The Productivity Costs of Planning for Supermarkets: evidence from a micro dataset

Paul Cheshire, Christian Hilber and Ioannis Kaplanis, LSE

Abstract

Few studies conceive of land as a productive factor but British land use policies may lower total factor productivity (TFP) in the retailing industry by (i) restricting the total availability of land for retail, thereby increasing space costs, (ii) directly limiting store size and (iii) concentrating retail development on specific central locations. We use unique store-specific data to estimate the impact of space on retail productivity and the specific effects of planning restrictiveness and micromanagement of store locations. We use the quasi natural experiment generated by the variation in planning policies between England, Wales, Scotland and Northern Ireland to isolate the impact of Town Centre First (TCF) policies. We find that TFP rises with store size and that planning policy directly reduces productivity both by reducing store sizes and forcing retail onto less productive sites. Our results, while they strictly only apply to the supermarket group whose data we analyse, are likely to be representative of supermarkets in general and suggest that since the late 1980s planning policies have imposed a loss of TFP of at least 20%.

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

SERC
Spatial Economics Research Centre

LSE

April 16 2011

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

The Productivity Costs of Planning for Supermarkets: evidence from a micro dataset [1]

1. Introduction

This paper contributes to two important current policy concerns. The first was succinctly summarised in a recent paper by Schivardi and Viviano (2011). This is the concern with the slow rate of growth of productivity in Europe compared to the US and particularly the contribution to this sluggish performance of the European retail sector. The second is the growing interest in the role of Britain's land use planning system in imposing significant costs on the British economy.

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 British cities in the mid-1980s the most expensive land for retail cost 250 times as much as the most expensive retail land in comparable US cities (Cheshire and Sheppard, 1986). In addition 'Town Centre First' (TCF) policy, especially in England, attempts to concentrate retail development on particular sites in central locations and so increases the cost and constrains the quantity of retail space and may force retailers to locate on intrinsically less productive sites. The control exercised by the planning system on the number of sites is also likely to introduce a specific barrier to entry into new retail markets.

The British system of land use planning explicitly aims to 'contain' urban areas and reduce land take for development. It imposes direct restrictions on the supply of land for each legally defined, category of use. The system thus increases the costs of space in all categories of development: notably 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. 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 substantially higher than in any other country for which it was possible

[1] 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: we would particularly like to mention Henry Overman, Steve Gibbons, Howard Smith and Robin Goodchild and colleagues in the DCLG and at NB Real Estate. We should also thank Gerard Derricks, Yue Yao and Zovanga Kone for their very diligent and capable research assistance and participants in meetings at the University of Aberdeen, the European Real Estate Society, SERC and the European Regional Science Association's annual congresses at which earlier versions of this paper were given. Perhaps most of all we should thank the major supermarket group who gave us access to their store level data but who wishes to remain anonymous. The authors are responsible for all errors and interpretation.

to get the requisite data. Even in a depressed provincial city such as Birmingham restrictive planning policies imposed the equivalent of a tax on marginal construction costs of 250 percent averaged over 1999-2005. In London's West End the regulatory tax was estimated to have averaged 800 percent. In 2005 total occupation costs for office space in Birmingham were some 44 percent higher than in Manhattan. Anecdotal evidence, at least, suggests such costs may be significantly greater in the retail sector. Not only do general containment policies restrict the supply of land for retail but, particularly in England, rigid 'TCF policies' have micromanaged retail location to specific sites in designated 'town centres' and virtually prohibited large scale out-of-town retail development. Town centres as designated for planning purposes, however, do not necessarily correspond closely to the centre of towns as most people would identify them.

Griffith and Harmgart (2008) and Haskel and Sadun (2009) provided the first academic attempts to analyse the economic impact of British planning policy on the retail sector. Their work was consistent with the less rigorously based conclusions of the McKinsey Global Institute (1998) who 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 British 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 previous researchers we have access to a wide range of individual store level data complete with full locational details. We also have full planning decision data for all English local authorities from 1979 to 2008 which allows us to analyse the impact of cross sectional variation in planning restrictiveness within England. The significant difference in both timing and restrictiveness of TCF policies in England compared to other countries of the UK helps us identify the specific impact of TCF policy on store productivity.

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. 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. According to the Competition Commission (2000) Appendix 12.7, land costs in France followed this spatial pattern and were, on average, 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.

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 costs 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 this paper to address this issue, particularly the issue of causation, directly, and ultimately quantify the impact of planning policies on TFP more precisely.

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. Section 5 presents the main analysis, estimating a production function for our store group which includes space as an input, and then shows how store size is influenced by planning policies. We use these relationships to estimate the TFP impact of planning policy. The final section summarises some conclusions and policy implications.

2. Existing land use policies: their evolution and some impacts

We need to know something of the particular form and timing of planning policies and how they are implemented if we are to develop useful hypotheses as to their economic impact. This description focuses on policies as they have developed in England but there are interesting and significant differences, both in the precise form and the timing, of policies for retail as between England, Wales, Scotland and Northern Ireland. While policy in Wales has tended to follow that in England closely, differences between these two countries and Northern Ireland and Scotland are significant. These differences are discussed in more detail in Section 5. Although there are national guidelines for policy for each country of the UK its implementation is initially the responsibility of local jurisdictions – Local Planning Authorities (LPAs). As the detailed data show, LPAs vary considerably in the restrictiveness with which they interpret national policies. Policies are implemented by means of 'development control' – that is, each proposed development[2] as defined in the relevant legislation is considered individually by the LPA and is then permitted or refused (in contrast to systems in force in the USA or continental Europe where what plans permit can be built). There is then a process of appeal against local decisions.

[2] Development has a legal meaning. It does not necessarily involve constructing anything but includes changes of use between legal 'Use Classes'. So a proposal to change the use of an existing shop from selling say books to selling houses would constitute 'development' and would need to be considered via the process of 'development control' by the relevant LPA.

Although restrictions on out-of-town retail developments had been emerging in England since 1988, 'TCF Policies' - in broadly their current form - were introduced in the revised PPG6 (Department of the Environment, 1996)[3]. The policy had a number of objectives which, as its subsequent evaluation (ODPM, 2004) pointed out, conflicted. On the one hand the purpose of PPG6 (1996) was to redirect development, not just in retailing but in all 'key town centre uses', including leisure and office development, 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.

There were strong commercial pressures in the early 1980s for the development of large scale, car-based, out-of-town shopping malls (known in the UK as Regional Shopping Centres - RSCs) and supermarkets. Planning Policy was initially formulated in the first version of PPG6, published in 1988 (Department of the Environment, 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 Dartford 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.

The initial PPG6 (1988) further determined that planning policy should not be used to inhibit competition. Policy became more restrictive in 1993 with a revised PPG6. This asserted a belief (according to ODPM, 2004) that the free market would 'under provide' in-town retail development. It attempted to offset for this supposed market failure in order to 'balance' out-of-town and in-town retail development. This represented a serious tightening of planning policy in relation to large format, out-of-town development.

The radical change in policy came in 1996, however, with a revised 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'. The revised PPG6 of 1996 introduced 'needs' and 'sequential' tests. The 'needs' test required the potential developer to demonstrate, according to prescribed formulae, that the community 'needed' more shopping space and that their proposed development would not undermine the viability of other local shopping facilities. The 'sequential' test was 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 and, subsequently, that sites in a 'district centre' or 'neighbourhood centre' were also not available before proposing to develop an edge-of or out-of town site. 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

[3] PPG stands for *Planning Policy Guidance*. It is a document that sets out national policy. PPGs have been superseded by PPS – *Planning Policy Statements*. The change in terminology was intended to confer a greater force to policy 'guidance'.

accessible locations for alternative [that is non-car] means of transport and facilitate 'linked trips' thereby reducing the need to travel." (ODPM 2004 page 21).

As Figure 1 shows the volume of applications for major new retail developments was sharply affected. Applications for major retail stores more than doubled from the bottom of the cycle in 1983 to the cyclical peak in 1988. Development activity fell sharply with the recession from 1989 but began to recover from 1992. But from 1996 it fell - despite the continuing economic recovery - so that by 2002 the volume of applications was little greater than in 1983. The revised PPG6 of 1996, however, applied to new developments and as ODPM (2004) reports, applications for store extensions boomed. From zero in the first four years of the 1990s applications for extensions to existing stores went to 10 per year by 1998. At the same time the strategic policy of major store groups was revised. Tesco and Sainsbury in particular developed smaller, in town, formats: in 1994 some 25 percent of Tesco's new openings were in town but by 2000 all new openings were defined as 'in town'; Sainsbury went from some 12 percent 'in town' in 1995 to 85 percent in 1999. According to Barker (2006) in 1971 around 65 percent 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.

Figure 1 about here

A further point is that the sharp reduction in store development – illustrated in Figure 1 – has come to be reflected in an older stock of buildings in the retail sector than in any other economic sector. As Barker (2006) shows, some 90 percent of retail space dates from 1980 or before: this compares to some 75 percent of office space or 70 percent of warehouse space. Older buildings tend to be less productive and also less energy efficient.

A further impact has been to raise the price of retail space everywhere but particularly in out of town locations as we showed in Cheshire *et al* (2011). The supermarket chain for which we have data classifies its stores' locations according to official types as designated by the planning system. It turns out that in fact stores which are officially in 'Town Centres' have the cheapest space, followed by those in officially classified 'District Centres'.

Indeed to the extent that space was most restricted in out-of-town locations where stores were likely most productive, space costs might actually rise with distance from functionally measured town centres.[4] If this were true then store size would become only weakly related to location vis à vis the spatial distribution of demand. In remoter and lower density areas with less market potential, stores might be smaller because, although the price of space was raised and so space substituted out of production and technological efficiencies lost, still stores reached their profit maximising size given the low total demand in the area they served. Demand would not support a larger store, although if land were cheaper, stores would in general be bigger and more productive. As population densities - or 'market potential'- increased, however, both price effects and direct regulatory constraints imposed by TCF policies would keep

[4] In Cheshire *et al* (2011) we document that retail space costs in the UK are only slightly related to various measures that attempt to capture the distance to city centres. Indeed they increase at the extreme periphery.

store sizes smaller. So below some observed population density (or market potential measured as total population within a 10 minute drive time) stores would be smaller as market potential fell further, but above that threshold stores would no longer tend to get bigger as economic potential increased because of direct regulatory constraints on store sizes.

This idea is explored in Figure 2. The dashed line divides stores into those in the lowest quintile of market potential measured as the population within a 10 minute drive time and the 80 percent of stores in locations with higher economic potential. It is worth noting that these low market potential stores (with a potential of less than 45,000 residents) are relatively concentrated in Wales and Scotland. As we can see from Figure 2, overall stores do not on average get very much larger in areas with greater market potential. In an unrestricted world one could reasonably expect a continuous increase in mean store size as individual stores served more people. This lack of a strong response in store size to market potential is confined to the stores in areas of higher potential, however. At the lower end of the distribution (lowest quintile) there is a strong positive relationship between increasing market potential and mean store size as illustrated in Figure 2.

Figure 2 about here

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 the reduction in productivity in the retail sector – or more accurately in the major supermarket group for which we have data - generated by a more restrictive planning policy.

There are three routes by which planning policies might reduce TFP in retailing. Policies may both directly restrict store size or format and site characteristics via TCF policies; secondly policy may favour incumbents and generate a barrier to entry as analysed by Schivardi and Viviano (2011) although in the Italian case which they analyse, regulation is directly on entry rather than via land use planning policy; thirdly 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. In practice these three routes reduce to two since we cannot differentiate between the first two: the impact of TCF policy on forcing stores to less productive locations and its impact on restricting entry. So in summary:

1. TCF policy may impede entry and force stores (by the sequential test, for example, or just by forcing location to be in town centres or on particular sites within town centres) to be on smaller and/or less productive sites than they would otherwise have selected. As discussed in Section 5 this effect would work mainly via reduced consumer welfare, reducing store sales, other things equal.

2. Separately, containment policies, by increasing the price of space in general, will tend to reduce store sizes: although retailers may still successfully choose

profit maximising store sizes, the higher cost of space causes space to be substituted out of production, increasing costs and leading to efficiency losses compared to the space use that would have been employed had the price of space not been increased by the constraint on land supply for retail.

To test these hypotheses we use 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

We use two novel datasets. The first consists of individual store-level information on a full set of stores from a major supermarket group who has given us access to their data but wishes to remain anonymous. Variables 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, the number of parking spaces and store format have been obtained. The store location is available at full postcode level and grid references have been obtained as well.

Some key summary statistics are shown in Table 1. In total there are 357 stores in the UK with all or most variables reported 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. See Section 5 for further rationale for this assumption.

Table 1 about here

The second dataset we use relates to planning decisions. We collected all data on planning outcomes from the Department for Communities and Local Government (DCLG). These are for Local Planning Authorities (LPA) and cover all LPAs in England and thus correspond to a subset of 269 stores. The variable used in our analysis to capture the restrictiveness of planning regulation at the LPA level is the refusal rate for major residential projects. This variable corresponds to the ratio of rejected to total planning applications for major residential projects (projects consisting of 10 or more dwellings). These planning data run from 1979 to 2008. We use the data for major *residential* projects rather than major *retail* projects because there are insufficient applications for major retail developments to yield statistically reliable indicators of regulatory restrictiveness.

Others have used planning variables in their analyses of the economic impact of the planning system (see, for example, Cheshire and Sheppard, 1989; Preston *et al*, 1996 or Hilber and Vermeulen, 2010). 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 rate for a longer time period as the best indicator for the individual LPA.

It is well known, however, that there is a potential endogeneity problem with the refusal rate measure 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. There is, however, a counterforce of restrictiveness. Although the probability of success may be lower in LPAs known to be more restrictive, thus discouraging would-be developers from applying, the payoff from successful applications will be higher because permissions are scarcer. This will tend to increase the flow of applications and – given that the LPA is restrictive – the refusal rate. Although we do not know *a priori* which of these two incentives will be stronger, we suspect the ‘discouraged developer effect’ should prevail.

As is discussed in more detail below, this possible endogeneity of the refusal rate measure makes identification of causality problematic. Our approach to this problem is to devise an instrument. Although we have identified four possible instruments, we discuss only the one which we employ here - 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. We discuss this in more detail in Section 5.

5. Results from the production function approach

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. We have only one year’s data available so cannot use a panel approach and the natural log of sales (turnover) is used as the dependent variable. The retailer whose data we have access to, however, 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.

Therefore, the main econometric specification is the following:

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

In log terms (1) can be expressed as:

$$\ln Y_i = \beta_0 + \beta_1 \ln F_i + \beta_2 \ln L_i + \beta_3 \ln K_i + X'_i\, \gamma + X'_\alpha\, \delta + u \tag{2}$$

(Returns to Scale (RTS) = $\beta_1 + \beta_2 + \beta_3$)

Notes:
Y: sales of store i
F: floorspace; L: labour; K: capital for store i
X'_i: vector of store specific controls
X'_α: vector of area specific controls

There are several advantages of the data we have for the purposes of estimating a production function. Javorcik (2004) discusses some of the significant econometric problems that have been identified in the literature. Moulton (1990) warns of the dangers of introducing industry or aggregated market variables when regressions are employed with micro units since this may downward bias estimated standard errors. Our observations, while for micro units, are for all such units within one firm and we do not include either industry or aggregated market variables. Griliches and Mairesse (1995) argue that the choice of inputs may be potentially endogenous since they are chosen by the producer who has specific knowledge about the productivity of say labour for that firm (compared to others) or in that market. Our data relates to all establishments of one firm so inter-firm variation in productivity known to managers but not to economists is not relevant and moreover, the firm in question has a standardised national policy governing its pricing and employment policies. Finally we include fixed effects for local labour markets, identified as Travel to Work Areas (TTWAs), and this should effectively control for differences in labour productivity or availability across local labour markets, known to local managers but not to the economist trying to analyse the data.

Table 2 shows 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 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.[5]

The measure of floorspace used is net floorspace. This is more sensible theoretically, but also it gives reassuringly better results than when using gross floorspace. In the specification that includes both net and gross floorspace as regressors the latter

[5] We experimented with refining these measures using ASHE data at the LPA level on hours worked for the specific occupational categories covering retail workers but concluded that the company's own data although somewhat approximate were more accurate than making implicit assumptions that workers in a given occupation and LPA worked similar hours regardless of which retailer/store employed them.

becomes insignificant. Table 2 shows the results of a simple TFP approach with appropriate controls. The first control is for the presence of a mezzanine; it is widely known in the retail trade that mezzanine floors tend to generate less sales per unit area than the ground floor does. Further relevant controls are for labour inputs measured as employment in FTEs, for total opening hours and a dummy variable for non-food format stores. The latter dummy is included because non-food stores differ from food format stores in various ways (e.g. their logistics) that may affect productivity. The dummy captures unobserved characteristics that are unique to the store type.

Table 2 about here

We also add a variable for the age of the store. Experimentation showed this was most effectively represented in quadratic form. We also control for the characteristics of store catchment areas – competition from other stores in the area, the economic potential of its location measured as population within a 10 minute drive-time and – crudely measured by local car ownership share – local income and accessibility levels. The competition variable captures the degree of competition to which each store is exposed. It is estimated by applying a distance decay function to the five nearest stores from each of the two main competing retail groups. As expected higher values of this 'competition measure' are associated with lower store sales.

In addition, we estimate models with area fixed effects and for English stores separately from those located in Scotland and Northern Ireland. The argument for including area fixed effects is that there may be unobserved (time-invariant) variables specific to certain areas. We use Travel to Work Areas (TTWAs) to capture these possible area effects on the grounds that TTWAs are defined to be economically self-contained in the sense that people who live within a given TTWA tend also to work in the same area; and so it may be supposed, tend to shop within that area too. The first two columns in Table 2 show results for the UK, first without and then with TTWA fixed effects. Columns (3) and (4) report the same specifications but only for England. The last two columns of the table report the same model specifications but estimated only for Scotland and Northern Ireland. We report results separately for England only and for Scotland and Northern Ireland only as the two areas are clearly distinctly different from each other in terms of their planning policies, in particular in terms of the introduction and rigor of TCF policies. As discussed in Section 2, Wales falls somewhat in between the two policy poles.

We only have consistent measures of planning restrictiveness for LPAs in England so when we later assess the impact of regulatory restrictiveness on store size, we have to confine our analysis to English stores. In column (2) we also include dummies for Scotland, Wales and Northern Ireland (England is the omitted category) since various policies (including planning) may be binding at the country rather than at the TTWA or LPA-level. It is possible that other factors affecting productivity may vary between the countries of the UK, too. Similarly in column (6) we include a country fixed effect for Northern Ireland (with Scotland being the omitted category).[6]

[6] In this context note also that we have to omit one TTWA in each country included in the regression sample. So for example when the regression sample includes stores for England we exclude the London TTWA and so express the fixed effects of the other English TTWAs relative to London.

All models suggest an increasing TFP with store size. In all models without area fixed effects and in the case of all the models estimated on the data for the English stores alone (even with fixed effects), the effect of store size on TFP, all else held the same, is statistically significant. In all models except for the one estimated in column (3) there is unambiguous evidence of increasing returns to scale since the coefficients on space and employment add to more than 1: given that there is some interaction between employment and the hours a store is open then the evidence for increasing returns is arguably somewhat stronger.

The age of the store is a particularly interesting control. We are observing something like a natural experiment since TCF policy is tighter in England than in the other three countries and was introduced earlier (Competition Commission, 2000, Appendix 12.3). By comparing the results from the models estimated on the English stores (models reported in columns 3 and 4) with those estimated on stores in Scotland and Northern Ireland (columns 5 and 6), one can easily see that the effect of age of store on productivity is highly significant in England but not at all significant in Scotland and Northern Ireland. It is worth noting that if we add stores located in Wales to the sample of Scottish and Northern Irish stores, our results are qualitatively similar. In particular, the age of store variable and the square of this variable are completely statistically insignificant independent of whether stores located in Wales are included or not.

For the sample of English stores the relationship between age of store and productivity is clearly quadratic. The oldest stores are – as would be expected – less productive other things equal. Store productivity increases for stores founded during the 1960s and 1970s but only until around 1986. Productivity in stores founded after then begins to fall and, as can be seen from Figure 3 the very newest stores are the least productive of all. 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 this process might at most take 2 years: it is not remotely plausible that getting a new store up and running at its most efficient level takes more than 20 years. The estimated best fit relationship for date of founding and store productivity is graphed in Figure 3 using the coefficients shown in Table 2, column (4). There is of course some error associated with estimating the peak store age for productivity but its growth closely reflects the period of innovation with larger format, out-of-town stores during the 1970s and 1980s and the peak and subsequent decline closely tracks the progressive tightening up of planning policy for retail in England from 1988 and strongly suggests that one impact of the changes in planning policy has been to make stores less productive for any given size. An obvious interpretation is that this results from policy forcing retail to less productive locations and sites: that is, it directly reflects the introduction and then rigorous enforcement of TCF policy in England.

Figure 3 about here

However we should spell out more clearly the form this productivity penalty takes. What the data are telling us is that controlling for all other factors, including store size, sales per store fell systematically for stores founded after TCF policies began to seriously bite in England. This however must largely come through the consumer welfare side since we do not directly measure costs. The hypothesis is that stores were constrained to less productive sites but the impact on logistic costs for the company is not completely captured in our data. What appears to be completely captured is the impact on customer experiences and satisfaction. In-town stores are more difficult to get to, require more carrying of purchases and may be more subject to stock control problems (storage facilities are smaller and delivery systems less efficient; see Bell and Hilber, 2006). The range of goods, especially pack sizes, may be less attractive for customers. Equally out-of-town easy to reach by car (and lorry) stores allow quicker and less stressful shopping and a greater chance of finding items the customer needs because storage and delivery systems are more efficient. So any additional costs imposed on the store group by the micromanagement of site selection imposed by TCF policies would be partially (e.g. with delivery-associated costs) reflected in our data but far from fully measured.

The interpretation of the relationship between year of store foundation and productivity is made more plausible still by two other pieces of evidence. The first is that we know TCF policies were introduced earlier and applied more rigorously in England than elsewhere (Competition Commission, 2000, Appendix 12.3). Although Wales adopted quite similar policies in 1996 the guidance continued to stress the need for a competitive retail sector and the application may have been more flexible at least until 2005. In Northern Ireland policies for the retail sector did not attempt to micromanage retail location and site choice at all until 1996 and then with significantly less emphasis on town centre first. For example the sequential test was not introduced, the need to retain a competitive and innovative retail sector was given some emphasis and the case for out-of-town retail was accepted in principle. Scotland tightened up its TCF policy only in 1998 and did not recognise the necessity of applying a needs test although it did introduce a sequential test on site selection.

Second, the most obvious alternative explanation of why older stores are more productive could be that as the store group expanded and built more stores over time, it chose the most productive and attractive to customer locations first. However the evidence does not support this explanation. The most obvious measure of an attractive location is the population within a 10 minute drive time. The correlation between the age of the store and population within a 10 minute drive time for English stores is wholly non-significant ($r= -0.019$, $p=0.76$). That for stores in the rest of the UK is ($r=0.260$, $p=0.014$). In other words there is no significant relationship at all between the measure of location attractiveness and store age in England. In the less constrained rest of the UK there is a significant if not strong positive relationship. So, although in the less constrained rest of the UK there is some tendency for the older stores to be in locations with higher market potential, since this is included as an independent variable in Table 2, its impact is controlled for even in Scotland, Wales and Northern Ireland in the estimation of the store productivity - store age relationship.

The role of planning restrictiveness

We have persuasive evidence, therefore, that the tightening up on out-of-town stores in England started in 1988 and the micromanagement of store locations imposed with the full-blooded TCF policies introduced in 1996 was associated with a decline of store productivity from the late 1980s in England. However another issue is whether cross sectional variation in the restrictiveness of the planning system also influences store productivity. The most obvious way in which to investigate this is to see whether there is a direct relationship between indicators of planning restrictiveness at the LPA level and store size: does more restrictive local planning policy make stores smaller and so reduce TFP? We have already argued that there are two distinct routes which could generate this outcome and they are certainly not mutually exclusive. We have already discussed the evidence relating to the impact of TCF policy in England. The second is that by constraining the supply of space, planning policy increases its price, thereby causing a substitution of space out of production. While also having the effect of reducing TFP this would be an 'efficient', cost minimising adaptation by stores to distorted factor prices. While the evidence is that wider containment policies have had the long standing effect of increasing the price of retail space (see, for example, Cheshire and Sheppard, 1986) nevertheless cross sectional variation in planning restrictiveness might be expected to be related to systematic variation in retail space prices between LPAs.

Table 3 about here

Table 3 shows the results of relating store size to local planning policy using the data for food format stores only.[7] We have planning outcomes for every LPA in England from 1979 to 2008. Since we do not 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. As is argued in Hilber and Vermeulen (2010) there are good reasons for taking the long term mean of measures of planning restrictiveness to eliminate one source of endogeneity. Here we take the average refusal rate of major residential projects in an LPA for the period 1979-2008 as our measure of LPA restrictiveness (see Section 4 for the rationale of taking the refusal rate of major *residential* projects).[8] As Table 3 indicates, more restrictive LPAs were associated with smaller stores: residential refusal rates are negatively correlated with floorspace.

Because of endogeneity concerns with respect to the use of the refusal rate we use an IV approach. Table 3 shows the results using the share of Labour councillors at the local elections over the period 2000-2008 as an instrument for the refusal rate of major applications for residential projects. The logic for using political composition as an instrument is as set out in Sadun (2008) or in Hilber and Vermeulen (2010). Low and middle income Labour voters traditionally care more about the availability of jobs, prices in shops and housing affordability and less about protection of house values (fewer low income residents own homes) by preventing development.[9] It may also be the case that concern for protecting green fields from development is a normal good. Higher income voters are more concerned with preventing development on

[7] As noted above space constraints are, in particular, likely to have a differential effect for food and non-food format stores. A dummy variable for non-food format stores would not (fully) capture these differential effects. We note however that results are qualitatively similar if we estimate specifications for the full sample of English stores and control for the store type by including a dummy variable, although the effects are slightly less precisely estimated.

[8] For models (3) and (6) which use data only for stores founded since 1990 we tried using the mean of our planning restrictiveness measures just from 1990 to 2008. The results were essentially unchanged.

[9] Homeowners have strong incentives to behave as NIMBYs (Not-In-My-Own-Backyard) and oppose new residential construction nearby as more local housing supply or poorer views (due to the new sites) adversely affect house prices. While renters may also like nice views, they are likely to be at least partially compensated for deteriorating views by being able to negotiate lower rents.

green field sites than are lower income ones. Hence, we would expect the local share of votes for the Labour party to be negatively associated with the restrictiveness of the local planning system. Our identifying assumption is that, controlling for the other covariates (i.e., the other explanatory variables of store size), the share of Labour seats affects retail store size only through planning restrictiveness. The first stage results reported in the bottom panel of Table 3 confirm that the share of Labour seats is strongly and statistically highly significantly negatively correlated with regulatory restrictiveness. The values of the Kleibergen-Paap F-statistic reveal that in all models except that reported in column (6), weak identification is not a problem and even in model (6) bias is likely to be small.

The first three models are estimated without TTWA fixed effects or controls; the second set of three models includes both controls for exogenous influences on store size and also TTWA fixed effects. These models arguably provide the stiffest test. Model (5), which includes these controls and fixed effects and relates to the period covered by the planning data would seem, therefore, to provide the best consistent estimate of the impact of restrictiveness and to confirm that planning restrictiveness has a direct casual influence on store size and so on TFP in retailing.

Table 3 thus provides evidence indicative of a causal relationship from more restrictive local planning policies to smaller store sizes.

Estimated impact on total factor productivity

The quantitative estimates of the relationship between the age of a store and its normalised productivity and between LPA restrictiveness and store size can be converted into direct estimates of the overall impact of planning policies on TFP in the supermarket sector. The results of this exercise are shown in Table 4.

The estimates shown in the top panel of Table 4 use the relationship between age of store and normalised productivity to simulate what productivity for an average store in 2006 – chosen as the date of opening by which it could reasonably be assumed that the store had reached full operating efficiency by 2008 – would have been, if the rate of productivity had continued to grow between 1986 and 2006 at the rate observed in our data for the period 1966 to 1986 (0.46% per annum). This provides our counterfactual productivity estimate for 2006 stores. The second value shows the productivity of a representative 2006 store as it actually was estimated to be in 2006, allowing for the store age productivity estimate. We can see that this represented a loss of productivity of 16.0 percent compared to our counterfactual.

Table 4 about here

There are two reasons why even this value may be a conservative or lower bound estimate of the productivity loss imposed by TCF policies. As Haskel and Sadun (2009) report, productivity in the British retail sector actually grew in the first 5 years of the 1990s at a rate of 0.38% pa. This, however, compares with an annualised rate of productivity growth in the US of 0.49% and, in the US, this productivity growth accelerated sharply in the second half of the 1990s to 3.23% per annum (Haskell and Sadun, 2009). Given this evidence from the US, to assume a constant rate of productivity growth in British retailing over the whole 1966 to 2006 is thus likely to be a low rather than high estimate. The second factor is that we are only to a limited extent including additional costs imposed on the firm. These are likely to include more expensive logistics given that stores were increasingly located in more congested areas in town centres, farther from motorway access, and were smaller, with less storage space, so requiring more frequent re-stocking.

To this estimate of a loss of productivity of 16.0 percent directly attributable to TCF policies must be added, however, an estimate of the impact of increasing land prices and reduced store sizes in the more restrictive LPAs. This is shown in the second panel of Table 4. Our baseline is the average predicted productivity assuming that all stores in the sample faced the same regulatory restrictiveness as the store located in the least restrictive LPA. We compare this to the predicted productivity based on the actually observed regulatory restrictiveness. This comparison implies a loss of TFP of 4.2 percent for the store group overall. When we compare the least with the most restrictive authority, the implied productivity loss is 12.8 percent. Again, given the implausibility of even the least restrictive LPA having had no impact on the price of retail land (for example see Appendix 12.7 of Competition Commission, 2000) both values seem likely to be lower bound estimates. Thus overall our estimates suggest that 20.2 percent is likely to be too low rather than too high an estimate of the aggregated loss of productivity in the supermarket sector produced by planning policies.

6. Conclusions

The results strongly suggest that planning policies – in particular Town Centre First (TCF) policies – directly cause a significant reduction in total factor productivity in retailing – at least in the case of the large supermarket sector. We have shown that if output is measured as turnover then productivity rises with store size. Furthermore our evidence is indicative that more restrictive local planning regimes generate smaller stores. This was shown by using the mean 1979-2008 refusal rate for major residential developments for each LPA as a measure of 'regulatory restrictiveness'. One concern with the refusal rate measure is that it may be endogenous and that, as a consequence, the estimated impact of regulation on floorspace may be biased. In order to address this concern we employ an instrumental variable approach and exploit exogenous variation derived from the political composition of local councils in charge of planning policy in order to identify the causal and unbiased effect of regulation on floorspace. We have thus reasonably established that more restrictive planning regimes generate smaller stores and smaller stores are less productive.

Since the more restrictive TCF policies came earlier and have been substantially more rigid with respect to store locations in England than elsewhere in the UK, the significant negative impact estimated on productivity for English stores alone, built since the late 1980s, can be reasonably interpreted as a measure of the impact of TCF policy. We regard the absence of this effect for stores elsewhere in the UK as being highly significant in pinpointing the loss of productivity on TCF policy. We have, in effect, a natural experiment and the results are, therefore, more persuasive still with respect to tying in TCF policies to a significant reduction in total factor productivity in the supermarket sector. Estimating the cumulative impact of this on store productivity by 2006 indicated there had been a loss of 16 percent. Adding this to the impact of variations in cross sectional restrictiveness between LPAs in their application of planning policies indicates an aggregate loss of TFP of more than 20 percent on average since the late 1980s as a result of planning policies and their application by LPAs.

This, of course, is a gross economic cost not a measure of net costs. Restrictive planning policies may also generate benefits not measured here. One further intended step in this research project is rigorously to investigate TCF policy's impact on the carbon footprint of retail. The great advantage of estimating a credible, if lower bound value for the total cost of planning policies in terms of retail productivity, is that even if it fails to estimate any benefits, it should improve policy decisions. Planning policy may generate some gains, such as preserving the existing appearance of town centres (even if, as Sadun (2008) shows, it reduces town centre retail employment) but it would seem important to have an estimate of the corresponding costs associated with such benefits. In particular it should help to think more systematically about what precisely such benefits might be and whether they could be achieved at lower cost to productivity.

References

Barker, K. (2006) *Barker Review of Land Use Planning; Interim Report - Analysis*, London: HMSO.

Bell, D.R. and C.A.L. Hilber (2006) 'An Empirical Test of the Theory of Sales: Do Household Storage Constraints Affect Consumer and Store Behavior?', *Quantitative Marketing and Economics*, **4**, 2, 87-117.

Cheshire, P.C. and C.A.L. Hilber (2008) 'Office Space Supply Restrictions in Britain: The Political Economy of Market Revenge', *Economic Journal*, **118**, 529, F185-F221.

Cheshire, P., C. Hilber and I. Kaplanis (2011) 'Evaluating the effects of planning policies on the retail sector: or do town centre first policies deliver the goods?', SERC Discussion Paper No. 66, London School of Economics, January.

Cheshire, P.C. and S. Sheppard (1986) *The Economic Consequences of the British Land Use Planning System: a pilot study*, Final Report to the ESRC.

Cheshire, P.C. and S. Sheppard (1989) 'British Planning Policy and Access to the Housing Market: some empirical estimates', *Urban Studies*, **26**, 5, 469-85.

Competition Commission (2000) *Supermarkets: A Report on the Supply of Groceries from Multiple Stores in the United Kingdom*, London.

Competition Commission (2008) *The Supply of Groceries in the UK Market Investigation*, London.

Department of the Environment (1988) *Planning Policy Guidance: Town Centres and Retail Developments –PPG6 (first issue)*, January, London.

Department of the Environment (1996) *Planning Policy Guidance: Town Centres and Retail Developments – Revised PPG6*, June, London.

Griffith, R. and H. Harmgart (2008), 'Supermarkets and Planning Regulation,' CEPR Discussion Papers No. 6713.

Griliches, Z. and J. Mairesse (1995) 'Production Functions: The Search for Identification,' National Bureau of Economic Research Working Paper No. 5067, Cambridge, MA, March.

Haskel, J. and R. Sadun (2009) 'Regulation and UK Retail Productivity: evidence from microdata', IZA Discussion Paper No. 4028, February.

Hilber, C.A.L. and W. Vermeulen (2010) *The impacts of restricting housing supply on house prices and affordability*, London: Department for Communities and Local Government. (www.communities.gov.uk/documents/housing/pdf/1767142.pdf)

Javorcik, B. S. (2004) 'Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages', *American Economic Review*, **94**, 3, 605-627.

McKinsey Global Institute (1998) *Driving Productivity Growth in the UK Economy*, London.

Moulton, B.R. (1990) 'An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units', *Review of Economics and Statistics*, **72**, 2, 334–338.

ODPM, (2004) Policy Evaluation of the Effectiveness of PPG6, London: Office of the Deputy Prime Minister.

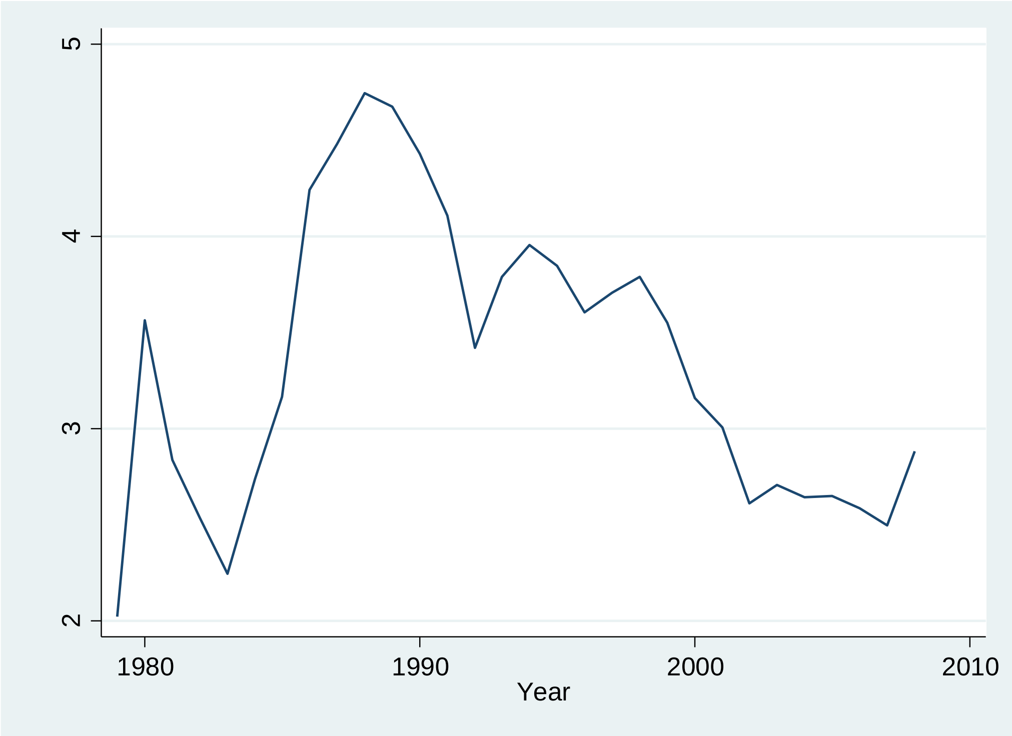
Preston, I., M. Ridge and S. Wood (1996) 'The Impact of the UK Planning system on House Prices', mimeo.

Sadun, R., (2008) 'Does Planning Regulation protect independent retailers?', CEP *Discussion* Paper N.888, August.

Schivardi, F. and E. Viviano (2011) 'Entry Barriers in Retail Trade', *Economic Journal*, **121**, 551, 145-170.

Figures and Tables

Figure 1: Number of applications for major retail developments, 1979-2008
(mean per local planning authority per year)



Source: Department for Communities and Local Government (DCLG)

Figure 2: Floorspace vs. population within 10m drive time

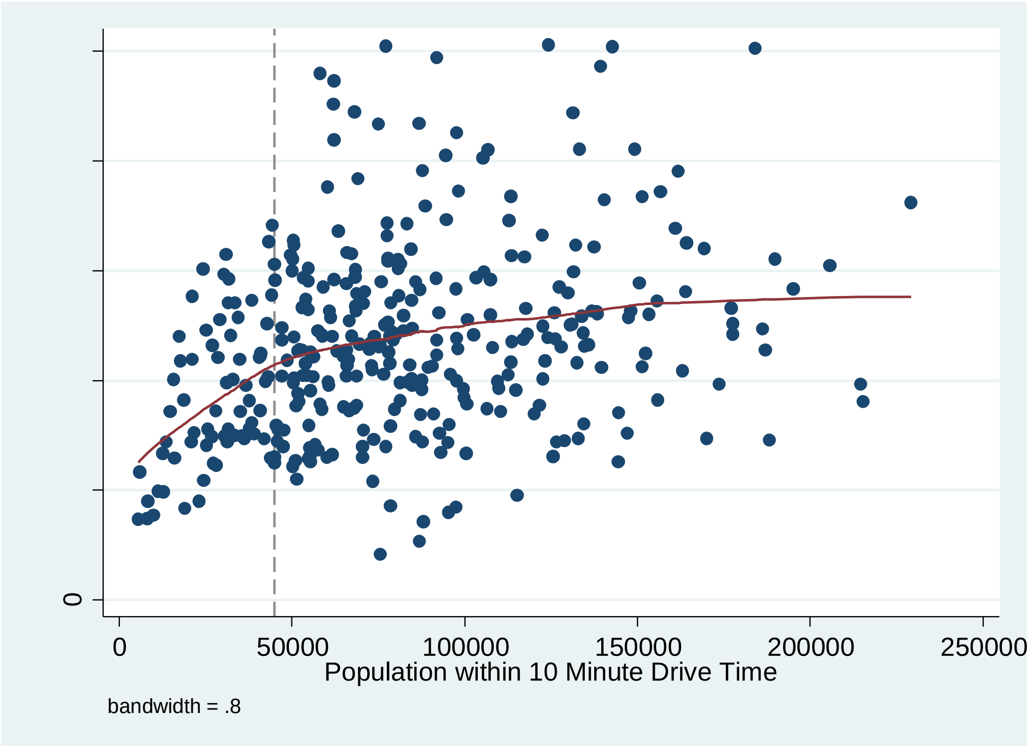
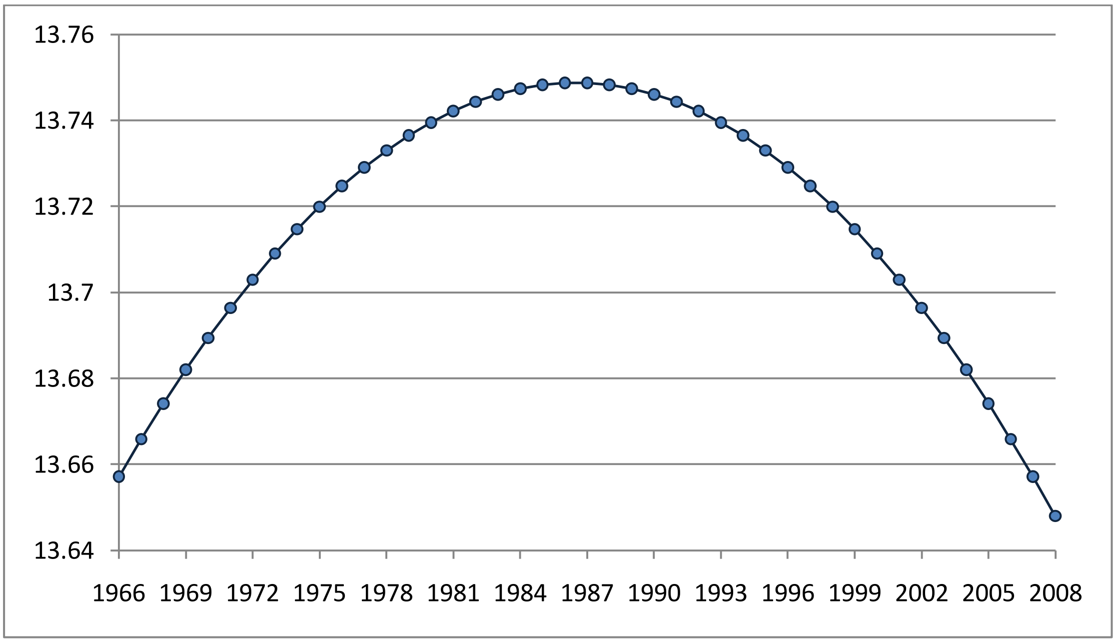


Figure 3: Simulated productivity (log total sales) by year of opening
(measured at sample mean; England only)



TABLES

Table 1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Weekly sales per employee (£)	357	4246	544	2349	5706
Weekly sales (£)	357	921115	406300	73978	2056014
Employment (FTE)	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 (sq. ft.)	357	27819.6	10144.7	0	54290
Non-food floorspace (sq. ft.)	357	18890.5	9859.5	671	52576
Net/gross floorspace (ratio)	357	0.58	0.07	0.33	0.83
Density (employees/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
Parking spaces	356	576	264	82	2000
Years since first opening	357	14.4	10.5	1	43
Total weekly opening hours	357	119	29	64	168
Population within 10 minute drive time	357	81226	43706	5532	229246
Car ownership share within 15 minute drive time	357	0.70	0.08	0.45	0.88
Competition variable [1)]	357	4.97	3.49	0.29	23.30
Refusal rate for major residential projects [2)]	254	0.22	0.073	0.084	0.50
Share Labour seats [2)]	254	0.38	0.23	0	0.94

Notes: [1)] Estimated by applying a distance decay function to the five nearest stores from each of the two main competing retail groups. [2)] Sample restricted to food format stores in England (Table 3).

Table 2: Basic results from a TFP approach with total sales as output variable

	Dependent variable: Log(total sales)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	UK *No* FEs	UK *With* FEs	England *No* FEs	England *With* FEs	Scotland and NI *No* FEs	Scotland and NI *With* FEs
Net Floorspace	0.120***	0.108	0.149***	0.158**	0.183**	0.170
	(0.0457)	(0.0725)	(0.0565)	(0.0791)	(0.0896)	(0.164)
Employment	0.894***	0.897***	0.841***	0.848***	0.934***	0.904***
	(0.0476)	(0.0748)	(0.0615)	(0.0910)	(0.104)	(0.145)
Mezzanine	-0.0409**	-0.0283	-0.0382*	-0.0448	-0.0350	0.0108
dummy	(0.0185)	(0.0310)	(0.0207)	(0.0347)	(0.0431)	(0.0698)
Non-food format	-0.148**	-0.179*	-0.260***	-0.253**	-0.148	-0.194
dummy	(0.0740)	(0.106)	(0.0900)	(0.124)	(0.111)	(0.152)
Hours	0.00105***	0.00112***	0.000937***	0.00104**	0.00153***	0.00118
	(0.000269)	(0.000422)	(0.000352)	(0.000516)	(0.000548)	(0.000960)
Years since opening	0.00939***	0.00795**	0.0122***	0.00981**	-0.00987	0.00437
	(0.00265)	(0.00397)	(0.00300)	(0.00430)	(0.00887)	(0.0116)
Years since opening	-0.00021***	-0.000183*	-0.00027***	-0.000218*	0.000269	-0.000137
squared	(6.61e-05)	(0.000112)	(7.30e-05)	(0.000118)	(0.000253)	(0.000346)
Population within	0.0590***	0.0510**	0.0522***	0.0638**	0.0735***	0.0417
10 min. drive time	(0.0138)	(0.0251)	(0.0177)	(0.0283)	(0.0266)	(0.0571)
Car ownership share	0.000976	-0.00111	0.000740	-0.000313	-0.00198	-0.00398
share within 15 min.	(0.000736)	(0.00174)	(0.000891)	(0.00192)	(0.00197)	(0.00455)
Competition	-0.00534**	-0.00399	-0.00553**	-0.00544	-0.0184**	-0.00564
	(0.00234)	(0.00347)	(0.00242)	(0.00361)	(0.00858)	(0.0136)
TTWA FEs	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
England		(omitted)				
Wales		-0.0252				
		(0.0768)				
Scotland		-0.174**				(omitted)
		(0.0691)				
Northern Ireland		-0.146***				0.0476
		(0.0544)				(0.119)
Constant	6.739***	7.128***	6.808***	6.665***	5.968***	6.577***
	(0.311)	(0.587)	(0.356)	(0.534)	(0.544)	(1.080)
Observations	357	357	269	269	62	62
R-squared	0.965	0.981	0.966	0.980	0.968	0.987

Notes: All regressors (except hours, car ownership, competition and dummies) are logged so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The specifications reported in Columns (5) and (6) were also re-estimated including all stores located in Wales. Results are qualitatively very similar. In particular, the coefficients on year since opening and year since opening squared are completely statistically insignificant as well.

Table 3: Does planning restrictiveness affect the net floorspace area of stores?
(TSLS estimates using share of Labour seats at the local councils as instrument)

	TSLS: *Second stage* Dependent variable: log (net floorspace area)					
	(1)	(2)	(3)	(4)	(5)	(6)
	All English stores	>1980	>1990	All English stores	>1980	>1990
Refusal rate:	-0.746	-1.088*	-1.515*	-1.050	-2.097*	-2.608
major residential projects	(0.532)	(0.582)	(0.834)	(1.079)	(1.230)	(2.338)
Population within 10 minutes				0.199***	0.125*	-0.0452
drive time				(0.0700)	(0.0735)	(0.163)
Car ownership share				0.00457	0.00486	0.000482
within a 15 minute drive time				(0.00549)	(0.00588)	(0.00745)
Competition				-0.0154	-0.0153	-0.0265
				(0.00954)	(0.0105)	(0.0214)
TTWA FEs	*No*	*No*	*No*	*Yes*	*Yes*	*Yes*
Observations	254	217	132	254	217	132
	TSLS: *First stage* Dependent variable: **refusal rate (major residential projects)**					
Share Labour seats	-0.192***	-0.190***	-0.196***	-0.148***	-0.140***	-0.126***
	(0.016)	(0.015)	(0.017)	(0.027)	(0.030)	(0.040)
Controls and FEs (included instr.)	*No*	*No*	*No*	*Yes*	*Yes*	*Yes*
Kleibergen-Paap rk Wald F stat.	153.1	165.9	131.4	30.0	22.0	9.8

Notes: **Instrumented variable in bold.** The sample is restricted to food format stores that are located in England. The refusal rate is calculated as the ratio of declined major residential project applications to the total number of applications and averaged over 1979-2008 (the period for which regulation data exist). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stock-Yogo weak ID test critical values: 10% maximal IV size: 16.38, 15% maximal IV size: 8.96, 20% maximal IV size: 6.66 and 25% maximal IV size: 5.53.

Table 4: Quantitative estimates of planning policy impact on retail TFP

	Specification	Predicted weekly sales per square foot	Loss in productivity
Representative store built in **2006** – ***but annual productivity growth since 1986 assumed at estimated rate for 1966-1986***[1)]	T2 (4)	£20.85	(Base)
Representative store built in **2006** (post introduction of Town Centre First Policy)[1)]		£17.52	**-16.0%**
All stores in sample assumed to have lowest level of regulatory restrictiveness[2)]	T2(4) + T3 (5)	£19.21	(Base)
Average of all stores in sample[2)]		£18.39	**-4.2%**
All stores in sample assumed to have highest level of regulatory restrictiveness[2)]		£16.76	-12.8%
Total Impact on TFP			**-20.2%**

Notes: [1)] Predictions are based on regression sample in Table 2, Column (4). Representative store: All values at sample mean except as indicated. [2)] Simulations are based on regression sample in Table 3, Column (5) and parameter estimates taken from the specifications in Table 2, Column (4) and Table 3, Column (5). Lowest and highest levels of regulatory restrictiveness are taken from Table 1.