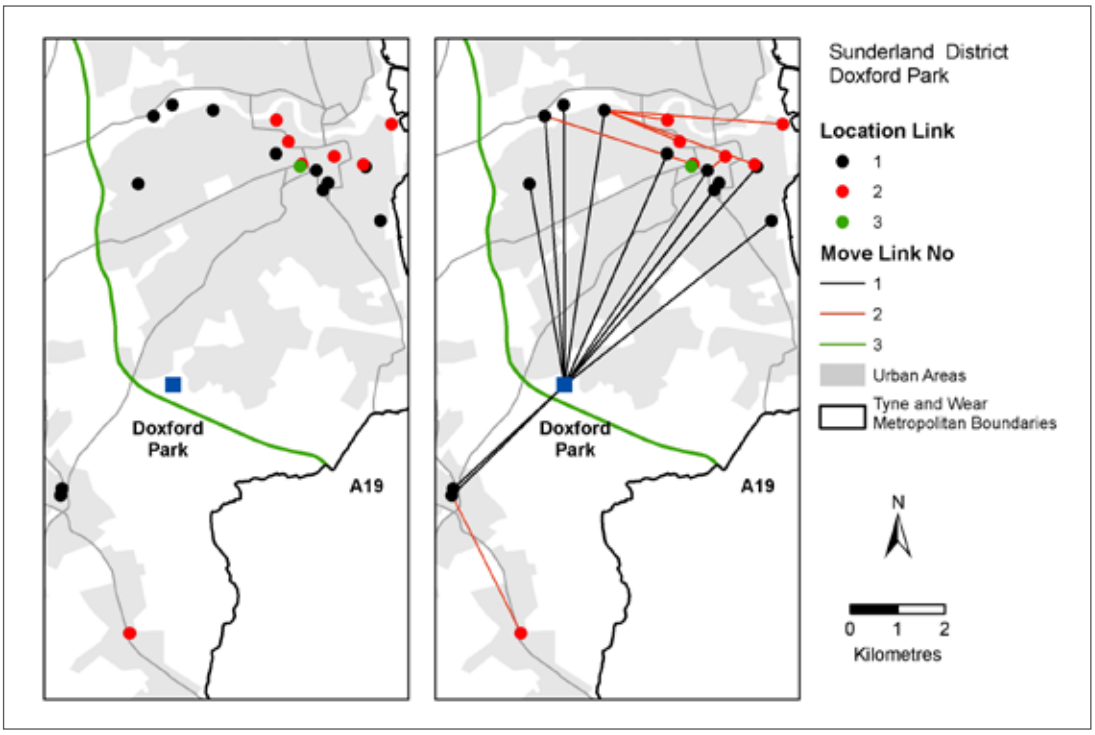
Unique identifier	Chain number	Link number	Consolidation	Previous occupier	Current occupier	Chain end
1	34	1		A	B	
2	34	2	Yes	B	C	
3	34	2	Yes	B	D	
4	34	3		D	E	
5	34	3		C	F	End
6	34	3		D	G	End
7	34	4		E	H	End

2.3 Movements Dataset

The business and address dataset represents the locations (nodes) of business premises and their positions in their respective chains, but does not convey chain movement effectively. Therefore, an additional dataset was generated to 'join up the dots' between the development and the address in the chain.

In addition to the data held in the Business address database the length of the line in km is included to allow a basic measurement of the distance of moves as the crow flies. The database attached to each move contains the same information provided for the point/address data to allow visual representation and analysis of the moves taking place.

Figure 3 – Joining up the dots



Constructing the database

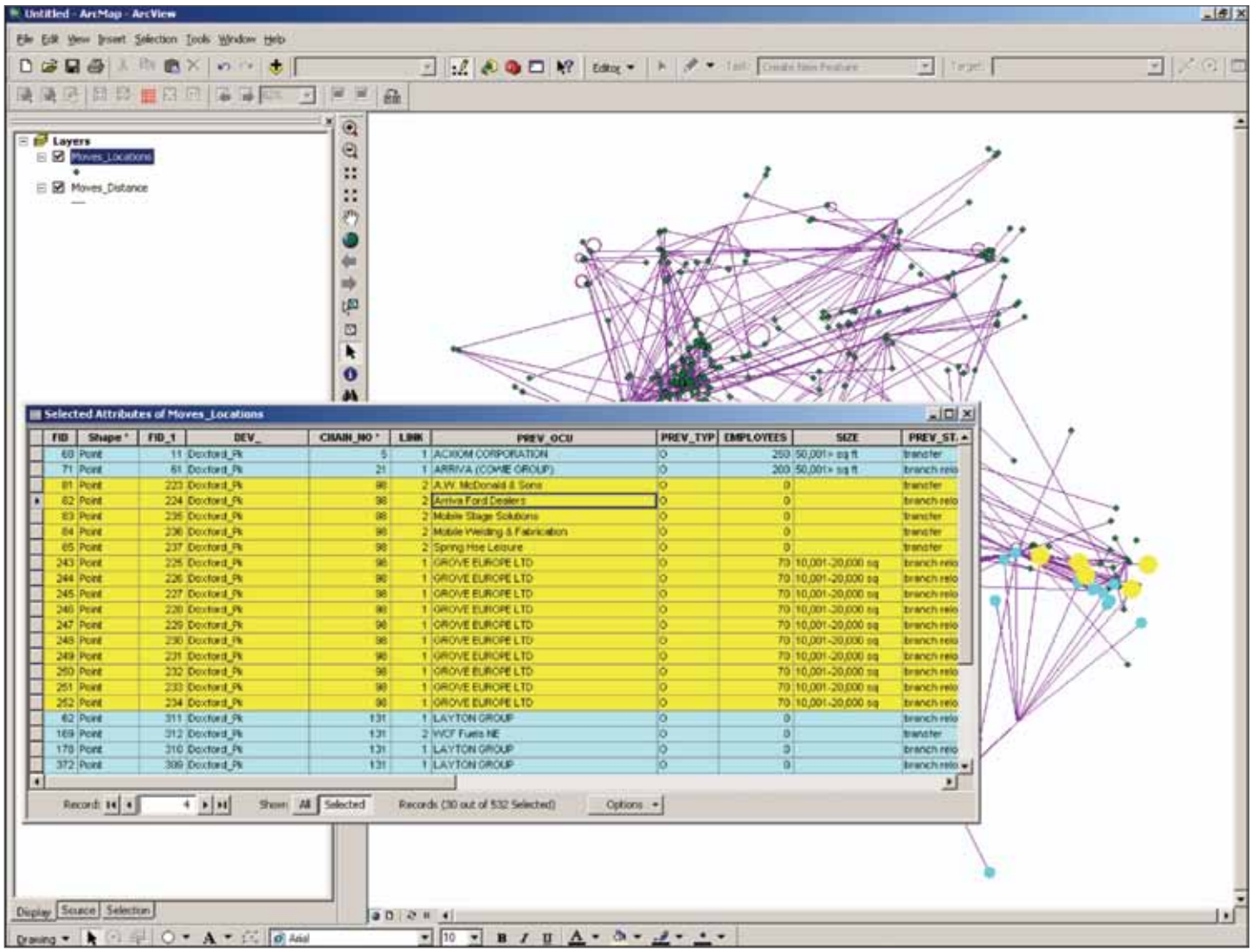
2.4 The GIS database

The structure and design of the database allows the data to be integrated and displayed relative to specific characteristics, – its type (industrial, office or mixed-use), if it is a chain end, a first move or a vacant property. Like any other database using the information provided it is possible to export data based on certain characteristics which can then be further manipulated. For this study, it was helpful to have quick access in viewing chains for one development in isolation to the other developments. This process can be adopted to create any combination of new files based on the original database, for example files which display and contain information only on chain ends or industrial occupiers. Unlike other databases the spatial component provides the capacity to visually display the information relative to location. It is possible to calculate the distance of a move relative to chain length and interpret the characteristics of where chains end or vacancies are located.

Figure 4 is an illustration of a working GIS database. As stated earlier, the development of the database itself is a key output that can be added to, along with the ability to display data in such a way that can feed into further analysis.

Due to the design of the database, as outlined above, it is possible to carry out some complex analyses comparing the spatial location of businesses and the nature of the movement along the chains.

Figure 4 – The Working Database



03 Analysis of GIS chaining data

The research provides information on employment generation, displacement, change of use, number of chains and their length, the distance of moves and characterisation of the locations from where the relocations originated and vacant properties are located (Greenhalgh, 2003). Adding the data into GIS adds value to the 'spatial' component of the study. The analysis of the data can be split into two key components in relation to key categories identified, such as development type, based upon:

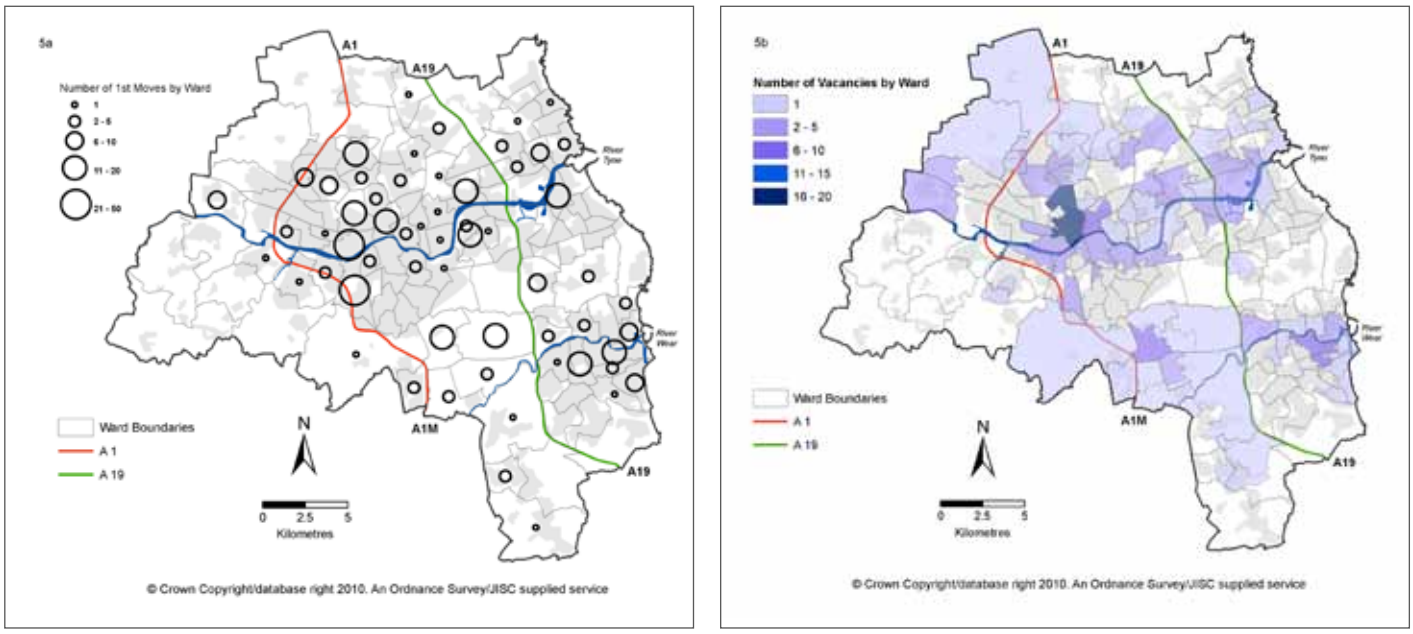
- location – vacancy, chain end or first move and;
- movement – length and number of links in the chain.

3.1 Location queries

It is possible to generate a number of queries relative to the location of a business address in the chain. The analysis can be split by focusing on first moves only. Figure 5a represents the origin of the occupiers on the 20 developments by number per ward. It is therefore possible to rank the data and allow comparison between the districts and the (donor) wards within them, which have been the source of occupiers for the 20 developments. Most relocations were made to facilitate business expansion (55%) or rationalisation/contraction (17%) (Greenhalgh *et al.,* 2003). Why were firms unable to accommodate such adjustments without moving? What are the characteristics of the donor locations and can these explain the reasons for moving, for example forcing factors? Some locations are better able to absorb vacant property (filtering or take-up) which in part may be assessed by the density of businesses in these locations. Figure 5b presents the spatial pattern and location of chain ends relative to status identifying those wards with the highest percentage of vacancies.

This data replicates the findings of Greenhalgh (2006) but presents the information in map rather than table format. It is possible to carry out the same level of analysis over a shorter time period and incorporate additional information to permit a better understanding of locations. Using the GIS software it is possible to focus on the interaction of place between developments rather than focusing on the chains of one development. How many of the business addresses are involved in the chain of more than one development and does this tie into their status (starter or nursery units), is it an indicator for high levels of excitation or is it something specific about the location? The structure of the database enables the number of points that have more than one movement to be calculated as well as the proportion and number of first, second or third moves, removing the impact of consolidations. Figures 5a and 5b highlight the location of those address with 3 or more moves associated. This figure offers some representation of market excitation and identifies the locations that have supplied occupiers to the new developments or have fuelled the chains arising from the first moves, feeding through to either a new business occupying the vacated property (absorption) or a vacant chain end. It should be noted that the circles in Figure 5a are positioned and the centre of the ward they represent rather than the actual location of the chain properties.

Figure 5a and 5b – Concentration and location of first moves and vacancies by ward



Analysis of GIS chaining data

The highest numbers of vacancies are on the periphery of Newcastle CBD but this also has the greatest stock of property so as a percentage the level of vacancy may be relatively lower than locations with nominally lower recorded levels of vacancy. Two other areas register with high levels of vacancy, these are the periphery of Sunderland City centre and Washington new town. The former has a similar status to that of the areas fringing Newcastle City centre and may be similarly associated with a 'hollowing out' effect, a term first used in connection with a chaining study by Robson *et al.,* (1998); the latter was originally identified by the author in the first analysis of chaining data (see Greenhalgh *et al.,* 2000) when it was observed that a noticeable number of, mainly industrial occupiers, had relocated from Washington to new premises located in Sunderland Enterprise Zone. This was because the New Town was no so 'new' any more and leases that had been granted 21 or 25 years ago were expiring, allowing firms to leave their old premises behind, lured to brand new accommodation in Sunderland Enterprise Zone with the incentive of no business rates payable for the life of the zone (Greenhalgh *et al.,* 2000).

Figure 6 shows the density of moves by location; those with the highest number of recorded moves are Sunderland Enterprise Park which attracted a high number of occupiers from Sunderland City centre, Team Valley Trading Estate which is the largest development in terms of total floorspace, Newcastle Business Park which attracted occupiers from Newcastle City Centre, the Regent Centre which is an ageing suburban office location in north Newcastle (famously the home of Northern Rock); there are two somewhat spurious locations registering high numbers of moves (TEDCO in Jarrow and OWNERS at Newburn) both of which are small business centres. When the analysis is repeated by floorspace and number of employees both of these locations diminish in stature.

Figure 6 – Density of moves including consolidations

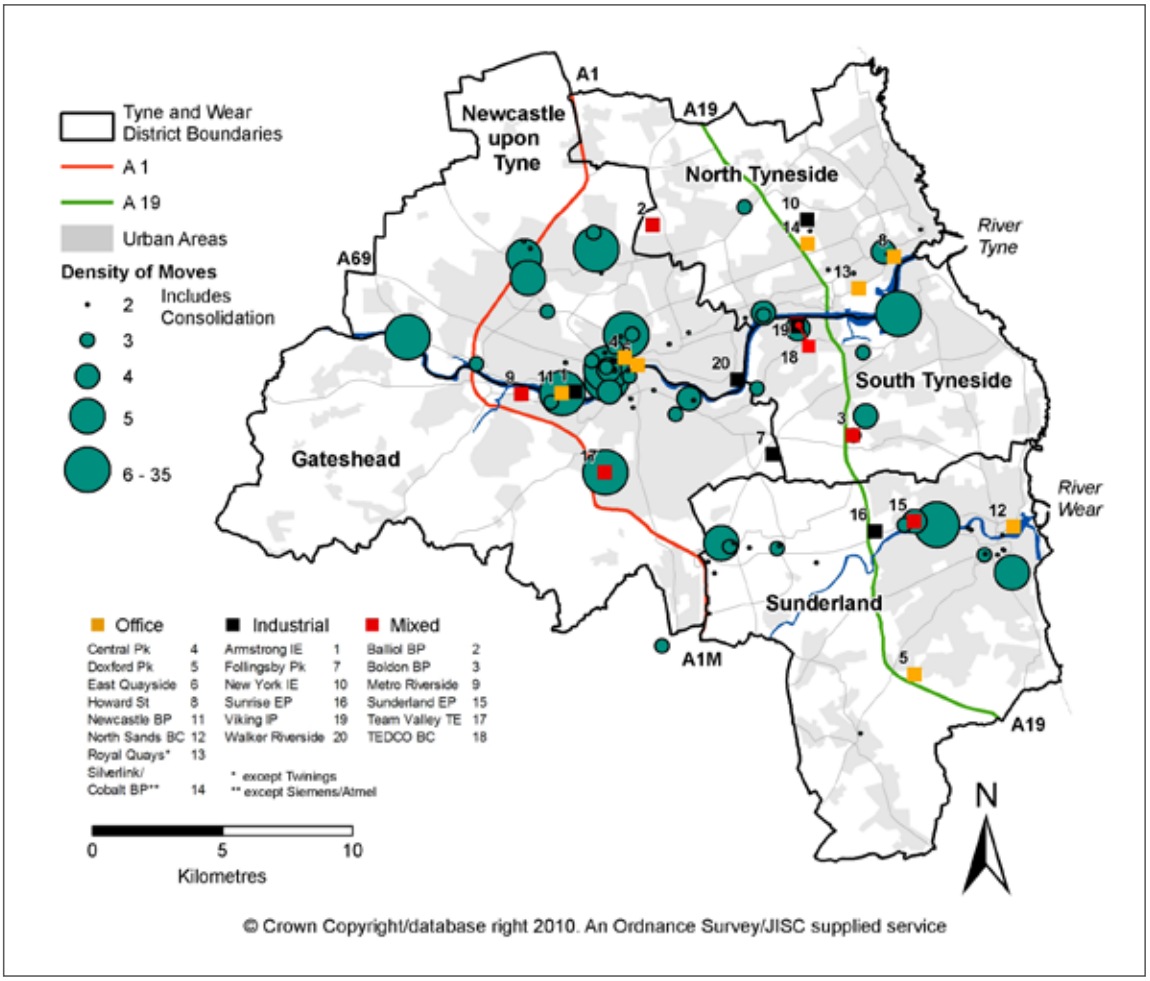
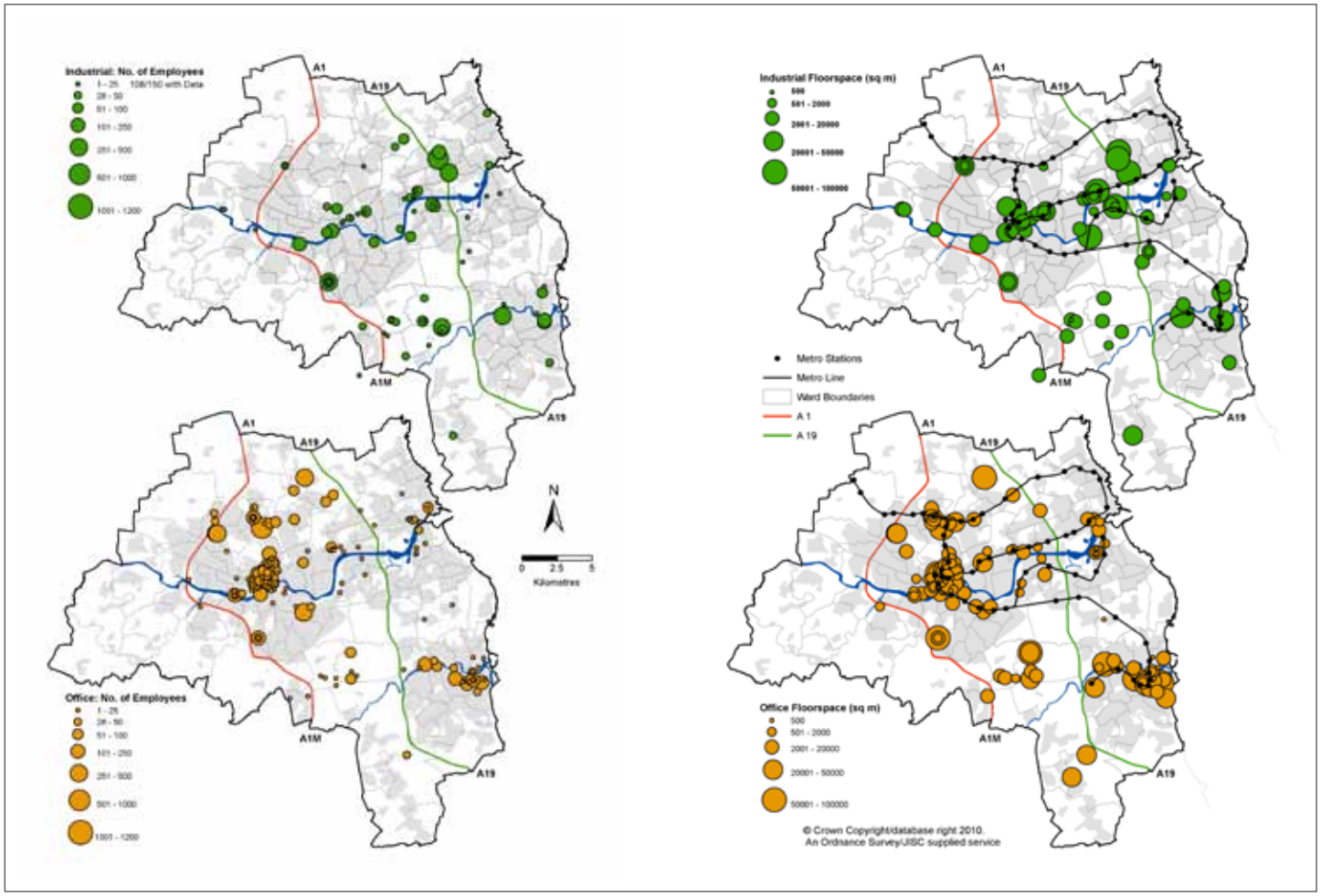


Figure 7 shows the density of moves by occupier type (Industrial/Office) and size (floorspace and employees). The pattern of moves in proximity to the Tyne and Wear Metro is remarkable, particularly for office occupiers. Two locations with a high density of moves that are not well served by public transport are Balliol and Silverlink/Cobalt business parks, both of which had Enterprise Zone status and have been criticised from a number of quarters for being unsustainable business locations that disregard national planning guidance (PPG13/ PPS4) and encourage car usage. Another location that appears remote from both Metro and A1/A19 corridors is Washington; however its location between the two major roads and its own extensive dual carriageway network mitigates this weakness, particularly for industrial use. Further analysis would be able to test the strength of relationship between end user type and proximity to transport infrastructure.

Figure 7 – Density of moves by occupier type and size (floorspace and employees)



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Analysis of GIS chaining data

3.2 Analysis of movement

The number of links in a chain varies from just one to four, as the chain lengthens the number of moves decreases. However, does the distance decrease correspondingly and how does this vary according to development and type or by District? Table 2 was produced using the movements database. It should be noted that the figures are different from those generated by the original analysis (See Greenhalgh *et al.,* 2003) due to the way that the GIS database treats consolidations. The original analysis recorded 251 chains with 550 points or nodes and 376 chain ends generating just under 1200 property transactions (moves); the new analysis contains the same number of chains, but fewer nodes (496) due to the treatment of consolidations, but the same number of chain ends.

The new analysis generates information on the number of links in a chain as well as chain length. It is therefore possible to look at distance of moves between all links in a chain - the number of links includes consolidations. In terms of the distance of move calculations these are useful as previously we only had a calculation of the distance of first moves; we would expect that as occupiers move (filter) up the property ladder, properties move down such that the further that a property is along a chain the smaller it is the distance that an occupier is likely to move to such premises would reduce; this is proven to be the case with the average distance of links decreasing from 4.8 km first moves/ links, to 2.8 km for second, 2.6 km for third and 1.3 km for fourth, although it should be noted that there are few of the latter.

Most average move distances lie between 2.4km and 5.9 km, with industrial developments recording a higher average distance of move (4.2km) than office developments (3 km). There are three developments that fall outside this range, firstly Sunrise Enterprise Park, located on the edge of Sunderland beside the A19 that recorded an average distance of move of 7.4km; this is consistent with the findings of the original analysis, the result being attributed to an industrial development located next to one of the conurbation's two main north/south carriageways. The other two are office developments with lower average move distances (Central Park and East Quayside) both of which are situated on the fringe of Newcastle City centre and have thus generated short distance relocations due to their proximity to the city centre.

The reliability of the distance calculation diminishes the further along a chain that the move takes place due to the relatively small number of moves that contribute to the average; this is particularly the case to third and fourth links, for example Royal Quays and Team Valley have only two 'third links' and Sunderland Enterprise Park has one 'fourth link'.

The resulting GIS would be capable of capturing the spatial concentration of chain ends and their status to identify locations that are slow to absorb vacant office and industrial property.

Analysis of GIS chaining data

Table 2 – Analysis of chain length, number of links and distance

		Chain length					No. of links					Distance					
Type	Name	1 Link	2 Links	3 Links	4 Links	No. of chains	Link 1	Link 2	Link 3	Link 4	Total no. of moves		Link 1	Link 2	Link 3	Link 4	Average all moves
Industrial	Armstrong IE	5	0	1	0	**6**	6	1	1	0	8		3.1	0.4	0.4	0	2.4
Industrial	Follingsby Pk	3	0	0	0	**3**	3	0	0	0	3		3.2	0	0	0	3.2
Industrial	New York IE	6	2	1	1	**10**	15	9	2	1	27		6.8	4.7	2.8	1.6	5.6
Industrial	Sunrise EP	1	2	1	0	**4**	4	4	1	0	9		10.4	6.2	0	0	7.4
Industrial	Viking IP	6	3	0	0	**9**	13	4	0	0	17		3.2	0.1	0	0	2.5
Industrial	Walker Riverside	4	1	0	0	**5**	6	1	0	0	7		4.5	0.7	0	0	3.9
	Sub Total	**25**	**8**	**3**	**1**	**37**	**47**	**19**	**4**	**1**	**71**	**Ave.**	**5.2**	**2.0**	**0.5**	**0.3**	**4.2**
Office	Central Pk	6	5	1	0	12	15	8	1	0	24		1.7	1.5	0.7	0	1.6
Office	Doxford Pk	3	3	1	0	7	21	8	1	0	30		5.4	2.3	0.1	0	4.4
Office	East Quayside	5	2	1	0	8	20	7	1	0	28		1.3	1.0	0.4	0	1.2
Office	Howard St	9	2	0	0	11	14	2	0	0	16		2.5	4.7	0.0	0	2.8
Office	Newcastle BP	12	11	7	0	30	45	26	6	0	77		4.2	1.2	0.3	0	2.9
Office	North Sands BC	6	2	0	0	8	12	2	0	0	14		5.2	0.7	0.0	0	4.6
Office	Royal Quays	7	2	2	0	11	18	4	2	0	24		6.2	0.5	1.2	0	4.8
Office	Silverlink/Cobalt BP	7	5	1	1	14	17	9	3	1	30		7.2	2.9	1.0	0.8	5.1
	Sub Total	**55**	**32**	**13**	**1**	**101**	**162**	**66**	**14**	**1**	**243**	**Ave.**	**4.2**	**1.9**	**0.5**	**0.1**	**3.4**
Mixed	Balliol BP	5	3	0	0	8	8	3	0	0	11		3.4	1.1	0.0	0	2.8
Mixed	Boldon BP	12	6	1	0	19	24	8	1	0	33		5.6	2.8	1.6	0	4.8
Mixed	Metro Riverside	2	3	0	1	6	13	4	3	2	22		5.1	6.3	0.6	0.9	4.3
Mixed	Sunderland EP	18	5	4	1	28	34	18	6	2	60		5.7	5.3	4.4	8.2	5.5
Mixed	Team Valley TE	26	5	2	0	33	24	8	2	0	34		6.7	2.7	10.4	0	5.9
Mixed	TEDCO BC	16	3	0	0	19	19	3	0	0	22		4.5	4.7	0.0	0	4.5
	Sub Total	**79**	**25**	**7**	**2**	**113**	**122**	**44**	**12**	**4**	**182**	**Ave.**	**5.2**	**3.8**	**2.8**	**1.5**	**4.7**
	All Developments	**159**	**65**	**23**	**4**	**251**	**331**	**129**	**30**	**6**	**496**	**Ave.**	**4.8**	**2.8**	**2.6**	**1.3**	

04 Multi-criteria analysis – identifying indicators of displacement

The need to relocate is usually driven by a combination of 'push' and 'pull' factors. Push factors typically result from a mismatch between the buildings that firms occupy and their needs (see Forthergill *et al.,* 1987; Harris 2002; Greenhalgh 2006). For a firm or organisation to choose to relocate, there needs to be a mismatch that cannot be resolved by expanding on site or refurbishing obsolescent premises (see Turok 1989). Pull factors are the socio-economic, physical, environmental and legal conditions offered by competing locations with available floorspace; in addition to which developers and public sector bodies may offer financial and fiscal incentives such as tax breaks, rates holidays, rent-free periods and contributions to capital works.

The original research (Greenhalgh *et al.,* 2000) identified better location, quality of accommodation, availability of workforce and value for money as being the most important reasons for choosing a destination; of secondary influence were security, improved environment and public sector assistance. The spatial distribution of relocations was also analysed and 'hollowing-out' of a number of locations, notably Grainger Town in Newcastle, the eastern fringe of Sunderland City and Washington New Town, was observed. Parallels were drawn with a typology of area characteristics developed by ERS (1998) for English Partnerships' 'Raising the Temperature' research. A hybrid typology was assembled for the 20 developments in Tyne and Wear based on the ranking, by occupier, of each individual development, of the 'pull' factors that influenced an occupier' choice of destination. The analysis did not systematically investigate the 'pull' factors of the locations in any greater depth.

Multi-criteria analysis – identifying indicators of displacement

Using GIS it is possible to investigate whether the location of a concentration of chain ends, first moves or vacancies, shares similar characteristics with a number of key indicator datasets. Do these characteristics inform the study of the impact of displacement of developments?

Increasingly data is becoming readily available in digital format that can be used in GIS software. Local Authorities readily represent information geographically through the use of maps on websites that are subsequently used in resource management and identification of areas for regeneration and development. The use of Indices of Multiple Deprivation (IMD) and Census data (income support, access to services etc) have been displayed visually to look at variation at local, district and regional level. A wide range of data sets are available to characterise a location over a range of geographic scales, the highest resolution at which data is available is the Lower Super Output Area which sits within a nested hierarchy of geographical administrative boundaries up to District and regional levels (Figure 8). The greater the resolution/fine grain of the data the greater the capacity to look at change spatially within a region in certain attributes or indicators identified in a dataset over space. The IMD represents a combination of datasets that provides an overall score that represents 'deprivation'.

Figure 9 uses IMD data by MSOA to demonstrate that the most deprived areas within Tyne and Wear are situated around the urban cores; the least deprived areas tend to be towards the peripheries of the conurbation. There is little correlation between the pattern of deprived areas, which are predominantly domestic in nature, and commercial and industrial property markets and there spheres of economic activity. This is one reason why the authors decided not to incorporate IMD data into the business activity score (see Section 4.2).

By combining raw data in a similar vein to the IMD but ultimately representing high/low business 'activity' the resulting score can be used to identify a correlation between the location of vacancies and the characteristics of the geographical area where they are found. Having identified these characteristics, it may be possible to identify areas prone to the effects of occupier displacement. As well as helping us to understand the impact of previous property developments, this approach could contribute to the formulation of local, city region and regional strategies.

Figure 8 – Geographical Context of Datasets

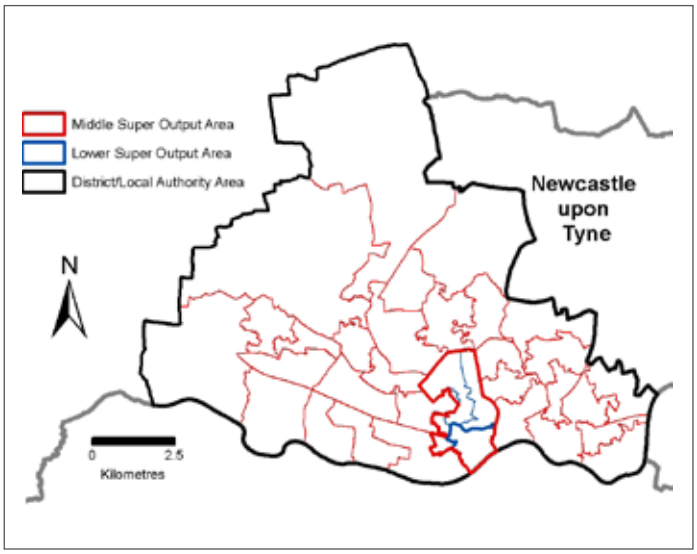

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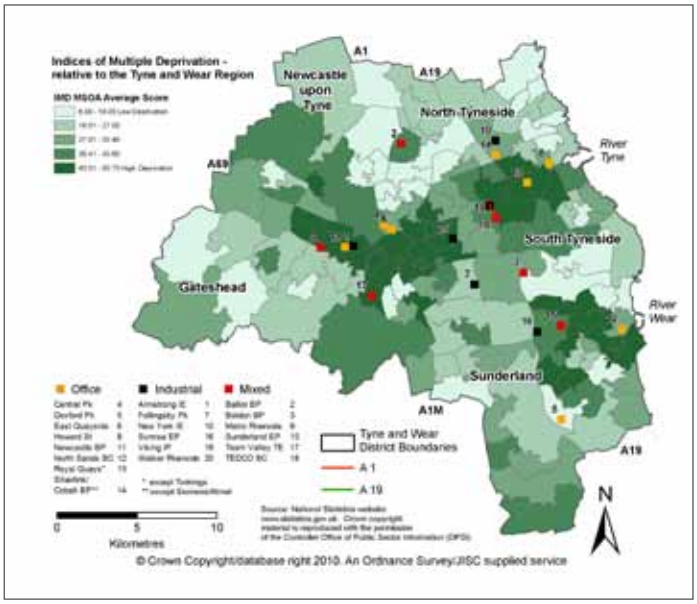
Figure 9 – Index of multiple deprivation by MSOA for Tyne and Wear



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From the wealth of digital datasets available through data portals such as Neighbourhood statistics and Government departments and agencies such as CLG (formerly ODPM) the following have been identified as potential indicators:

- Commercial and Industrial floor space and rateable value statistics
- VAT registration.

The use of two datasets is by no means exhaustive but they were chosen by the authors as they can be used to tell us something about the business 'activity' and characteristics of the location or administrative boundary by which the data is held. One of these datasets goes back as far as 1998 but were collected at District level only – it is only in 2003 that the information become available at a finer resolution of MSOA (Figure 8). The data for this study was collected for chain ends of the 20 developments at a snapshot from 2000/2001 which is when most of the relevant data is only available at the district level. For the purpose of this study, datasets from 2003 provided at the MSOA level have been used to illustrate the potential of developing a business activity score to add a level of understanding of the location of chains. The aim is to highlight the potential application of a study of this type in further work. It should be noted however that the socio-economic, physical and environmental status and condition of an area drifts very slowly due to inertia of these factors thus any error due to a few years incompatibility of dates would only be marginal at most. Further investigation could exploit data collected in 2005 when all the vacant chain ends recorded by the original survey were revisited to determine whether their status had changed. This offers a representation of the absorption of vacant property in local property markets, in some instances extending existing chains further or identifying a change of use.

Multi-criteria analysis – identifying indicators of displacement

4.1 Indicator datasets

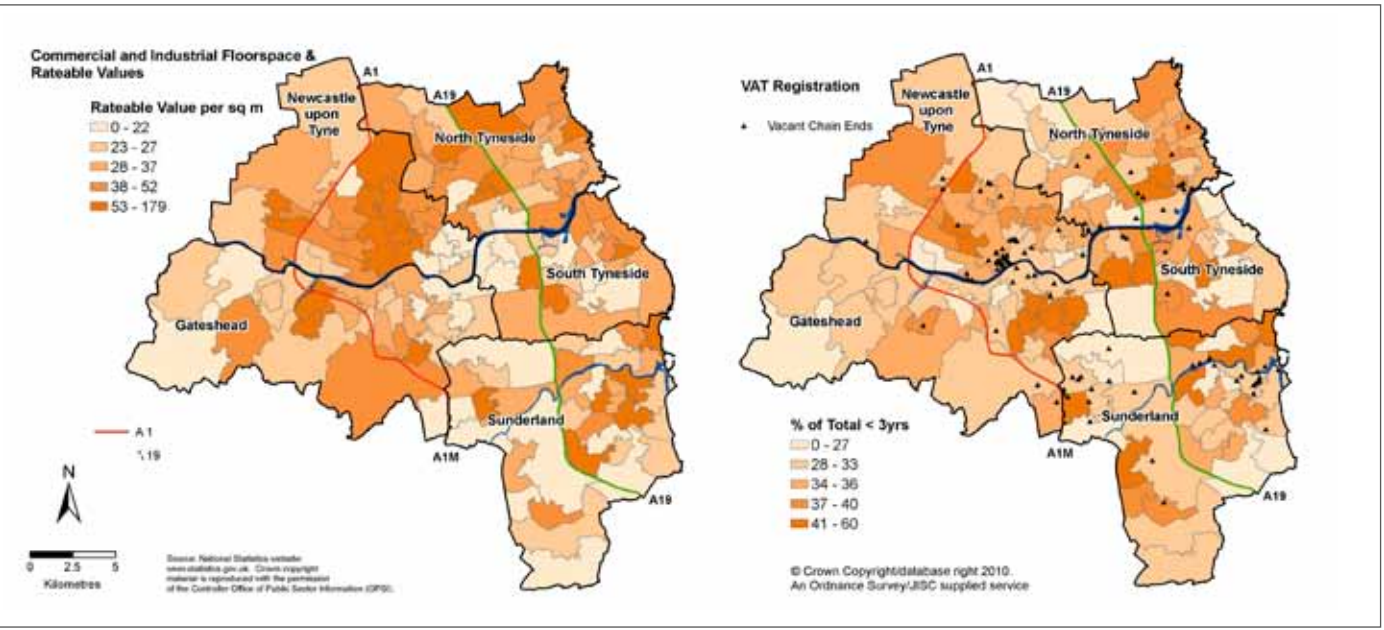
Commercial and Industrial property Rateable Value data is supplied at Local Authority level area only for the time period of 1998 – 2003. Datasets post 2003 are available at MSOA. The dataset provides information on floorspace and its rateable value for non-domestic property sourced from the administrative database of the Valuation Office Agency (VOA) and is accessible online for download via the Neighbourhood statistics website. As a dataset it is possible to analyse net change in commercial and industrial stock over time and, used in combination with other datasets, is a valuable tool for strategic planners when targeting areas to satisfy housing demand and local employment opportunities (ODPM 2005). Information is provided for four categories of 'bulk class': retail premises, offices, factories and warehouses. For each bulk class, the number of hereditaments, the total floorspace, total rateable value and rateable value per m^2 are provided. The business rateable value is based on the annual open market rent for the premises reviewed every five years. The rateable value (RV) of a property is an estimation of its market rental value at the antecedent date of valuation. It is therefore influenced by a complex array of factors, the most significant of which will be the size of the premises, the use to which it is put and its location.

Rateable values

Rateable values may be used as a proxy for property market vitality, with high average RVs indicating a location where there is healthy occupier demand and low average RVs identifying locations where occupier demand is weak (RTPI 2008). Such data may be used, in isolation or in combination with other datasets, as an indicator the relative 'health' of local commercial and industrial property markets within an urban area. It may be inferred that those locations with higher average RVs are more buoyant local property markets with greater resilience to absorb property vacancies whereas areas with lower RVs may suffer from longer term vacancy. One could hypothesise that localities with high average RVs would record low levels of vacant property, relative to the local stock of commercial and industrial property. Conversely, localities with low average RVs may contain relatively higher levels of vacancy. A study carried out in Leeds by Katyoka and Wyatt (2008) has demonstrated that it is possible to use "experimental statistics" provided at a finer resolution than the government vacancy statistics at Local authority level, to establish the density of vacant properties and to identify clusters which were then interpreted relative to their micro -location. There is potential to use this experimental information to enhance the Tyne and Wear study.

Figure 10 shows the pattern of MSOA areas shaded by average RV for the Tyne and Wear conurbation. For the purpose of this study, the dataset collected in 2003 was used and, due to the complexity of the bulk categories, the Rateable Value per m^2 for all bulk classes was used. Higher rateable values (both gross and per unit area) represent a better quality of building in a better location and businesses moving/filtering up the property chain generally occupy premises that command higher rents and as a result attract higher rateable values. We would expect to see occupiers filtering to higher value premises and for lower value/inferior premises to move down the property ladder. A limitation of using the bulk categories is that they contain retail premises which skew the data in some locations. Further work would be required to isolate the datasets to represent just office and industrial bulk categories.

Figure 10 – Analysis by Rateable Value (per sq m) and VAT Registration (% < 3 yrs)



In isolation, due the limitations identified above, the RV map of Tyne and Wear does not display any unpredictable patterns or clusters of high or low values. For example, one would expect the cluster of darkest shaded areas to proliferate in and around Newcastle CBD, and to a lesser extend around Sunderland City centre and other outlying sub-centres. The deprived inner west and east ends of Newcastle show a lighter shade as well as the North bank of Wearside. The lightest shades are predominantly rural areas at the periphery of the urban area that contain a high concentration of green belt land.

VAT

To provide a richer representation of vitality, it was necessary to complement the RV data with other datasets. The New VAT registrations dataset was selected because, not only is the data generated by the same sectors of the economy that contribute to RVs, but the number of new businesses (start-ups) registered for VAT purposes may be used as a proxy for the economic vitality of a location. Thus, a relatively high density of VAT registrations would suggest that an area has a dynamic economic base; conversely, a low density of new VAT registrations would indicate a locality with a weaker economy. New business start ups could be expected to take up available small office suites and industrial units, thus reducing the vacancy level in a locality. Thus, an area with a relatively high level of VAT registrations may be expected to have a low level of vacant business units relative to total stock; conversely, a location with a low level of new business registrations could be predicted to show a higher level of relative vacancy.

All businesses that pay VAT are recorded in the Inter-Departmental Business Register (IDBR). This dataset provides a wealth of information on business activity and size relative to its location with the first of yearly datasets available for 2005 at MSOA level. Information is available on VAT registered companies categorised by age, industry group, local/enterprise, rural/urban, employment size band, public/private, single/multi-site. In this study it is the number of business that have registered within three years in any given MSOA that is of interest covering the period from 2002 to 2005. Is there a relationship with VAT registrations for new business creation that feeds into absorption of vacant space or lack of take-up?

The second map in Figure 10 shows the pattern of MSOA areas shaded by the number of new VAT registrations over a three year period. It can be seen that, despite the two datasets being loosely related there appears to be little apparent correlation between the two maps. However, it is possible to combine the two datasets together, to produce a business activity or vitality score, and overlay the resulting map with the pattern of recorded vacant chain end or first move properties to reveal a different, synthesised representation of the datasets.

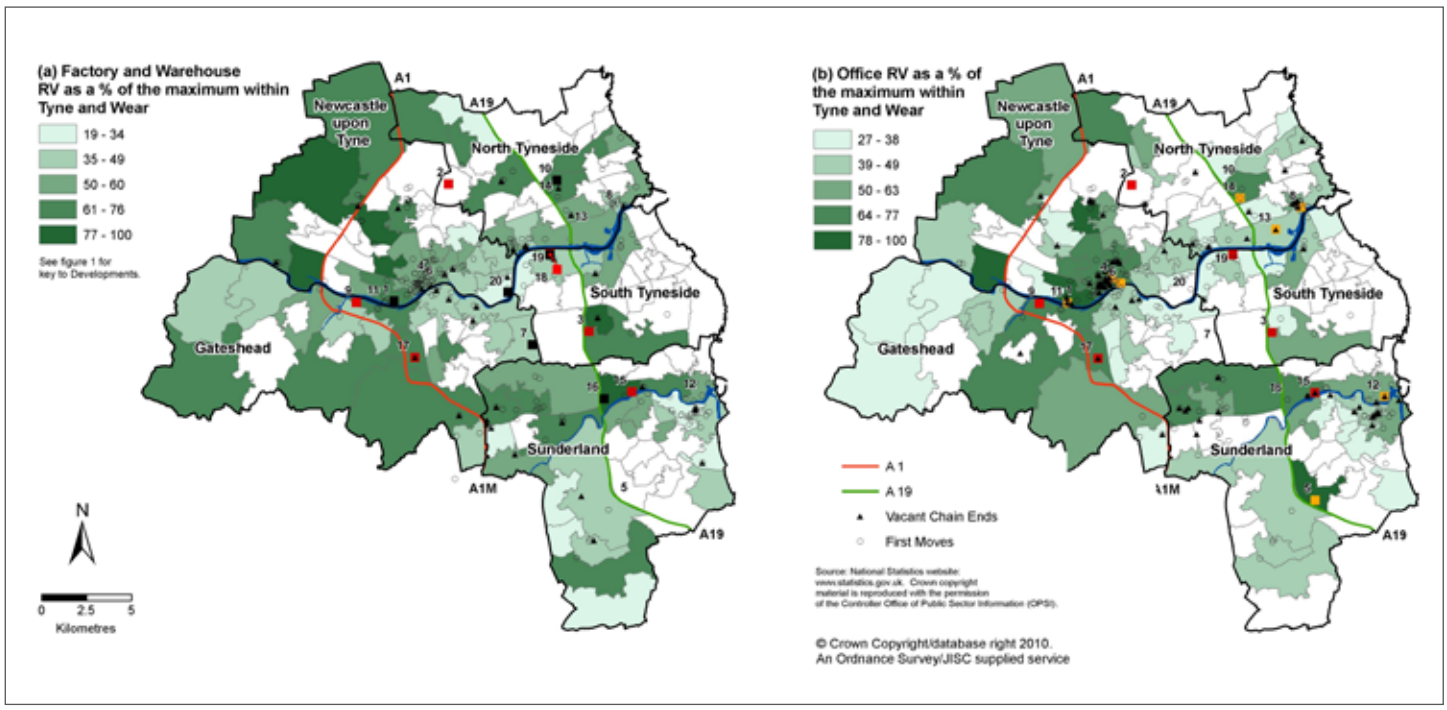
Multi-criteria analysis – identifying indicators of displacement

One of the limitations of using all bulk classes is that it includes retail property which was not covered by the survey and also displays different locational characteristics to office and industrial accommodation. It was therefore deemed necessary to strip out the retail bulk class and analyse the data by combining factory and warehouse bulk classes to represent industrial use and to separate out the office bulk class. All MSOA areas registering a nil rateable value figure were removed and rateable values were then scaled against the maximum RV recorded for the type of use. Figure 11 shows RV overlaid by the location of the 20 developments and vacant chain ends by use. This offers an effective representation of property market vitality by rateable value for the two distinct property types.

Figure 11 may be interpreted as follows; for industrial property, the areas with high average RVs are those that have benefitted from new industrial development in a location where little old industrial stock previously existed that may otherwise reduce the average. Such locations include Sunderland West (SEP and Sunrise; 15 & 16 respectively); West Boldon (3); Newburn Riverside and Airport both of which are situated beside the A1 western bypass. These locations contain few if any vacancies. Most vacant chain ends are situated in the old industrial areas to the east of Newcastle, Gateshead and Sunderland, which record low average RVs of less than half the highest average RV.

The pattern for average office RVs is broadly similar to that of industrial, with a few notable anomalies. The highest average office rateable values again occur in locations that previously had little if any office stock, for example Doxford Park (5), Newburn Riverside, Newcastle West (Business Park 11). Interestingly, the CBDs record lower average RVs due to the quantity of inferior stock that exists; this is particularly prominent in Sunderland City centre which has no significant office market to speak of. Locations recording low average office RVs are mostly situated along the banks of the River Tyne to the east of Newcastle City centre. Many vacant chain ends are located in and around Newcastle and Sunderland City centres and Washington, evidencing the hollowing out of core areas.

Figure 11 – Industrial and Office relative Rateable Values by MSOA (VOA RVs 2003)



4.2 A Business Activity Score

Individually these indicators may be used to characterise the nature of the location of the vacant properties, first moves or chain ends. It is only when this information is used in combination does the role of GIS as a tool of adding value to data become apparent. Using GIS to score each individual dataset on a scale that represents the best spread of values, all those locations that score highly in a specific characteristic identified as either positive or negative, when combined, will appear as a distinctive signature. If there is a correlation in the location of chain ends and vacancies identified through the chaining technique, a quantitative measure of the signature of these areas and the characteristics of their vitality or vulnerability can be identified.

Table 3 – Quantile distribution of raw data into five classes

Score	Office and Industrial Rateable Value per m sq	VAT Registrations < 3years %
1	0 – 22	0 – 27
2	23 – 27	28 – 33
3	28 – 37	34 – 36
4	37 – 52	37 – 40
5	53 –179	41 – 60

Table 3 presents the information used to score an individual dataset – raw data is reclassified to a range of values from 1 to 5. The quantile classification method separates raw figures for two datasets of contrasting units of measurement into equal numbers for each class break using the range of values for the MSOAs of Tyne and Wear. This then allows identification of the areas where high or low scoring MSOAs coincide geographically. At present there is no rational for differential weighting of the datasets.

Multi-criteria analysis – identifying indicators of displacement

Figure 12 represents the total for all of the individual datasets – those that score highly will have correspondingly high scores in both of the datasets. The correlation with the business activity score and number of vacant properties is positive but weak. Some patterns do emerge, especially when the characteristics of MSOAs that contain a vacant property are reviewed (see Table 4).

It is evident that there is a relationship with the percentage of new start-ups within three years, a proxy indicator of economic activity, demonstrated by the pattern of increased number of MSOAs containing vacant chain ends and first move properties with a decreasing VAT registration score – fewer start-ups (within three years) as a percentage of the total number of VAT registrations.

Table 4 – The number of MSOAs that contain vacant or first move properties by Score

Score	Vacant chain ends		First moves only	
	VAT Age < 3	RV per sq m	VAT Age < 3	RV per sq m
1	5	12	8	14
2	22	10	25	14
3	15	9	17	12
4	8	10	10	12
5	3	12	5	13
Total	**53/145**		**63/145**	

Figure 12 – Business activity score

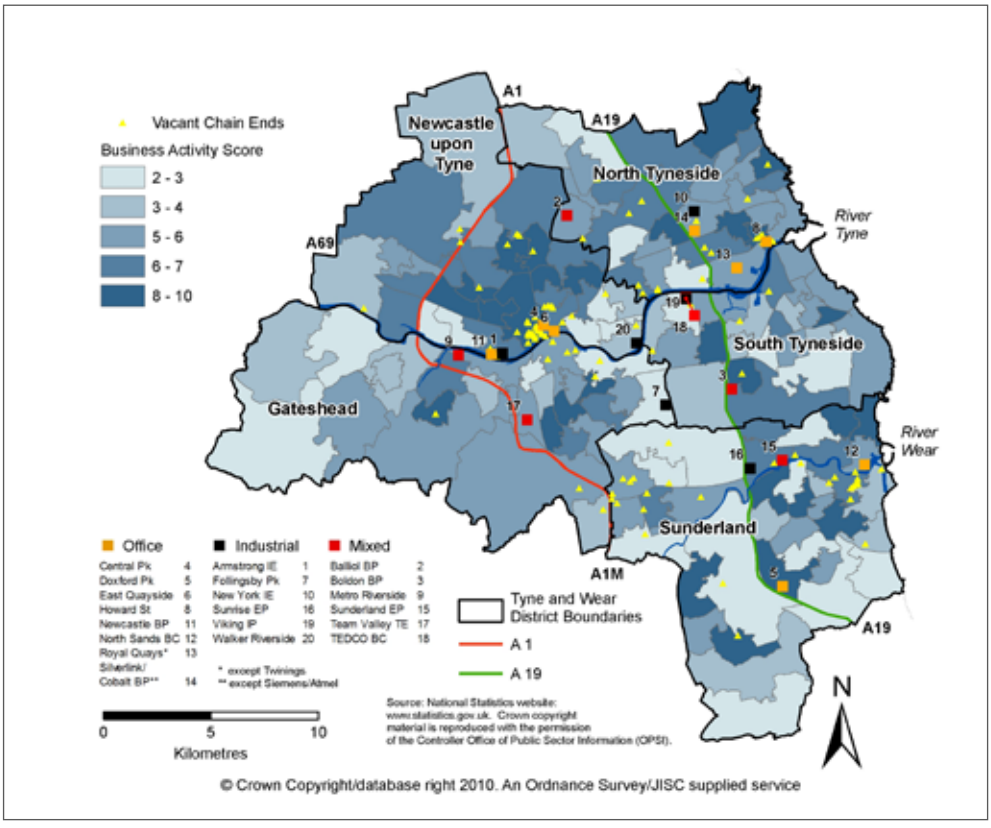


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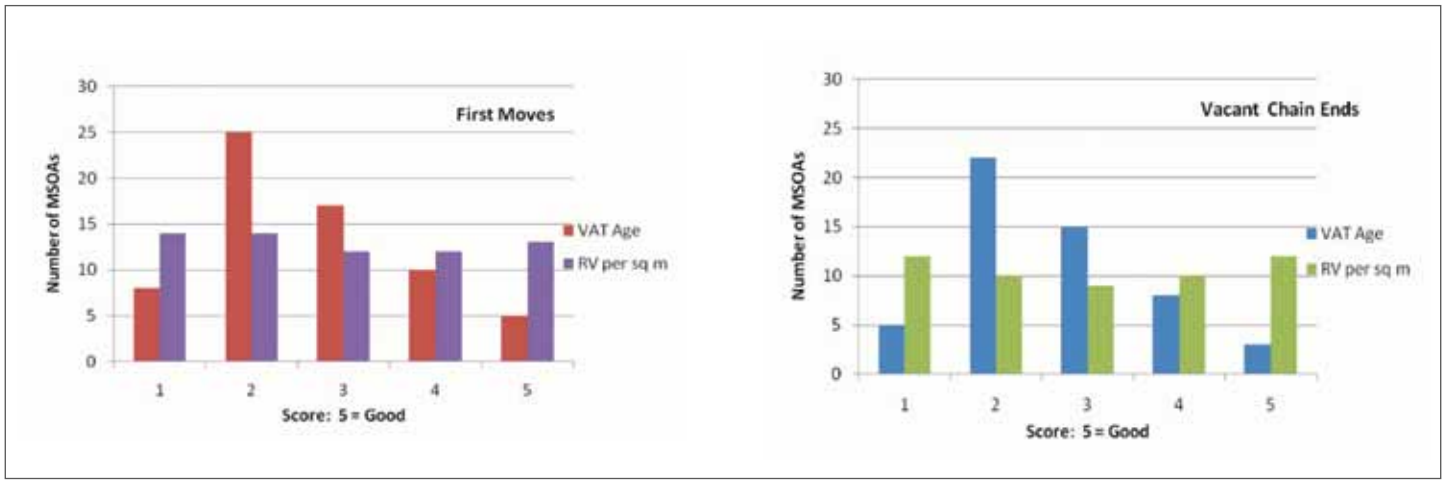
Figure 13 demonstrates that when looking at the Rateable Value there is no distinct pattern in the scores of the MSOAs that contain both vacant and first move properties, all scores 1-5 having an almost equal number of MSOAs (green and purple columns respectively). However, it is evident that when looking at the Score for VAT Age, in both cases over 75% of the MSOAs that contain vacant or first move properties score 3 and below (blue and red columns). Therefore it can be argued that both first moves and vacancies are located in areas with relatively fewer new business start ups.

It is necessary to reiterate that this paper presents a pilot study of the use of GIS to test and demonstrate its suitability for representing property occupier chaining data. The datasets used to generate the business activity scores are three years out of synch with the chain ends and consequently it is not possible to interpret the results with great degree of certainty. Inevitably assumptions have been made about what a dataset can or cannot infer and other datasets, for example vacancy 'experimental statistics', may be identified and incorporated into the business activity score. Other factors may be modelled in relation to business locations, for example proximity to transport infrastructure. In particular, further work is needed to better represent the level of recorded vacancy (by floorspace) against the total stock of office and industrial property in a locality which would allow a greater appreciation of the relative density of vacant chain ends.

Figure 13 – A histogram of the score of MSOAS that contain vacant or first move properties



05 Findings and recommendations

Database design and development is important in increasing the functionality of the data and the ability to analyse interrelationships between the different categories of information provided. In some respects it is harder to convert a pre-GIS database into GIS than one designed with GIS application in mind, but some key lessons have been learnt for the future development of this dataset and further studies.

5.1 Key findings

It has been demonstrated that it is possible, and is a relatively straightforward and logical process, to translate property occupier chaining data into a GIS. The data processing phase, whilst laborious, was truncated due to the inheritance of a pre-existing Excel database record of office and industrial occupier chains in the study area incorporating embedded data on end user type and firm size by floorspace and number of employees. These characteristics, particularly office/industrial classification was crucial to our ability to analyse data in variety of ways.

The GIS was able to replicate and verify the findings of the original research, for example, to calculate not only the average distance of first moves, but for links all the way down the chains, which confirmed the accuracy of the original calculations to the nearest 500m and that the average distance of move diminished the further they occur along a chain (see Table 2).

The spatial distribution of relocations, from first moves to chain ends and all points in between, has been illustrated with GIS, replicating what was originally done on Ordnance Survey maps. This has confirmed the hollowing-out of Newcastle and Sunderland CBDs and Washington New Town. A particular focus of the research is on the spatial distribution of vacant chain ends. Not only has the GIS provided a clear and accurate representation of vacant chain end properties, but has also been able to relate their pattern to other indicator datasets such as industrial and office rateable values and VAT registrations. By studying the incidence of first move origins and vacant chain-ends by ward, it is possible to identify donor wards of occupiers who relocate to new office and industrial developments, and scale the relative concentration of vacant chain ends across the conurbation (Figures 5a and 5b).

The representation of the density of all moves effectively identifies the locations with the greatest levels of property market excitation generated by the twenty new developments (see Figure 6), however these ‘hotspots’ did not accurately portray the scale of the moves by firm size. Fortunately, the original survey had recorded the approximate floorspace and number of employees for most relocating firms so it was possible to produce new maps (see Figure 7) that represented scale of first moves by both end use (office/industrial) and firm size (by floorspace and number of employees). The first moves/links are most significant as they are the moves directly associated with the supply of new office and industrial accommodation; they also constitute the majority of all movements (63%). This permitted interpretation of the two property market sectors and provided an opportunity to introduce some geographical context to the analysis, for example by imposing road and metro transport infrastructure onto the maps. The proximity of the location of office occupier movements to the Tyne and Wear Metro was remarkable. There is further opportunity to explore the relationship between both office and industrial occupier locations and strategic transport infrastructure.

Two indicator datasets (Rateable Value and VAT registrations) were tested to identify whether they could shed further light on the pattern of vacant chain ends. A business activity score was compiled to represent the relative economic health and property market vitality of MSOA areas within the Tyne and Wear conurbation. The two datasets are employed to offer an alternative interpretation of patterns of the origin of first moves and incidence of vacant chain ends. Of the two, the strongest correlation with both first move origin and the location of vacant chain end, by MSOA, was with VAT registrations within a three year period. This indicator is associated with economic activity and enterprise that would generate new businesses or start-ups that would typically take-up small office and industrial units, thus absorbing vacant accommodation and contributing to property market filtering. There is an opportunity to further refine this analysis by splitting the Rateable Value dataset by bulk class and analysing office and industrial first moves and chain-ends separately to determine whether a stronger correlation exists. The business activity score is imperfect and capable of refinement by adding, for example, other (experimental) indicator datasets such as vacant property.

5.2 Recommendations

The project establishes the potential to use GIS multi-criteria analysis and a business activity score technique as a tool, not only for evaluating the impact of property market interventions, but for modelling future area based policy interventions, by representing spatial characteristics that may be used as a predictor for weakness and vulnerability or vitality and resilience. This approach is not dissimilar to work carried out over a decade ago by ERS for English Partnerships, to develop a typology of area characteristics that could inform strategic property investment decisions. It could also contribute to spatial planning and economic strategies at both regional and city region levels.

This work should therefore be of interest, and the model of some use, to a variety of policy makers including Local Authorities and, Development Agencies and Local Enterprise Partnerships, the national Homes and Communities Agency, Regeneration and Development Companies and emerging City Region bodies.

This is a fertile field for further research and development, offering a range of opportunities and a breadth of different applications. Even ignoring property occupier chains and property market filtering, there is value in using GIS to exploit existing and emerging datasets, that are increasingly available at finer resolutions, to characterise cityscapes from an economic and property market perspective. It may be possible to produce an Index of Property Market Vitality (IPMV) at, for example, city region level, to identify the push and pull factors that contribute to mis-match and encourage occupier displacement, similar to the way that IMD and census data is used to represent the wellbeing of localities from a domestic and demographic perspective.

Findings and recommendations

5.3 Further work

The following list of 10 opportunities, for further work that may be undertaken to improve and extend this project, is by no means exhaustive; funding would be required to deliver some these:

1. Incorporate data gathered from revisiting vacant chain ends into analysis;

2. Carry out longitudinal studies of office and industrial developments as they come on-stream in order to reveal more accurately the impact of the supply of new business space on occupier markets;

3. Gather comprehensive employment and floorspace data for all links in occupiers chains in order to calculate full additionality;

4. Refine the use of VOA rateable value data in the multi criteria analysis to achieve a better fit with discrete property market sectors;

5. Use VAT datasets to develop a diversity index of business; does a more diverse business base support greater local infrastructure of service provision and lead to a more desirable location from a business perspective?

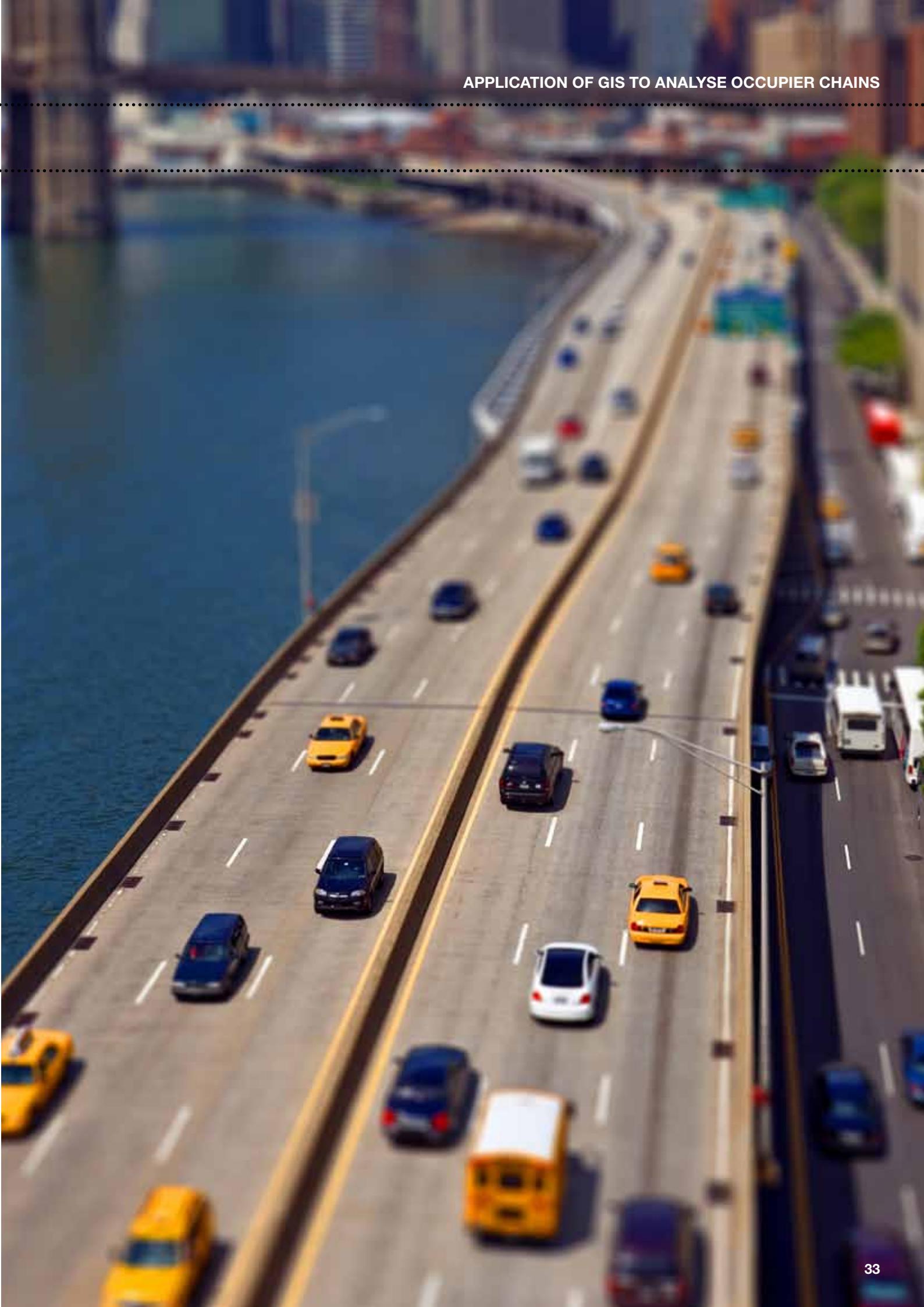
6. Incorporate experimental property vacancy dataset to enhance the analysis of the incidence and duration of property vacancy in relation to recorded occupier displacement;

7. Exploit other property market datasets compiled by Real Estate Analysts, that may be compatible with GIS;

8. Pursue analysis of the proximity of transport infrastructure to office and industrial locations using network analysis, travel times and function;

9. Use data captured by other chaining studies to replicate the approach established by this project;

10. To use GIS to inform spatial planning and strategic investment decisions.



Glossary of acronyms and terms

Additionality

The extent to which activity takes place at all, on a larger scale, earlier or within a specific designated area or target group as a result of an intervention (ODPM 2004)

CDC

City Development Company

Chaining

The study of the movement of occupiers when the relocation of one generates a void that is reoccupied by another, and so on, until an end point is reached whereby the property is absorbed or remains vacant or is developed for an alternative use

CLG

(Department of) Communities and Local Government

DETR

Department of the Environment, Transport and the Regions (became ODPM)

Displacement

The proportion of the intervention's output/outcomes accounted for by reduced outputs/outcomes elsewhere (ODPM 2004)

Filtering

When properties, that have become vacant due to their previous occupiers having relocated, are re-occupied by firms at different stages of their industrial and commercial development (DoE 1995)

Geo-referenced

X-Y spatial coordinates (easting and northing)

GIS

Geographic Information System

HCA

Homes and Communities Agency
(formerly English Partnerships and Housing Corporation)

IMD

Index of Multiple Deprivation

LSOA

Lower Super Output Areas

MSOA

Middle Super Output Areas

ODPM

Office of the Deputy Prime Minister (now CLG)

PPG13

Planning Policy Guidance note 13

PPS4

Planning Policy Statement 4

RDA

Regional Development Agency

RICS

Royal Institution of Chartered Surveyors

RV

Rateable Value

URC

Urban Regeneration Company

VAT

Value Added Tax

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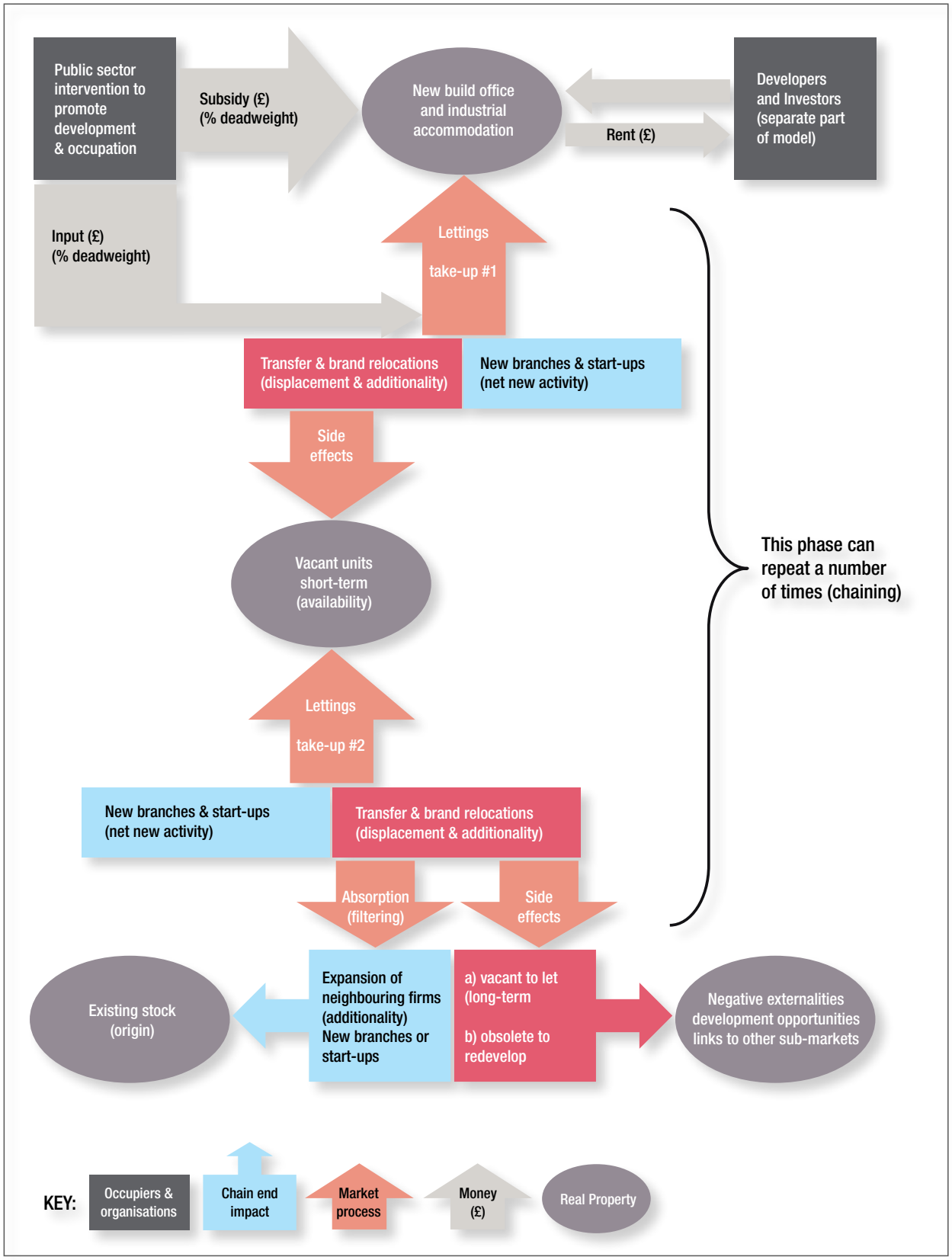
Appendix A

Model of a commercial property market to illustrate how occupier chains are generated by occupier displacement and vacant property is absorbed by the filtering effect



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