Preliminary Draft

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Land Use Regulation and Retail: Space Constraints and Total Factor Productivity

Paul Cheshire, Christian Hilber and Ioannis Kaplanis, LSE

Abstract

Retailing is a sizable sector of the economy – on a reasonable measure of employment the second largest industry in the UK. Land use policies in the UK have the effect of restricting the availability of land for retail; in addition 'town-centre-first' policy are designed to concentrate retail development on expensive central land and so increases the cost of retail space. After setting out some of the possible economic implications of these policies this paper uses a unique micro data set of store specific information to estimate the impact on productivity of space and the specific effects of planning restrictiveness on store size. It is the first paper to analyse the contribution of space to productivity and to relate that firmly to land use regulation policies. Our results suggest that productivity rises with store size and that planning restrictiveness by directly constraining store sizes and additionally by raising the price of space reduces productivity in retailing thereby increasing retail prices.

JEL classification: D2, L51, L81, R32.
Keywords: Land use regulation, regulatory costs, firm productivity, retail

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Corresponding author:
Paul Cheshire
Dept of Geography & Environment
London School of Economics
Houghton St
London WC2A 2AE, U.K.
p.cheshire@lse.ac.uk

Land Use Regulation & Retail: Space Constraints and Total Factor Productivity[1]

1. Introduction

Introductory economics tells us there are three factors of production: land, labour and capital. Unless a student of agricultural economics, land as a factor of production will never be mentioned again. Yet space for some industries is a significant input and that would seem to be true of retailing. This is a sizable sector of the economy – on a reasonable measure of employment the second largest industry in the UK. Land use policies in the UK have the effect of restricting the availability of land for retail; in addition 'town-centre-first' policy attempt to concentrate retail development on expensive central land and so increases the cost of retail space. In British cities in the mid 1980s the most expensive land for retail was 250 times as expensive as the most expensive retail land in comparable US cities (Cheshire and Sheppard, 1986).

The British system of land use planning imposes direct restrictions on the supply of land for different, legally defined, categories of use in different locations. The system thus increases the costs of space in all categories of development: residential, commercial, wholesale, industrial and retail. The greater is demand for land for a particular use in a particular location, the greater, other things equal, will be the increase in price that is generated. Over the past 20 years a literature has developed analysing the economic effects of these restrictions and planning imposed costs on development. Most of this work has related to the residential sector but more recently studies have begun to analyse the costs in other sectors. Cheshire and Hilber (2008), for example, examined the office sector and concluded that the additional costs imposed by the operation of the land use planning system in Britain were not only substantially higher than in any other country for which it was possible to get the requisite data but over the period 1999-2005 restrictions on office space imposed the equivalent of a tax on construction costs of more than 800 percent in the most constricted jurisdiction where demand was strongest – London's West End. Anecdotal evidence, at least, suggests such costs may be significantly higher in the retail sector because of strong town centre first policies and the virtual prohibition on large scale out of town retail developments imposed since 1996.

Many countries' systems of land use regulation constrain space for particular types of development in particular types of location. As Cheshire and Vermuelen (2009) argue there are good reasons relating to problems of market failure that suggest such restrictions could potentially improve overall social welfare. The British land use planning system, however, apart from restricting the supply of space to an extent that appears to significantly reduce overall welfare (see Cheshire and Sheppard, 2002) has many peculiar features that impose costs on development. Most notable perhaps is its reliance on the very time intensive and uncertain system of 'development control' as its mechanism of enforcement. As Mayo and Sheppard (2001) showed long ago this

[1] This paper represents work in progress and is still very much a preliminary draft. We would like to acknowledge the funding provided to SERC by ESRC, DCLG, BIS and the Welsh Assembly. We have benefited greatly from discussions with many colleagues and professional contacts and also the help provided by a major retailer, who wishes to remain anonymous, with respect to data access. The authors are responsible for all errors and interpretation.

on its own renders the supply of development more inelastic simply by making the planning decision making process stochastic rather than predictable in its outcomes.

In addition development control is likely to mean that the ultimate decisions taken are less 'plan led' (an hypothesis we briefly investigate here) and more politically influenced, and greatly increase the costs of delay and transactions (see, for example, Allmandinger and Ball 2009; Ball, 2010) associated with the development process. As argued in Cheshire and Hilber (2008) all these costs of compliance will end up negatively capitalised into land prices, as will other costs associated with the planning system, including both the transactions costs involved in negotiating Section 106 Agreement (designed to recoup the value of 'planning gain' for the community) and the value of those Agreements[2]. This is doubly ironic since, of course, this process of capitalisation will be subtracted from any possible value of 'planning gain'. Thus the costliness of the process intended to capture planning gain itself reduces – even eliminates – the value of planning gain. Indeed it is likely that the compliance costs associated with the planning process renders all development non-viable in many locations.

Haskel and Sadun (2009) provided the first attempt by academic economists to analyse the impact of British planning policy on the productivity of the retail sector although the McKinsey Global Institute (1998) had long since concluded that by preventing the emergence of more productive, large format stores and increasing the costs of space, planning policy was seriously impeding the growth of Total Factor Productivity (TFP) in the retail sector. Perhaps overlooked, because hidden in a detailed appendix, is the work of the Competition Commission (2008, Appendix 4.4). They had full access to a very wide range of store specific data for the four main supermarket groups for the period May 2005 to May 2006 covering store sizes from 280 to 6,000 m^2. They also had additional if more restricted data for nine other retail groups. Their analysis produced very strong evidence of the importance (and statistical significance) of store size to profitability and TFP – see for example the results reported in Table 6, Appendix 4.4, Competition Commission (2008). The contribution of the present work is that unlike Haskel and Sadun (2009) we have access to individual store level data complete with full locational details so we can match the store level data to other spatial data. We also have full planning decision data for all local authorities (so far compiled only for England) from 1979 to 2008. This allows us to directly relate store level productivity to local planning policy.

An earlier report, Competition Commission (2000), devoted considerable space to the role of the planning system as a drag on competition in the grocery/supermarket sector and collected a vast quantity of useful and relevant data. Appendix 12.7 of this report, for example, contains careful comparisons of land costs for retail development in various Continental European countries calibrated on a basis as far as possible comparable with those in the UK. This is difficult. Moreover the principles of urban economics predict that land costs for any given use will fall with distance from the centre of a city and also fall as city size falls. The values quoted for France,

[2] Section 106 Agreements are unknown outside the UK – indeed their complexity means that even within the UK they are not widely known: less than half of all Local Planning Authorities (LPAs) have ever negotiated one at all. They are a provision within the legislation governing planning which allows LPAs to negotiate with would be developers a requirement to provide 'community gain' – often low cost housing or public facilities of some kind – as a condition of permission.

summarised in Table 1, reflect this. According to the Competition Commission (2000) land costs in France were five to ten times lower than in Britain. Estimates for Germany and the Netherlands produced similar patterns as between city sizes and location with respect to city centres and also comparable values to those reported for France. We can therefore reasonably conclude that the cost of land for supermarkets in Britain is at least some five to ten times greater than in similar Continental European countries.

Table 1: Land Costs for Supermarkets in France £ per hectare

City	City Population*	Town Centre	Edge of Centre	Out of town
Paris	2 100 000	3 100 000	700 000	350 000
Lyon	450 000	750 000	230 000	140 000
Reims	187 000	750 000	230 000	140 000
Provincial	Less than 50 000	53 000		

*As quoted in Competition Commission (2000): actual population for functional urban region substantially larger: in 2000 - Paris 10 908 000; Lyon 2 003 000; Reims 400 000.
Source: Competition Commission (2000) Appendix 12.7

Thus we already have strong evidence that TFP in supermarkets increases with store size other things equal and that land and space costs in Britain are an order of magnitude higher than those in Continental European countries and a further order of magnitude greater than in the US (though here the existing evidence is old). From other work on the impacts of land use planning policy on the costs of space it may be reasonable to assume that these inflated land cost are caused by planning policies and that some combination of direct controls on store sizes and higher land costs causing the substitution of space out of production leads to smaller supermarkets in Britain and so reduces TFP in the retail sector. But to date the link to planning policies is only circumstantial and there has been no direct estimation of the quantitative impact of planning policies on TFP although Haskel and Sadun (2009) suggest that the fall in within chain store sizes post-1996 was associated with a loss of 0.4 per cent p.a. in TFP growth. It is the purpose of the project of which this paper is the first output to address this issue, particularly the issue of causation, directly and ultimately quantify it more precisely.

In so far as planning policies reduce TFP in retail then we would expect there to be an inequitable impact on the distribution of welfare. Low productivity will increase store prices and, since poorer households spend proportionately more of their incomes on food and other store sold items, this will reduce the purchasing power of poorer households relative to richer households.

A further purpose of the paper is to explore the specific impact of 'town-centre-first' policy. This is intended to favour town centre retail development. According to ODPM (2004) this is to improve access to retail stores by public transport partly to maintain access for poorer households without access to cars and partly to reduce overall energy use: for 'sustainable development' in other words. As was discussed above in fact if the policy reduces TFP in retail then this will differently reduce the real incomes of poorer households. Moreover for several reasons it seems more likely tht it will increase energy used in retail rather than reduce it. There are at least three reasons why it is likely to increase energy use. The first is that in so far as the policy

reduces out of town retail and concentrates retail space in existing city centres it will tend to increase the average distance between households and retail outlets. Households have continued to decentralise over the past thirty years despite containment policies, In addition to shopping trips being longer they will tend to be in more congested conditions (which increase energy use per mile) and may be more frequent. Frequency will tend to be increased in so far as space in retail outlets is reduced since package sizes and quantity discounts will likely be reduced. The third factor relates to the logistics of retail. Smaller stores require more frequent re-stoking and town centre locations imply longer distances from motorways and distribution centres as well as travelling in more congested conditions. Thus it is a reasonable hypothesis that town centre first policies in so far as they focus retail space towards the centres of towns will increase, rather than reduce, total energy use in the sector.

This hypothesis is not tested in the present paper however although we do test the extent to which town centre first policies have in fact concentrated retail space towards the centre of towns rather than just restricted the total space for retail use.

The paper proceeds as follows. Section 2 briefly sets out the key elements of planning policy with respect to retail and summarises some of the findings so far as to their effects. The next section establishes more formally our hypotheses and our methodological approach especially with respect to identifying the causal processes at work and the specific role of planning policies. The following section describes the data we use and then we summarise the results. The final section summarises some conclusions and discusses some of the problems with this provisional analysis and what additional data and tests are necessary.

2. Existing Land Use Policies and their evolution

'Town Centre First Policies' in broadly their current form were introduced in PPG6, published in 1996. The policy had a number of objectives which, as the evaluation of the policy (ODPM, 2004) pointed out, conflicted. On the one hand the purpose of PPG6 was to redirect development, not just in retailing but in all 'key town centre uses', including leisure, office development and other uses, such as restaurants, to town centres. But the policy's objective included "maintain(ing) a competitive, efficient and innovative retail sector". As ODPM, 2004 pointed out, this was not consistent with the other objectives of the policy. Moreover although the policy was supposed to encourage local authorities to plan for the wider revitalisation of town centres with a 'plan-led' approach, in practice it came to be seen as primarily a development control tool to prevent out of town development rather than 'positively plan for towns centres'. ODPM (2004) states that the policy "…may have acted as a brake on retail development, and has yet to deliver any widespread renaissance in the role of smaller towns and district centres."

There were strong commercial pressures in the early 1980s for the development of so-called Regional Shopping Centres (RSC) – essentially large scale, car based out of town malls. Merryhill in Dudley and the Metro Centre in the North East were prototypical examples. Planning Policy was initially formulated in the first PPG6 published in 1988. This took a largely neutral view of such developments, accepting their commercial logic but tried to steer them away from Greenfield sites and direct them to areas of derelict land such developments could reclaim. The best example of this was perhaps the last RSC to be actually developed, Bluewater, near Dartmouth in

Kent, built on the site of the chalk workings acquired by Blue Circle Cement: the origin of most to the Portland cement used to construct 19th and early 20th Century London. That Bluewater was not opened until 1999 tells one something about the deliberate nature of the development process as it interacts with the British planning system.

PPG6 (1988) further determined that planning policy should not be used to inhibit competition. Policy was revised in PPG6 (1993) which attempted to balance out-of-town and in-town retail development on the belief according to ODPM (2004) that the free market would 'under provide' in-town retail development. This heralded the first serious tightening of planning policy in relations to large format, out-of-town development.

The radical change in policy came in 1996, however with a new PPG6. This strongly redirected retail (and other traditional town centre uses) to town centres. Far from attempting to avoid 'unnecessary regulation' as previous policies had done, it put the emphasis firmly on 'town centre first'. PPG6 introduced a 'sequential test' designed to rule out all possible sites before allowing an out of town site even to be considered. A potential developer had to show that suitable sites in town centres were not available before proposing to develop an edge-of or out-of town site; and then to demonstrate that a site in an existing centre - whether a district or neighbourhood centre - was also not available. According to ODPM, 2004 the underlying rationale for the change in policy was that town centre sites were the most 'sustainable' "…on the premise that town centres are the most accessible locations by alternative means of transport and facilitate 'linked trips' thereby reducing the need to travel." (ODPM 2004 page 21).

Figure 1: Number of Applications for Major Retail Developments, 1979-2008

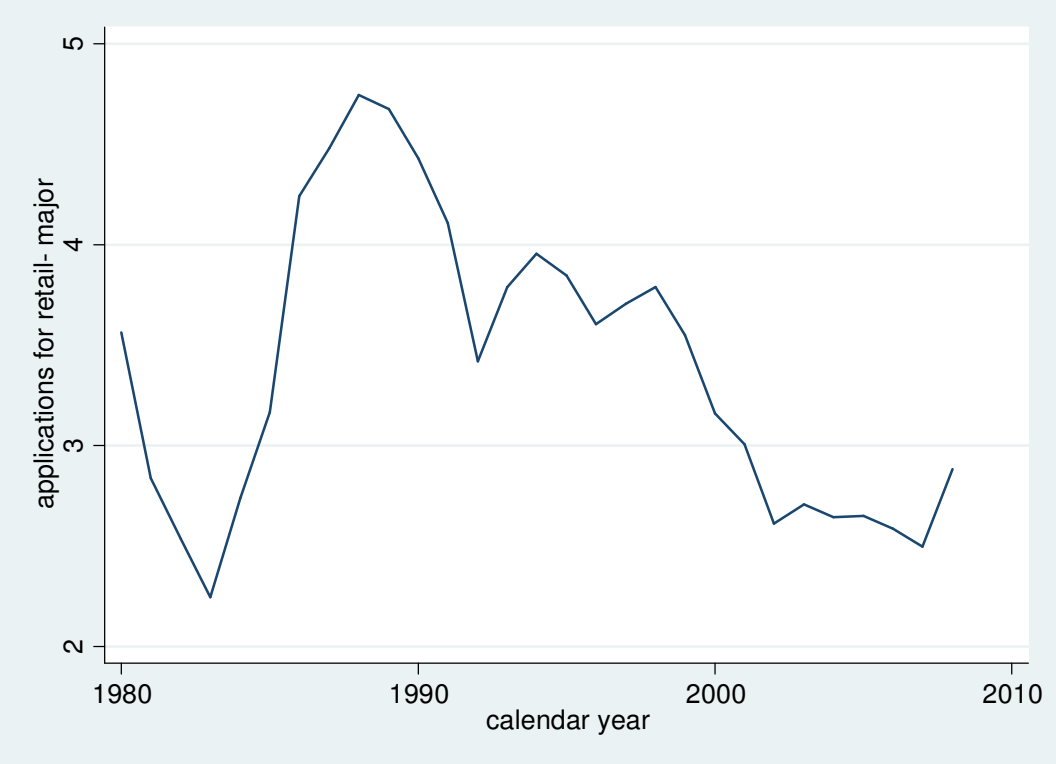
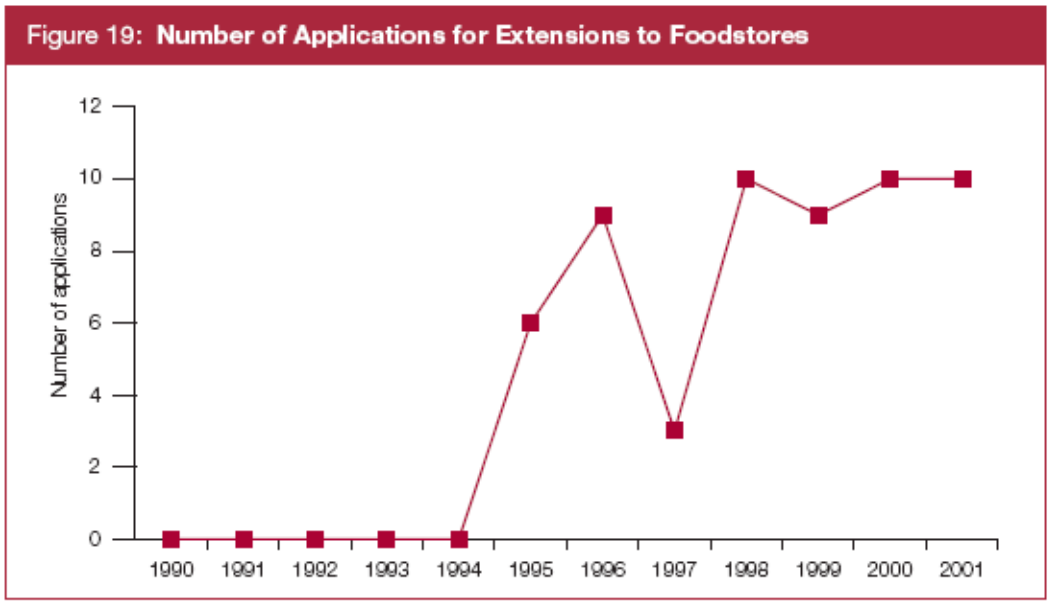


Figure 2: Applications for Extensions to Foodstores, 1990 to 2001



Source: ODPM 2004

As Figures 1 to 4 show the change of policy was reflected in radical changes in the number, location and types of developments. According to Barker (2006a) in 1971 around 65 per cent of new retail space was being constructed in town centres: by 1996 this proportion had fallen to 23 percent. Following the change in policy it had risen again to over 40 percent by 2003.

Applications for major retail developments (Figure 1) fell sharply from 1993 and trended downwards thereafter although there was a cyclical upturn in 2005-06. This was compensated for by an even more noticeable upturn in applications for *in situ* extensions (Figure 2) – far less influenced by the change of policy and in existing productive sites. In-centre store openings increased and out-of centre openings declined (Figure 3). This change in locational pattern was more visible in some groups such as Tesco than it was in others. Finally as Figure 4 shows, the sharp reduction in store development – illustrated in Figure 1 – was reflected in an older stock of buildings in the retail sector than in any other economic sector.

Figure 3: Big 5 Supermarkets In- and Out of Centre Openings, 1990-2000

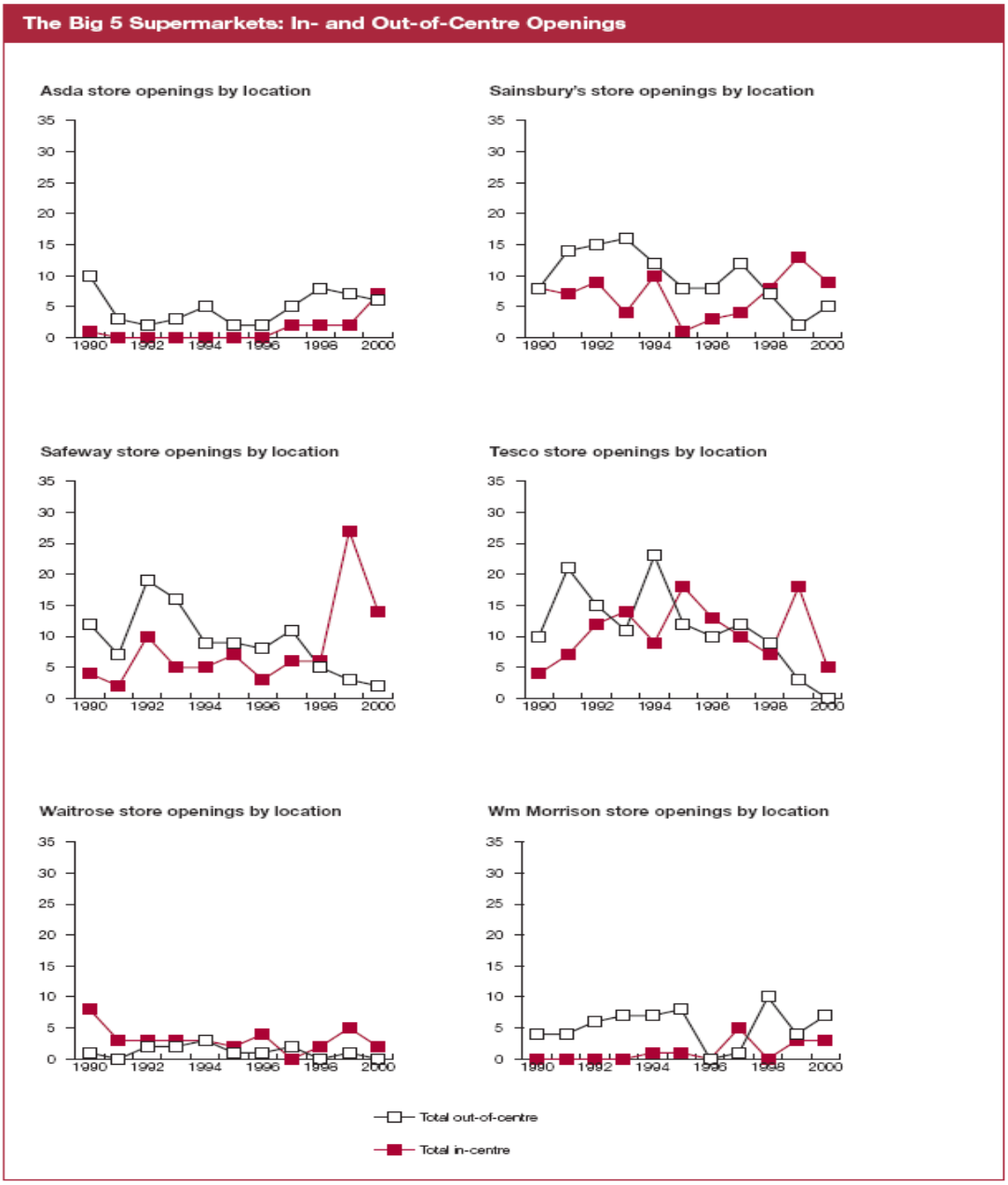
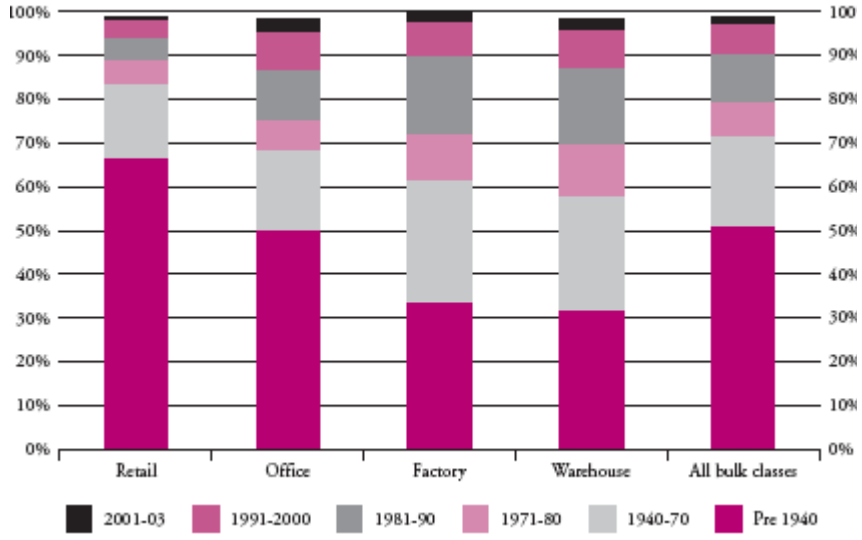


Figure 4: Age of Building Stock by Use Category



Source: Barker 2006a

3. Our hypotheses and approach to testing

The hypotheses we are interested in testing are then as follows. The first is to confirm the findings of the Competition Commission (2008) that larger stores are associated with higher TFP but to do so in a way which makes it possible to test whether the operation of the planning system has a causal role in reducing store sizes. In so far as this is the case we then seek to quantify to reduction in productivity in retail sector generated by a more restrictive planning policy. Planning policies may both directly restrict store size format and site characteristics via town centre first policies but in addition, the restriction on space for retail may increase the price of such space and so cause it to be substituted out of production further reducing TFP in the sector.

To test these hypotheses we need detailed store level data with exact store location so other geographic/spatial data which is relevant and may influence store productivity can be included in the analysis. Furthermore we need store location because of the fact that the characteristics of the location with respect to the centre of urban areas may plausibly be causally linked to store productivity and the planning system is operated at the level of Local Planning Authorities (LPAs) and despite a national policy may vary in its restrictiveness from LPA to LPA. It is to the issue of data that we now turn.

4. Data

The dataset used has individual store-level information on a full set of stores from a major retailer who has given us access to their data but wishes to remain anonymous. Variable include sales (for food and non-food items), various measures of floorspace, (including the presence of a mezzanine floor) and employment. Furthermore, store characteristics like total opening hours, whether there is a petrol-station attached, the number of parking spaces and store format have been obtained. The store location is available at postcode level and grid references have been obtained as well.

Table 2 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Sales/employment	357	4246	544	2349	5706
Sales	357	921115	406300	73978	2056014
Employment	357	213	85	32	471
Net floorspace (sq.ft.)	357	46710	17352	8313	101091
Gross floorspace (sq.ft.)	357	81633	31095	15076	180000
Food floorspace	357	27819.6	10144.7	0	54290
Non-food floorspace	357	18890.5	9859.5	671	52576
Net/gross floorspace (ratio)	357	0.58	0.07	0.33	0.83
Density (empl/1,000 Sq.ft)	357	4.57	1.10	1.01	7.40
Non-food format (dummy)	357	0.06	0.24	0	1
Mezzanine (dummy)	357	0.17	0.38	0	1
Petrol station (dummy)	335	0.52	0.50	0	1
Parking spaces	356	576	264	82	2000
Years since first opening	357	14.4	10.5	1	43
Total opening hours	357	119	29	64	168
Population within 10mins	357	81226	43706	5532	229246
Car ownership share within 10 mins drive	357	0.70	0.08	0.45	0.88
Competition variable	357	4.97	3.49	0.29	23.30

Some key summary statistics are shown in Table 2. In total there are 357 stores in the UK with all or most variables for 2008. Out of the total of 357 stores, 336 are food-formats and 21 non-food formats. Since non-food formats are quite different to the food-format stores, they are considered as a special case and either excluded from the analysis or a dummy is added. From the food-format stores, there are 55 defined by the company as 'small stores', 252 'superstores' and 29 'supercentres'. The small type stores have a mean floorspace of 25,000 sq.ft, the superstores 49,000 sq.ft and the supercentres 85,000 sq.ft. Overall net floorspace varied from a low of just over 8,000 sq ft to a high of more than 100,000 sq ft. Our measure of employment varied from 32 to 471.

The vast majority – 95 percent - of employees are paid on an hourly basis with the rest on a salaried basis. This information has been used to construct a full-time equivalent of employment since the hourly contracted staff worked part-time while the salaried staff were full-time. Staff remuneration and individual hours were not available from the company so in the results reported here to obtain a measure of Full time Equivalent (FTE) labour inputs at the store level, the simple assumption is made that salaried employees are full time and hourly workers are on average half time. We are working on improving this method using wage and hours worked information at the Local Authority level for the relevant occupations. The overwhelming majority of

hourly paid workers are in the occupational categories "retail cashiers" and "sales & retail assistants" and data on pay and hours worked of these workers have been obtained from the Annual Survey of Hours and Earnings (ASHE), and will be used to improve labour input estimates in future work.

The data on planning outcomes comes from CLG and is at the Local Planning Authority (LPA) level. The information we have so far is, as noted above, only for England and thus corresponds to a subset of 269 stores. The main variables used in order to capture the restrictiveness of planning regulation in the LPA are the refusal and the delay rates. The former corresponds to the ratio of rejected to total planning applications for major projects. The refusal rates for both major retail and major residential projects have been used. The delay rate corresponds to the ratio of planning applications that have been left pending for more than 13 weeks. We also have applications at the LPA level per person. These planning data run from 1979 to 2008.

Others have used planning variables such as these (see for example Cheshire and Sheppard, 1989; Preston *et al*, 1996 or Hilber and Vermeulen, 2010). The reason for using these variables is to devise a measure of 'planning restrictiveness' at the Local Authority level. The most obvious variable to use is the refusal rate although it might be expected that more restrictive LPAs would also have more delayed decisions so that the delay and refusal rates would be positively correlated. Given the cyclicality of application rates for development one might think of the mean refusal or delay rate for the whole period as the best indicator for the individual LPA.

It is well known, however, that there is a potential endogeneity problem with such measures since the behaviour of developers may be influenced by the behaviour of LPAs. Since applications cost significant resources would-be developers may hold back from making applications in LPAs known to be restrictive, so no refusal results. Indeed there may be prior negotiations before any application is made and when it is clear an application will not be likely to be successful it may not come forward. Equally more restrictive LPAs may not have more or longer delays: they might just refuse a higher proportion of applications or very fewer applications may come forward.

As is discussed in more detail below this possible endogeneity of planning measures makes identification of causality problematic. Our approach to this problem is to devise instruments. We have identified three possible instruments. The first is to exploit the change in planning policy heralded by the 1996 PPG6. As observed in section 2, this made major retail projects much more difficult, especially out of town projects, and led to a substantial reduction in applications for major retail development but increased applications for store extensions since these remained relatively less affected. In LPAs already actually restrictive in 1996, therefore, one should not expect any significant change in the refusal rate. LPAs which prior to the change of policy had been relatively unrestrictive, however, should be expected to have increased in their measures of restrictiveness following the change in policy. So the instrument would be the *change* in refusal rate noted between a mean of say 1990 to 1995 and 1997 to 2000.

A second possible instrument can be constructed from the change in the delay regime initiated in 2002 when performance targets were introduced for LPAs with respect to the proportion of applications decided within 13 week for major *and* minor developments separately. Prior to the change, targets related to all applications together and since there are many applications for minor development relative to major development, more restrictive LPAs prior to this change could use delays for major development to restrict development overall but still have met their decision time target for all development applications. Following the introduction of the new targets, therefore, it became much more difficult explicitly to delay applications whether for major or minor developments so that more restrictive LPAs would no longer tend to have both higher refusal rates and more delays[3]. So again the change in the relationship between refusals and delays, or the change in the delay rate itself, would be the appropriate instrument from a mean of 1994-96 to the mean of 2004-06.

Figures 5 and 6 show the estimated value of the regression coefficients for LPAs between their refusal and delay rates for each year from 1979 to 2008 for major residential and major retail. We do observe that for nearly every year prior to 2002 these measures of restrictiveness were positively associated. From 2000, however, the relationship became negative and was strongly negative for 2004-2006 when the new targets were well established. This is more obvious for major residential than for major retail but then there are far more applications for major residential so random error should be less.

A third instrument is to exploit the difference in restrictiveness associated with political control. A number of authors (Haskell and Sadun, 2009 or Hilber and Vermeulen, 2010, for example) have noted that Labour controlled LPAs – or LPAs with historically stronger Labour representation, tend to be less restrictive than Conservative dominated LPAs. They use a measure of local voting outcomes as an instrument with some success. We plan to test these instruments as the work develops but for the time being only have results using the straight measure of refusals or delays and the change in delay rate post-2002 are available.

Table 3a simply tabulates stores by their classification for planning purposes into 'location types'. One issue is that since the planning system deals in legal rather than economic or functional classifications and notoriously lacks systematic and strategically binding local Development Plans (an assessment in January 2010 judged that the majority of LPAs did not have an 'up to date development plan' – a requirement for the implementation of PPG6 and its successor PPS6 - Thomas Eggar LLP, 2010) 'location types' for planning purposes may bear only a slight relationship to location as commonly understood. This partly reflects the reliance on the process of development control with the non-transparency and politicisation of decisions that seem to arise as a consequence. A particular and notorious case is that of Dudley, which following the development of a truly out-of-town regional shopping mall, Merryhill, when it found it difficult to permit enlargement and further development

[3] As Ball (2010) shows, however, delay is very much more complicated than the simple measure of time between application and decision (as well as unrecorded prior periods of negotiation). If delay is taken as the elapsed time from first application to final decision then Ball reports it is 43 weeks on average and more than a year for over 41 percent of sites - excluding time taken in discussions prior to the first application. LPAs get down to 13 weeks delay per application by rejecting applications but allowing a further revised application. Ball's analysis relates to residential development.

following the introduction of PPG6 in 1996 decided to re-classify Merryhill as 'town centre' Thus it is at least possible that classifications of locations for retail development for planning purposes bears little systematic relation to actual economic or functionally geographic reality.

Figure 5: Plotting the coefficients from regressing refusal rate on delay rate: Residential (major) 1979-2008

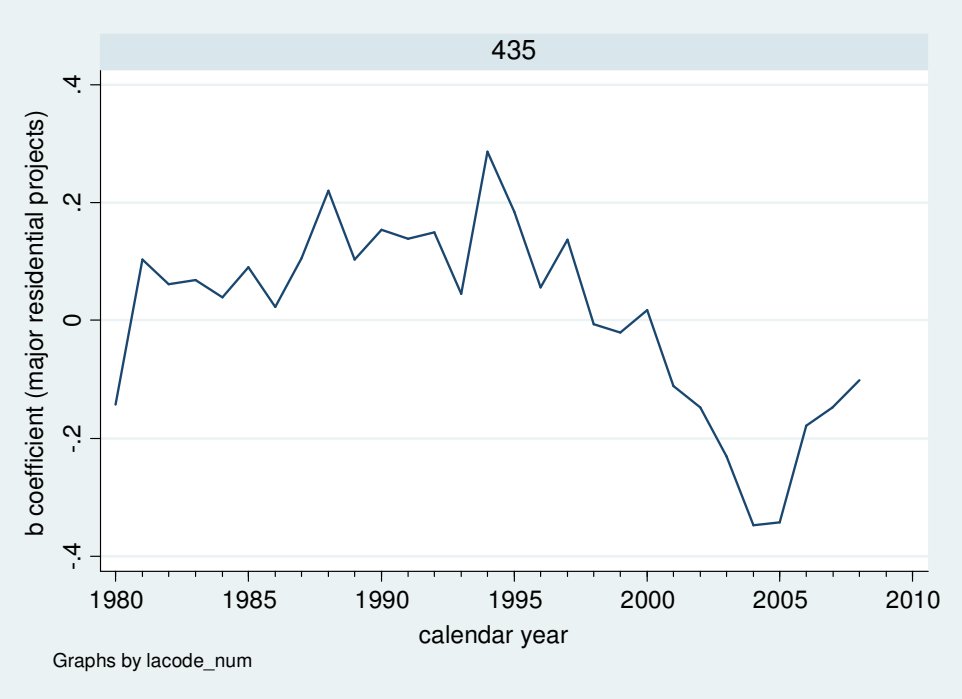
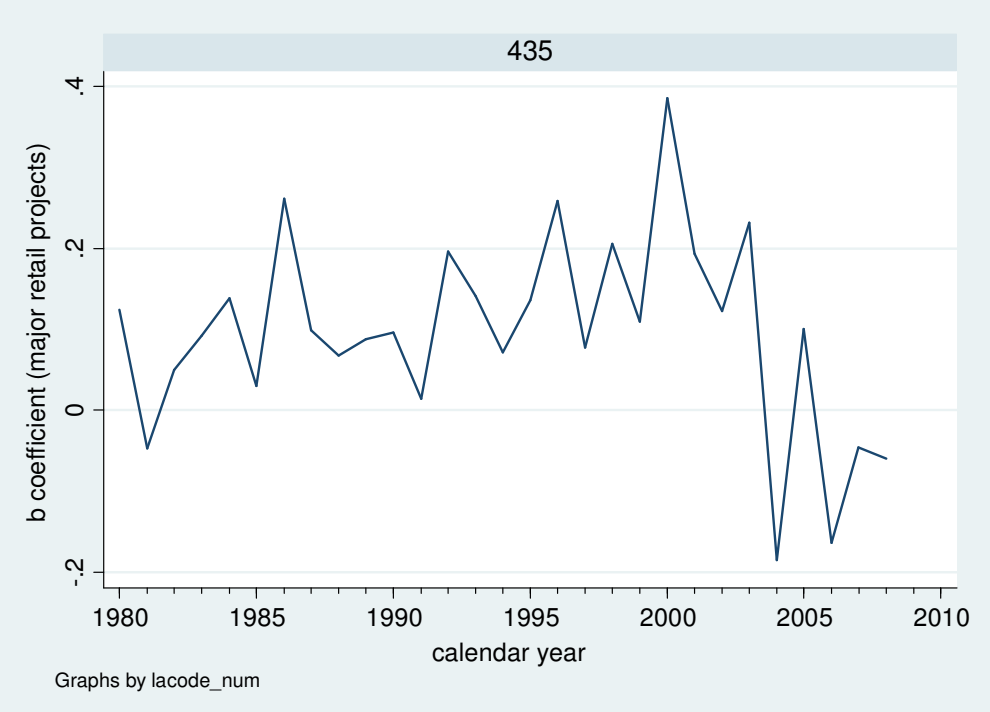


Figure 6: Plotting the coefficients from regressing refusal rate on delay rate: Retail (major) 1979-2008



In so far as this is so we might expect the net outcome of PPG6 to have been to restrict all retail development in every location rather than to simply restrict out of town, large scale 'mall-type' or hypermarket developments while easing town centre development. If that was the case two consequences might follow. The first would be that store size would become only weakly related to location vis à vis the centre of (large) built up areas or functional urban regions. The second would be a general increase in land and space prices for retail regardless of location. So that instead of observing a typical 'rent-gradient' with space prices falling with distance from town centres and with respect to city sizes, space costs would appear to be relatively flat and higher everywhere.

Table 3a Number of stores and average floorspace by 'location type'

Location Type	No of stores	Mean Net floorspace (sq.ft.)	S. D.
Town Centre	46	42609	15429
District Centre	41	45564	18053
Suburban Centre	25	44732	10202
Edge of Centre	63	43598	16527
Out of Town	123	50889	17459
Destination	13	63760	22824
Retail Park	25	52015	14063
Non-food Format	*21*	*28279*	*5086*

Table 3b Floorspace costs by 'location type'

Location Type	Rateable value 2005/net floorspace	S.D	Rateable value 2005/gross floorspace	S.D.	Rateable value 2010/net floorspace	S.D.	No of stores
Town Centre	23.5	6.7	12.9	3.6	33.5	8.9	45
District Centre	24.7	6.9	14.4	4.6	37.1	9.5	39
Suburban Centre	27.8	4.7	15.3	2.5	35.9	6.7	21
Edge of Centre	26.3	6.0	15.0	3.8	36.2	6.9	60
Out of Town	26.7	5.8	15.4	3.5	37.8	6.6	112
Destination	31.8	3.8	17.6	3.8	41.2	4.9	12
Retail Park	27.8	9.3	16.2	6.3	40.6	14.4	21
Non-food Format	13.8	4.5	9.9	2.8	17.4	5.6	13
All stores	25.7	6.8	14.8	4.1	36.1	9.0	323

We propose to test this proposition in two ways. The first is set out in Tables 3a & b which tabulate average store sizes and a measure or the costs of floorspace by 'location type' as classified by our store group for planning purposes. The results are broadly consistent with the rather negative hypothesis outlined above. Store sizes vary little between location types: the mean size of 'town centre', District centre', Edge of Centre' and Suburban centre' shows almost no variation. 'Out of town', 'Retail Park' and 'Destination' stores are rather larger, on average, but not remarkably so, except for the small category of 'Destination' stores'. Rateable value per square foot is the most accessible measure of price and has been shown in previous work (Mehdi, 2003) to be closely correlated with market measures of price. We see there is no obvious relationship with 'location type'. In France (see Table 1) land values for retail use fall as predicted by the monocentric model with distance from city centre and as city size falls. In 21st Century Britain no such relationship is apparent[4]. Town centre store space is in fact the cheapest followed by that in District Centre stores. The most expensive space is in the notionally out of town locations, Suburban centres, Retail Parks and Destination Stores. Essentially space costs did not vary systematically with respect to the classification of location for planning purposes.

The second way that we plan to test this hypothesis is to examine the price per sq ft. of store location as it varies with actual measured distance from the centres of built-up areas or urban regions: i.e. examine the land rent gradient for retail space. We saw from Table 1 that in France this appeared to follow exactly the general pattern predicted from urban economic theory. Is this the case in the UK or has the planning system simply so restricted space for retail everywhere that there is no such pattern?

5. Initial Results from Cross sectional analysis

We follow a total factor productivity approach (TFP) in this section, the main empirical analysis. A Cobb-Douglas functional form is applied with factors of production floorspace, labour and capital. In this still preliminary analysis we have only one year's data available so cannot use a panel approach and sales are used as the dependent variable, although future data acquisition will enable us to use gross-margins and value added as alternative measures of output and data for additional years. It is understood however that the retailer who's data we have access to, has a policy of uniform mark-ups by broad product type across all stores, so sales per store should be closely correlated with gross margins and value added. The gross margins measure of output is reached by deducting the value of purchased goods (P_wQ_w) from sales (PQ) - ideally intermediate inputs (like lighting, electricity etc.) should be deducted as well (P_mM) but at present we do not have the data necessary to calculate gross margins more accurately.

[4] An interesting point to note is that in Cheshire and Sheppard 2005 land values for retail in Reading, Berks – a medium sized and prosperous town 60kms west of London – were reported for 1984. They were classified into 7 zones according to distance from the town centre. The mean price per unit acre of land for retail use was estimated to fall from £28,000,000 in the innermost zone 1, to zone 2 £14.000, 000; zone 3 £11,500,000; zone 4 £8,900,000; zone 5 £3,500,000; zone 6 £5,700,000 and zone 7 £2,500,000 (Cheshire and Sheppard, 2005, Table 2). The evidence for a period substantially pre-dating the change in policy in 1996 shows a declining price for retail space with respect to distance from the centre as would be predicted from urban economic theory.

Therefore, the main econometric specification is the following:

$$Y = A\, F^{\beta 1}\, L^{\beta 2}\, K^{\beta 3}\, e^{\gamma X}\, e^{u}$$

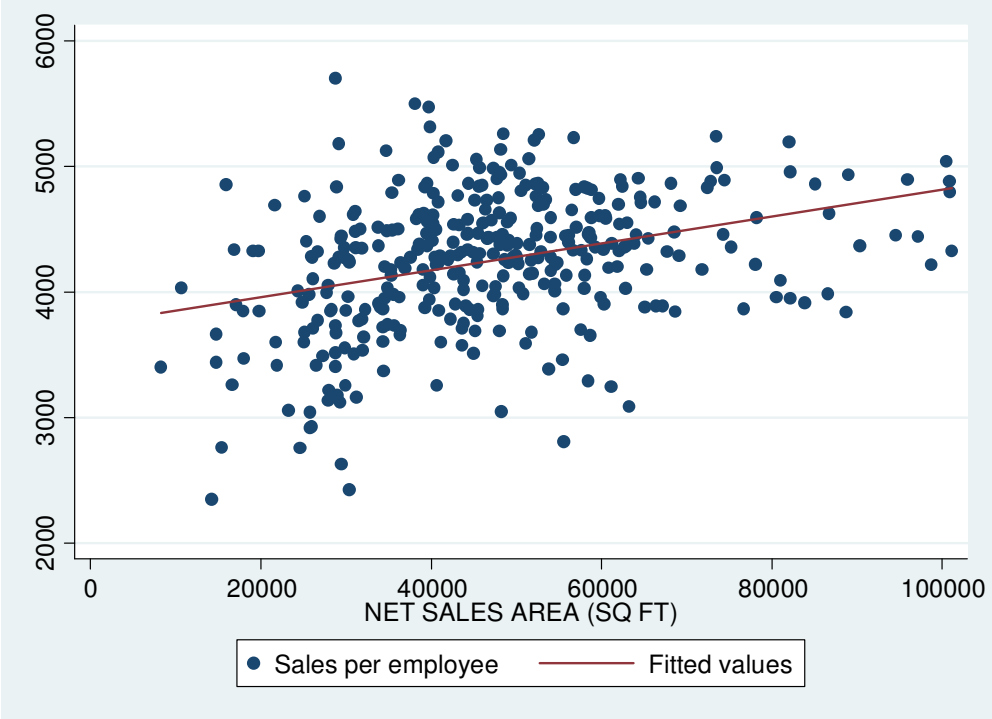
$$\ln Y_i = \beta_0 + \beta_1 \ln F_i + \beta_2 \ln L_i + \beta_3 \ln K_i + X\square_i\, \gamma + X\square_\alpha\, \delta + u$$

$$(\text{RTS} = \beta_1 + \beta_2 + \beta_3)$$

Y: sales of store *i*; or gross margins Y= PQ- P_wQ_w or Y= PQ - P_wQ_w - P_mM
F: floorspace; L: labour; *K*: capital for store *i*
X_i: vector of store specific controls
X_α: vector of area specific controls

Figure 7 shows a scatter of the main relationship in which we are interested: that between 'productivity' – represented as sales per employee – and floorspace. We can see immediately that there is a general relationship between store size and productivity and that, as expected, productivity rises with store size.

Figure 7: Relationship of productivity (sales/employment) to net floorspace



Tables 4 and 5 show the results of fitting such a model with some additional controls. One problem is that we do not have exact information on labour hours per store, only a head count of salaried staff who we assume are fulltime, and hourly paid staff who we assume are half time. So we construct an approximate measure of full-time equivalent employment (FTE) by multiplying the headcount of hourly-paid staff by 0.5 and salaried paid staff by 1. As we have experimented both ways, we know that this estimate of FTE employment gives slightly better results than just adding up hourly-paid and salaried staff. We are in the process of refining these measures using

ASHE data at the LA level on hours worked and wages for the specific occupational categories covering retail workers but at present are still using the simple weighted values described above.

The measure of floorspace that is used refers to net floorspace. This is more sensible theoretically, but also it gives better results than when using gross floorspace. In the specification that includes both net and gross floorspace as regressors the latter becomes insignificant. Table 4 shows the results of a simple TFP approach with controls only for the presence of a mezzanine, for non-food format stores and for total opening hours. We can see even in this simple formulation net floorspace is significant and the elasticity of sales with respect to floorspace is around 0.12. It is in some ways still a naïve model since store size is also a function of space prices and planning restrictions both control the size of stores and – as argued above – influence the price of space. Smaller store sizes and lower TFP may therefore reflect both factor substitution as the firm efficiently reduces space inputs in the face of higher prices and a constrained use of smaller stores.

Table 4: Basic results from a TFP approach with Total Sales as 'output'

VARIABLES	(1)	(2)	(3)	(4)
Net Floorspace	0.0472	0.0972	0.128	0.118
	(1.407)	(2.665)	(2.719)	(2.542)
Employment	1.083	1.043	1.000	0.974
	(37.76)	(35.42)	(22.15)	(20.27)
Mezzanine dummy		-0.0594	-0.0499	-0.0547
		(-2.815)	(-2.408)	(-2.685)
Non-food format dummy			-0.0815	-0.0775
			(-1.091)	(-1.052)
Hours				0.000915
				(3.246)
Constant	7.405	7.093	6.989	7.126
	(29.64)	(26.25)	(23.45)	(24.54)
Observations	357	357	357	357
R-squared	0.958	0.959	0.959	0.961

Notes:
The dependent variable is log(sales)
All regressors are logged (except the hours and the dummies), so that they can be interpreted as elasticities.
t-statistics in parentheses

Tables 5 shows the results of adding more store-specific controls and analysing food and non-food format stores separately. These additional controls are more or less self explanatory. In Table 5 we add a variable for the age of the store and variables for the characteristics of its catchment area – competition from other stores in the area, the population within 10 minutes drive-time and – crudely measured by car ownership –

local income level - as well as whether the store has a petrol station. The competition variable tries to capture the competition potential in each store's catchment area and is estimated by applying a distance decay function to the five nearest stores from each of the two main competing retail groups. Further experimentation with this variable is envisaged but as expected higher values of this 'competition measure' are associated with lower store sales.

Table 5 Adding further store & area controls; result for UK and England

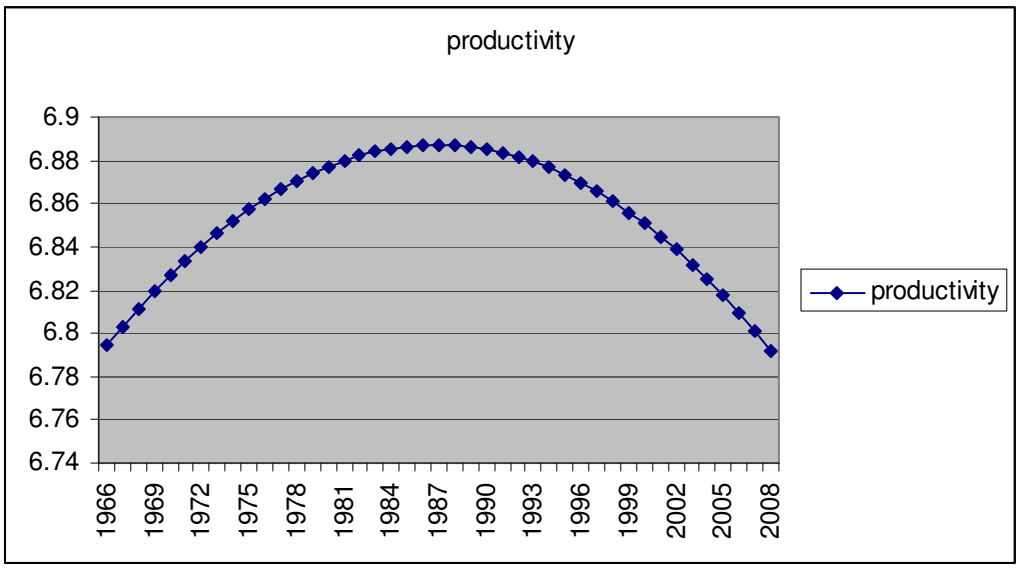
VARIABLES	(5) UK	(6) UK	(7) UK	(8) UK	(9) UK	(10) ENGLAND
Net Floorspace	0.135	0.140	0.102	0.103	0.115	0.144
	(2.925)	(3.107)	(2.185)	(2.207)	(2.538)	(2.559)
Employment	0.936	0.902	0.918	0.913	0.899	0.846
	(19.39)	(18.86)	(19.29)	(18.77)	(18.94)	(13.79)
Mezzanine dummy	-0.0430	-0.0393	-0.0387	-0.0382	-0.0391	-0.0365
	(-2.168)	(-2.025)	(-2.081)	(-2.020)	(-2.110)	(-1.765)
Non-food format dummy	-0.105	-0.133	-0.135	-0.140	-0.145	-0.257
	(-1.433)	(-1.821)	(-1.839)	(-1.891)	(-1.958)	(-2.870)
Hours	0.00106	0.00102	0.00101	0.00104	0.00103	0.000905
	(3.745)	(3.653)	(3.695)	(3.787)	(3.807)	(2.541)
Years since opening	0.00222	0.0106	0.00900	0.00910	0.00942	0.0123
	(3.402)	(3.925)	(3.335)	(3.377)	(3.529)	(4.074)
Years since opening sq.		-0.0235	-0.0201	-0.0203	-0.0213	-0.0272
		(-3.428)	(-2.957)	(-3.021)	(-3.195)	(-3.705)
Population within 10mins			0.0444	0.0491	0.0570	0.0509
			(3.742)	(3.799)	(4.164)	(2.885)
Car ownership share within 15m				0.0769	0.0945	0.0740
				(1.050)	(1.293)	(0.835)
Competition variable					-0.00379	-0.00415
					(-2.078)	(-2.236)
Constant	7.098	7.183	7.024	6.923	6.783	6.844
	(24.78)	(25.56)	(25.42)	(22.57)	(22.21)	(19.33)
Observations	357	357	357	357	357	269
R-squared	0.962	0.963	0.965	0.965	0.965	0.965

Notes:
The dependent variable is log(sales)
All regressors (except hours, car ownership, competition and dummies) are logged so they can be interpreted as elasticities.
t-statistics in parentheses

The age of the store is a particularly interesting control. It turns out to be quadratic. The oldest stores are – as would be expected – the least productive other things equal. Store productivity increases as stores get younger but only until the late 1980s. Productivity in stores founded after then begins to fall and the very newest stores are the least productive. It might be expected that productivity levels would take time to reach their maximum in any store and that there would need to be some bedding down. However it is not plausible that getting a new store up and running at its most efficient level takes nearly 20 years. The estimated best fit relationship for date of founding and store productivity is graphed in Figure 8 using the co-efficients shown in Table 5, col.9: a scatter of the observations is shown in Appendix Table A1. There is of course some error associated with estimating the peak store age for productivity but it seems broadly to reflect the progressive tightening up of planning policy for retail from 1988 and strongly suggests that one impact of the changes in planning policy since then has been to make stores less productive for any given size. This results probably from policy forcing retail to less productive locations and sites.

Since at this stage we only have the planning variables for England col. 10 of Table 5 shows the full model estimated only for the English stores. It is reassuring that the results are essentially unchanged.

Figure 8: Productivity by year of opening



The role of planning

The first and most obvious way in which to investigate the role of the planning system is to see whether there is a direct relationship between indicators of planning restrictiveness at the LPA level and store size: does more restrictive planning policy make stores smaller and so reduce TFP? We have already argued that there are two distinct mechanisms which could generate this outcome and they are certainly not mutually exclusive. The first mechanism is that 'town centre first' policy might be forcing stores to locate on smaller sites in less productive locations and so be directly

constraining the size of stores. The second is that by constraining the supply of space, planning policy is increasing it prices and thereby causing a substitution of space out of production. While also having the effect of reducing TFP this would be an 'efficient' adaptation by stores to distorted factor prices. Our approach so far does not allow us to discriminate between these mechanisms.

Table 6 shows the first results of relating store size to planning local policy using the data for food format stores only. We have planning outcomes for every LPA in England from 1979 to 2008. Since we do not as yet have this information for Scotland, Wales or Northern Ireland we have to drop stores in those countries from the analysis reducing the number of observations from 357 to 254. Taking the average refusal rate of major residential projects in an LPA for the period 1979-2008 as our measure of LPA restrictiveness we find that more restrictive LPAs were associated with smaller stores: residential refusal rates are negatively correlated with floorspace. Excluding stores that opened in the earlier period (1966-1979) and focusing only on the period for which planning data are available, this relationship is weakly significant at the 10% level. Restricting further the sample to the stores that opened in the post-1990 period, the relationship becomes stronger and significant at 5% level. These results suggest that planning restrictiveness of the LPA measured by the refusal rate of residential projects negatively affected retail floorspace per store.

Table 6: Regressing floorspace on planning restrictiveness (major residential projects refusal ratio)

	(1)	(2)	(3)	(4)
VARIABLES	All England	>1980	>1990	>1997
Refusal rate	-0.485	-0.642*	-1.058**	-0.900
(residential)	(-1.508)	(-1.818)	(-2.255)	(-1.583)
Constant	10.85	10.90	10.96	10.91
	(149.5)	(139.3)	(106.0)	(84.17)
Observations	254	221	143	114
R-squared	0.010	0.018	0.041	0.027

Notes:
The dependent variable is log(net floorspace)
The sample is restricted to the stores that are located in England since regulation data was available only for this period.
The sample excludes non-food formats.
The refusal rate is calculated as the ratio of declined major residential projects applications to the total number of applications and averaged over 1980-2008 (the period for which regulation data exist).
t-statistics in parentheses

We expected residential refusal rates to be a more useful measure of LPA planning restrictiveness since they are far more numerous than applications for major retail development. Moreover prior to applying for a major retail project the potential applicants enter rounds of discussions with the planning authorities and therefore might only apply if a positive outcome is expected. Furthermore, using residential

projects rather than retail ones somewhat eases the endogeneity concerns for the measure since at least it is not for retail development. Reflecting these concerns we see in Table 7 that when the refusal rate for major retail projects is used, the negative association with floorspace becomes weaker and is not statistically significant.

Table 7: Regressing floorspace on planning restrictiveness (retail projects refusal ratio)

VARIABLES	(1) All England	(2) >1980	(3) >1990	(4) >1997
Refusal rate (retail projects)	-0.0509	-0.132	-0.294	-0.223
	(-0.180)	(-0.441)	(-0.621)	(-0.426)
Constant	10.75	10.79	10.80	10.76
	(171.7)	(160.4)	(107.0)	(95.05)
Observations	254	221	143	114
R-squared	0.000	0.001	0.003	0.002

Notes:
The dependent variable is log(net floorspace)
The sample is restricted to the stores that are located in England since regulation data was available only for this period.
The sample excludes non-food formats.
The refusal rate is calculated as the ratio of declined major retail project applications to the total number of applications and averaged over 1980-2008 (the period for which regulation data exist).
t-statistics in parentheses

As noted above, even using measures of refusal rates for residential applications potentially involves a problem of endogeneity although the object of interest is the restrictiveness of the LPA with respect to retail development. Would-be developers may be discouraged from making applications if it is known a LPA is restrictive and a more restrictive LPA is likely to be more restrictive with respect to development of all types. As was suggested earlier a potentially interesting instrument is the change in behaviour with respect to delays induced by the introduction of specific delay targets for major development applications after 2002. The more restrictive a planning authority was in its planning regime, the greater would be the reduction of its measured delay rates for major applications to meet the new targets. More restrictive authorities would previously have been likely to have been both refusing and delaying applications (as witnessed by Figures 5 and 6). Again, however, because of the relatively small numbers of applications for major retail developments we should expect any relationship to be more apparent for residential than for retail applications.

Table 8 shows the results of using this alternative and hopefully exogenous measure of LPA planning restrictiveness. We find a positive relationship between the change in the delay ratio and store size, suggesting that planning restrictiveness does indeed reduce store size (and so store productivity). For the change in behaviour with respect to major residential development the relationship is significant at the 5% level when the sample is restricted to the stores that opened in the post-1990 or the post-1997 period. Although the co-efficient signs are as expected there is no significant relationship when changes in behaviour with respect to major retail applications is

used, however, probably reflecting the small and somewhat erratic number of such applications.

Table 8: Regressing floorspace on an instrument for planning restrictiveness (the change in delay rate from 1994-98 to 2004-2008 for major residential projects)

VARIABLES	(1) All England	(2) >1980	(3) >1990	(4) >1997
Change in delay rate (major residential)	0.0688	0.0333	0.371**	0.455**
	(0.565)	(0.255)	(2.082)	(2.029)
Constant	10.75	10.77	10.77	10.75
	(428.0)	(422.0)	(328.7)	(272.8)
Observations	254	221	143	114
R-squared	0.001	0.000	0.030	0.035

Notes:
The dependent variable is log(net floorspace)
The sample is restricted to the stores that are located in England since regulation data was available only for this period.
The sample excludes non-food formats.
The delay rate is calculated as the change in the average delay ratio of applications pending for more than 13 weeks between the period 1994-98 and the period 2004-2008.
t-statistics in parentheses

6. Conclusions and further developments

The results so far are highly suggestive but not as yet conclusive. We have shown that at least if output is measured as turnover then productivity does rise with store size. We have further shown that the is good evidence that more restrictive local planning regimes generate small stores. This was shown not only measuring 'restrictiveness' using the mean 1979-2008 refusal rate for major residential developments for each LPA as our measure of 'restrictiveness' but also a measure more obviously exogenous: the change in an LPA's delay rate following the introduction of specific targets for delays for major and minor development separately in 2002. We have thus reasonably established that more restrictive planning regimes generate smaller stores and smaller stores are less productive. We have also presented a range of more circumstantial evidence which suggests that the tightening of planning policy with respect to retail development – especially out of town retail development in 1996 – caused a drop in store development, an increase in space prices and a levelling out of the rent structure with respect to distance from town centres. This last is consistent with a more general restriction of land supply for retail in all locations.

We have not so far been able to discriminate between the impact of direct constraints on store sizes and locations and increased space costs as sources for this reduction in store sizes and productivity. In addition many of the variables can be improved and we need to increase the range of variables and years for which there are data to refine out analysis. Some of these improvements although time consuming are not difficult. We can improve our estimates of labour inputs and competition easily. We can also

collect data for and test additional instruments such as local political make up of LPAs and LPA behaviour changes following the introduction of PPG6 in 1996. Other improvements require more difficult to get data (such as additional years of store level information) and further analysis.

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APPENDIX

Figure A1: Scatter of store productivity (measured as sales per FTE Employee) and Year of Store Foundation