LAND USE REGULATION AND PRODUCTIVITY – LAND MATTERS:

EVIDENCE FROM A UK SUPERMARKET CHAIN*

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Abstract

We use store-specific data for a UK supermarket chain to estimate the impact of planning on store output. Exploiting the variation in policies between England and other UK countries, we isolate the impact of Town Centre First (TCF) policies introduced in England. We find they directly reduced output by forcing stores onto less productive sites. We estimate TCF policies imposed a loss of output of 32 percent on a representative store opening after their rigorous implementation in 1996. Additionally, we show that, household numbers constant, more restrictive local authorities have fewer stores and lower chain sales within their areas.

JEL codes: D2, L51, L81, R32.

*Keywords***:** retail productivity, land use regulation, Town Centre First, local regulatory constraints.

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1.   Introduction

Our paper contributes to two important current policy concerns and strands of the literature. The first is the concern with the slow rate of growth of productivity in Europe compared to the US, especially the contribution to this sluggish performance of the European retail sector. The second is the growing evidence in both the US and the UK that land use regulation often imposes significant economic costs.

Land use regulation (planning) in the UK intentionally restricts the availability of land for retail, along with land for all other urban uses, and has done so rigorously since 1947[1]. In English cities in the mid-1980s the most expensive land for retail cost more than 250 times as much as the most expensive retail land in comparable US cities (Cheshire and Sheppard, 1986). In addition, regulation of retail development in England – Scotland and Northern Ireland are different – tightened in 1988 and tightened decisively in 1996 with the introduction of 'Town Centre First' (TCF) policies. These aimed to concentrate new retail development on particular sites in central locations.

In this paper we explore the adverse impact these planning policies – and chiefly TCF policies – have had on retail output. To estimate the impact of *TCF policies in England* on store output, we use store-specific data for a major UK supermarket chain. Although rich and detailed, our data relate to only one year, 2008. Clearly it would be preferable if there was a panel but only one year was available. However, we are able to add a time dimension to the data because we know the exact date at which each store opened. This is crucial for our empirical setup since the store location and site choice are determined at the store opening date[2] and our central proposition is that the precise site, its characteristics and location, are important in determining the productivity of any store. If a store opened prior to 1988

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[1] The year that the Town and Country Planning Act was introduced. This expropriated development rights from the owners of real estate and made development of space for each category of legally defined 'use' subject to 'development control'. Development legally covers changing the use of any parcel of land or building from one legal category of use to another (including construction of new buildings). Development control requires that the proposer of any such legally defined development must apply to the Local Planning Authority for permission.

[2] Of course in a literal sense the characteristics of a location, even a site, can evolve over time. However, given that we observe store sales only 12 years later, it seems reasonable to assume that any changes will not significantly affect the results.

anywhere in the UK we can justifiably assume that it had greater freedom of choice both with respect to locations and sites than was true after that date. For stores opening within England after the imposition of strict TCF policies in 1996, retailers effectively lost control of their ability to choose locations and sites on the basis of their inherent productivity. While a retailer could still choose not to enter a local market, if the planning system allowed them to build a store, their choices of a site were determined by planners. Hence, our data allows us to directly test whether increasing restrictions on out-of-town locations, starting in England in 1988 and culminating with the introduction of strict TCF policies in 1996 adversely influenced output of the affected stores as observed in 2008. In essence what we do, therefore, can be described as a Difference-in Difference (DiD) approach 'in spirit'.

Whereas TCF policies are countrywide, the rigour with which planning policies have been implemented varies considerably from jurisdiction to jurisdiction. We explore the effect of these variations on retail chain presence and total sales in the local area, by combining the analysis of the store level data with detailed quantitative measures of the restrictiveness with which planning policies have been implemented by Local (Planning) Authorities (LAs) in England since 1979. This allows us to analyse the impact of cross-sectional variation in local planning restrictiveness, not only on total retail output in the local area, but also on whether there is likely to be a store at all serving the local community. Since we use as our measure of restrictiveness the rejection rate for major developments over a long time period, we are analysing a dimension of planning constraints quite distinct from the micromanagement of site choices involved in TCF policy. There are many LAs – particularly in southern England - where any major development is a problem.

Our key findings are as follows. Firstly, the costs of English planning are very substantial. According to our most rigorous estimate, the initial tightening up of controls on retail development in England in 1988 led to a loss of output in a representative post-1988 English store of 14.6 percent. The subsequent introduction of the strict TCF policy in 1996 caused a further loss of output of 17.3 percent on stores subjected to this second tightening (i.e., a total loss compared to pre-1988 of 31.9 percent). This is equivalent to more than a lost decade of output growth. Secondly, we observe that in areas applying local planning policies more restrictively and holding household numbers constant, there is a much reduced probability of there being a store at all, and if there is, then there are fewer stores and they are smaller. This has two effects; on the one hand it increases sales per sq ft of store space - presumably because of increased local monopoly power; on the other hand, it substantially reduces the

total sq ft of store space in more restrictive LAs and thereby substantially reduces the total sales of the chain in that LA. Our estimates imply that a one standard deviation increase in local restrictiveness reduces total sales in the local area by around 32 percent. A final finding is that there is no tendency for the productivity of English stores to increase the more recent they are. This is in contrast to stores in Scotland and Northern Ireland. Research in the US (Foster *et al*. 2002) argues that productivity growth in retailing largely occurs in new stores so this finding reinforces the conclusion that productivity growth in English retailing is anomalous and, as the evidence we present here shows, can be traced to planning policies.

Our paper ties into a relatively small but growing literature on the economic impact of planning. Most closely related to our study, Griffith and Harmgart (2008) and Haskel and Sadun (2012) provided the first academic attempts to analyse the economic impact of British planning policies on the retail sector. Their work was consistent with the less rigorously based conclusions of the McKinsey Global Institute (1998) who argued that by preventing the emergence of more productive, large format stores and by increasing the costs of space, planning policy was seriously impeding the growth of Total Factor Productivity (TFP) in the UK. 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. Their analysis produced very strong evidence of the importance (and statistical significance) of store size to profitability and productivity – see for example the results reported in Table 6 of Competition Commission (2008, Appendix 4.4). Our results confirm this conclusion.

Restricting the supply of urban land naturally raises its cost and so increases the price of space and influences welfare. Most research to date has been on the impact this has in the residential sector but Cheshire and Hilber (2008), for example, examined the office sector and concluded that British land use planning imposed additional costs substantially higher than in any other comparable country. Even in a depressed provincial city such as Birmingham, restrictive planning policies generated the equivalent of a tax on marginal construction costs of 250 percent averaged over 1999-2005. In London's West End this regulatory tax was estimated to have averaged 800 percent over the same period.

From this and other work[3] on the impacts of land use planning policy on the costs of space in Britain it seems reasonable to assume that it causes the substitution of space out of production, and severely constrains locational choices. But to date the link between any lost productivity in retail and planning policies is more circumstantial than conclusive and the most rigorous estimation of the quantitative impact of planning policies on retail productivity (Haskel and Sadun, 2012) is based on firm rather than store level data. Nevertheless, their estimates suggest a loss of 0.4 percent a year in TFP growth from 1997 to 2003.

Other studies have examined the economic impact of other forms of control on entry into local markets by retailers, such as licensing requirements. As was shown by Bertrand and Kramarz (2002) and by Schivardi and Viviano (2011) such barriers to entry alone can significantly reduce supermarket employment or productivity – at least in the cases, respectively, of France and Italy.

The main contributions of our paper to the existing literature are as follows. Firstly, unlike previous academic researchers we have access to a wide range of individual store level data, complete with the year of store opening and full locational details, for a major UK supermarket chain. Compared to chain level or even regionally aggregated chain data this allows us to control for a far wider range of relevant factors, such as local competition or characteristics of catchment areas and local planning regimes. It also allows us to address some of the issues raised in the literature (see, for example, Javorcik, 2004) on the estimation of production functions such as the role of local labour market conditions since we can include local fixed effects. Secondly, using store-level data for just one firm with a common national pricing and management policy greatly reduces problems associated with estimating production functions, so makes estimates more credible. Thirdly, unlike previous studies we not only have the micro-level store data but information on the store opening date and local planning decisions allows us to set up our models explicitly to test for the causal roles of both TCF policy induced effects and local planning constraints on output and productivity. The quasi-natural experiment of the significant difference in both timing of the introduction and in the rigor of application of TCF policies in England compared to other countries of the UK helps us identify the specific impact of TCF policies on store output.

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[3] See for example Cheshire and Sheppard (1986), Competition Commission (2000) or Hilber and Vermeulen (2010, 2012). The Competition Commission (2000, Appendix 12.7) found that average retail land costs in Britain were five to ten times higher than those in France or Germany and declined with neither city size nor distance from city centres. In contrast, land costs in France followed the classic monocentric urban economic rent gradient pattern. Estimates for Germany and the Netherlands produced similar spatial patterns and also comparable land values to those reported for France.

As a final preliminary note we should stress we are attempting to quantify only the costs of planning policies for retail – not the value of any benefits that they may produce. It is our view that at least knowing "the prices on menus" is helpful information and at present we have powerful and influential planning policies without any measure of their economic costs – or, indeed, of the value of their benefits.

The paper proceeds as follows. Section 2 briefly sets out the key elements of British planning policies with respect to retail. Section 3 establishes more formally our hypotheses and our methodological approach. Section 4 describes the data we use. Section 5 discusses our empirical specifications and results and presents and interprets our findings. The final section summarises conclusions and policy implications.

2.   Existing land use policies: Their evolution and some impact

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. In addition, the difference in both policies and their date of introduction across the countries of the UK provides a valuable means of identifying their impact. Here we just summarise the main features very briefly: more detail is given in Appendix A.

A common feature of land use planning across the whole UK is that it intentionally constrains space available for urban development and allocates space separately for each legally defined category of land use. Moreover, unlike systems in Continental Europe or the US, the British system enforces planning by means of 'development control'. Any development which legally constitutes a change of use requires individual approval by the 'Local Planning Authority' (in Britain the smallest governmental jurisdiction, commonly called a 'Local Authority' and abbreviated throughout as LA). There are national policies and also local plans but these latter are not binding.

Given that the fundamentals of this system of land use planning had been in place since 1947, even by the mid-1980s the UK had had a system of supply constraints for all urban and specifically for retail land, acting independently of prices, for more than a generation. The construction of the motorway (highway) system from about 1960, growth of car ownership and use[4] associated with residential decentralisation, created strong forces favouring the development of out-of-town, large format supermarkets and shopping centres. Underpinning

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[4] Total car miles increased by 39 percent from 1970 to 1980; by 56 percent during the 1980s; 12 percent during the 1990s and a further 7 percent from 2000 to 2008 (Department for Transport, 2012).

our methodology is the fact that planning policies towards retail development have differed widely between the countries of the UK with that divergence starting in 1988. While planning policies in Wales closely followed those in England, policies towards out-of-town retail development were later to develop and less restrictive in Scotland and very substantially less restrictive in Northern Ireland.

In England from 1988 policy changed to confine out-of-town retail development to so-called 'regeneration sites' (mainly abandoned industrial land) and tightened these restrictions in 1993. Really tight restrictions in the form of Town Centre First (TCF) policies in England came into force in 1996 with Planning Policy Guidance note 6 (PPG6)[5] (Department of the Environment, 1996). PPG6 dropped any mention of 'avoiding unnecessary regulation' – present in previous national planning policies for retail – but most importantly introduced two essential new instruments: the '*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. It can be argued this erected a barrier to entry into local markets. 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. A site was only defined as 'suitable' if it was identified for retail use in the local plan. The fact that such a site might be owned by a rival supermarket chain did not render it 'unsuitable'. As ODPM (2004) stated: "PPG6… (was) increasingly used by LAs as a development control tool to prevent out-of-centre development…It became all but impossible to develop large-format out-of-town stores in England."

In 1996 Scotland introduced some regulation with town centres becoming 'preferred' locations, but no *needs* or *sequential* tests were introduced to enforce this and the policy still aimed to support a competitive retail sector. Scottish policy tightened somewhat in 1998 and tightened more firmly in 2006 to include a form of *sequential* test (but continued to support a competitive retail sector). Policy towards out-of-town retail development was consistently more relaxed in Northern Ireland and no form of TCF policy was introduced during the

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[5] PPGs were renamed Planning Policy Statements from 2004; these have now been abolished and incorporated in the National Planning Policy Framework, 2011.

period covered by this study although since we have few observations for Northern Irish stores the difference between policy there and in Scotland has little influence on the results.

In this paper we exploit these differences in 'restrictiveness' and timing of the policies in England compared to Scotland and Northern Ireland. We need to clarify, however, that both England and Scotland were 'treated' by restrictive retail planning policies but to a different extent. In that sense, we are not comparing treated versus non-treated but treated (1988) and then very rigorously and clearly treated (1996) (England) to treated gradually, more moderately and later (Scotland).

So, in summary, policy towards out-of-town supermarket and retail development in England tightened from 1988 in two main steps with the radical change in policy coming in 1996. We try to capture this in the models we estimate in the empirical analysis below.

As Figure 1 illustrates, the gradual policy change in England sharply affected the volume of applications for major new retail developments. These had more than doubled from the bottom of the economic cycle in 1983 to its peak in 1988 and by 1992 had begun to recover from the 1990 recession. Following the introduction of the full blown TCF policies in 1996, however, development applications fell sharply despite the continuing economic recovery, so that even by 2002 the volume of applications was little greater than in 1983. 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.

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, an astonishing 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 energy efficient.

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

'District Centres'. Indeed the evidence shows that retail space costs in the UK are only slightly related to measures capturing the distance to functionally measured city centres; they actually increase at the extreme urban periphery. This suggests that policy most restricts the supply of space for retail development in out-of-town locations where stores are likely most productive.

3. Hypotheses and approach to testing

There are two main mechanisms through which planning policies and restrictions on land availability for retail might affect store output (measured as sales), productivity and welfare. The first mechanism is the general restriction on land for retail development. This policy of urban containment has been in place as a national policy since 1947, raising prices of land for all urban uses. However the strictness with which planning operates locally varies, as we know from previous studies such as Cheshire and Sheppard (1989); Preston *et al*. (1996); or Hilber and Vermeulen (2010 and 2012).[6] Such variation in local restrictiveness should affect the local price of land and is also likely to affect the probability that any given proposal to develop a store will be approved. Thus in more restrictive LAs we should expect not only that stores might be smaller because of land costs, but there will simply be fewer stores because the planning system is operating as a form of barrier to entry, more powerfully in more restrictive LAs.

The second mechanism is the impact of TCF policies on store location and site choice. This resulted from the impact of first restrictions on, and then the virtual prohibition of, the development of large format, out-of-town stores in England starting in 1988 and then really biting from 1996 with the introduction of TCF. Restricting out-of-town locations and then the detailed micromanagement of store market entry, sites and locations introduced with TCF policies are likely to have had three effects. The first is that the application of the needs test introduced with TCF may have imposed additional barriers to entry, protecting local incumbents (and reducing the total number of stores)[7]; second it may have forced stores to more awkward and difficult to manage sites; and third it may have forced stores to

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[6] In more decentralised countries such as the US it is well-established that land use restrictiveness varies within and across metro areas (Green *et al*., 2005; Gyourko *et al.*, 2008; Quigley and Raphael, 2005; Saiz, 2010; Hilber and Robert-Nicoud, 2013). This might be less obvious for a highly centralised country such as England.

[7] Our data do not allow us to (convincingly) test this directly. However, it is noteworthy that while in our regression sample 50.6 percent of stores in England precede 1996 in Scotland and Northern Ireland, the equivalent figure is only 33.9 percent. That is, proportionately far fewer stores were opened in England after 1996 than in Scotland and Northern Ireland. If we plot store openings per inhabitant we observe an acceleration in openings post 1996 in Scotland and Northern Ireland compared to England.

intrinsically less productive locations chosen by local planners. A feature of TCF policies is that, in effect, store locations are micromanaged by the planning system.

Our measure of output is sales per store. As has been noted in the literature this has a potential problem as a measure of output (see, for example, Griffith and Harmgart, 2005 or Reynolds *et al.*, 2005). Increased monopoly power might be translated into higher store prices so higher measured output and *increased* TFP. The store chain whose data we analyse assures us that they have a rigid policy of uniform mark-ups, so there is no variation in product prices across its whole chain (except for petrol where it ensures its prices match those of its nearest competitor) so our results should be free from this potential source of misrepresentation: sales per store should be closely correlated with gross margins and value added.

However, in so far as more restrictive local planning policies or TCF policies[8] might generate barriers to entry, they could have the effect of increasing sales per store − because there are fewer available stores for consumers to choose from − and so still appear to increase TFP at the individual store level. In so far as this happened, however, it would be at the expense of passing on costs to consumers. Consumers would on average have to travel further to stores than they would otherwise have had to and put up with a less convenient and more crowded shopping environment. Moreover, although our store chain does not vary prices of given goods across its stores, it almost certainly does vary its product mix. Smaller stores, for example, are likely to stock a narrower range of products and smaller pack sizes. In addition, although barriers to entry are likely to increase sales at individual stores, they will be likely to reduce sales of the chain as a whole since there will be fewer and, if associated with higher land costs, smaller stores. Moreover the less accessible and convenient is shopping in a supermarket the more likely is it that consumers will substitute shopping modes and buy more of what they require online.

We are therefore testing three hypotheses. Our first, (Proposition 1) is that the variation in the restrictiveness with which the planning system operates locally influences the probability of there being a store to serve the local community at all. In more restrictive LAs it is less likely that there will be a store (Proposition 1a) and all else equal, we expect to observe fewer stores (Proposition 1b). We further expect that those stores which are present in more restrictive LAs will tend to be smaller because of higher land costs (Proposition 1c). Finally, as a consequence of these effects, we would expect total LA-specific sales to be lower, the more restrictive an LA is (Proposition 1d). The second hypothesis (Proposition 2) is that all else

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[8] There may be variation between LAs in how strictly they interpret the 'needs' test for example.

held constant, larger stores have higher sales and are more productive. Our third and main hypothesis (Proposition 3) is that the restrictions imposed in England starting in 1988 but really tightening with the introduction of TCF policies in 1996, reduced store sales and also TFP directly.

In so far as the evidence supports these propositions then there would be three routes by which we should expect to observe adverse effects on output and productivity in the retail sector (or in our case, a retail chain). Policies may both locally (more restrictive operation) and nationally (TCF policies) generate barriers to entry as analysed by Bertrand and Kramarz (2002) for France or Schivardi and Viviano (2011) for Italy. Both these studies found barriers to entry damaged supermarket efficiency, although in the cases they analysed, regulation was directly on entry rather than via land use planning policies. The second route by which there might be a reduction in output and/or productivity is the locally variable restriction on the availability of space (land) for retail development. In so far as this increases its price it would cause space to be substituted out of production, further reducing productivity in the sector. The third route is that TCF policies may directly restrict stores to less productive locations, to sites with awkward or less favourable characteristics or restrict store formats.

4. Data

To test the three propositions discussed in the previous section, we use detailed store level data with exact store location so other geographic/spatial data, which is relevant and may influence store sales and productivity, can be included in the analysis. Moreover, since we know there is variation in the restrictiveness with which policy is implemented across LAs (despite a national policy), we need a store's exact location to match it to LA planning data.

We use two novel datasets. The first consists of individual store-level information on a full set of stores from a major UK supermarket group who has given us access to their data but wishes to remain anonymous. Variables include sales, both net and gross floorspace (the difference between them being storage space), whether a store has a mezzanine floor and employment by store. Furthermore, store characteristics like total opening hours and store format have been obtained. The store location is available at full postcode level from which grid references have been obtained.

The key summary statistics are shown in Table 1. We have dropped stores in Wales[9] which leaves us with a total of 331 stores: 269 in England, 48 in Scotland and 14 in Northern Ireland. Most variables are reported for 2008.[10] Out of the total of 331 stores, 17 are non-food formats. Since non-food formats are quite different to food-format stores, they are considered as a special case so a dummy is added. Overall, net floorspace varies from a low of just over 8,000 sq. ft. to a high of more than 100,000 sq. ft. Our measure of employment varies from 32 to 471. The main capital employed in the supermarket sector beyond the premises themselves is stock. We do not have data on this but do have a measure of storage space which we take to be a proxy for stock. This is therefore our capital measure.

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 in detail from the company but based on their information we make the simple assumption that salaried employees are full time and hourly workers are on average half time. This allows us to estimate Full Time Equivalent (FTE) labour inputs at the store level.[11] We also have the year in which the store opened.

In addition to the store specific data we have data relating to the area within which the store is located. This includes the population living within a 10 minute drive time of the store, a measure of competition from other supermarkets (measured as a distance weighted function for the nearest five stores in the two main competing chains) and the political composition of the LA within which the store is located.

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[9] Stores in Wales could arguably be categorized as part of the treatment group since planning policies followed closely those of England. However, Welsh policy guidance implied rather more flexibility (see Appendix A), inducing us to drop it from the 'treatment group'. Results are similar if we include the Welsh stores in the treatment group.

[10] Our measure of competition from other supermarkets could only be measured in 2010. However, we would expect little change in this variable over a two year period. The planning variable and Labour share are mean values over the years shown in Table 1.

[11] We also experimented with other ways of estimating FTEs, for example, simply aggregating up all employees or using the Annual Survey of Hours and Earnings (ASHE). Specifically, we used the ASHE data at the LA 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. Our conclusion from this exercise is that the estimate of FTE employment is not particularly sensitive to the methodology used. Using a multiplier of 0.5 for hourly workers, however, yields – by a small margin – the best estimates in that the coefficient on FTE employment is most precisely estimated.

Table 1 about here

The second dataset we use relates to LAs in England. We collected all data on LA-level planning outcomes from the Department for Communities and Local Government (DCLG). These cover all LAs in England less the Isles of Scilly. Two further LAs (the Isle of Wight and the Corporation of London) were dropped due to lack of local political composition data during the years surveyed. There are therefore 351 LAs, 188 of which have a store within their boundaries. The variable used in our analysis to capture the restrictiveness of planning regulation at the LA 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. Many LAs have had no applications for major retail development at all and numbers are 2 or less a year for 55 percent of all LAs.[12]

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 and 2012). The most obvious variable to use is the refusal rate. As is argued in Hilber and Vermeulen (2010 and 2012) there are good reasons for taking the long term mean of the refusal rate to eliminate one source of endogeneity, their fluctuation with the economic cycle. We therefore take the average refusal rate of major *residential* projects in an LA for the period 1979-2008 as our measure of LA restrictiveness.

5. Empirical analysis

5.1. Production function, empirical specifications and identification strategy

Underlying our empirical approach is that retailing embodies a form of production function in which capital, labour and land are combined to generate output. First however we test the hypothesis that variations in planning restrictiveness between LAs influence the probability of there being a store in a given LA (Proposition 1a), the number of such stores (Proposition 1b) and their size (Proposition 1c). In so far as there is evidence that more restrictive LAs reduce the number and size of stores this will affect the total sales of the chain across LAs (Proposition 1d).

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[12] Nevertheless, in a robustness check we have estimated specifications using the refusal rate for major *retail* instead of that for major residential developments. See Section 5.2 for a brief discussion of findings.

Underlying our analysis of the impact of store size and TCF policies on productivity is the estimation of a production function for supermarkets with land as an explicit factor of production. A Cobb-Douglas functional form is applied with factors of production floorspace, labour and capital as explanatory variables and with the natural log of sales (turnover) as the dependent variable. The production function is as follows:

$$Y_i = AF_i^{\beta_1}L_i^{\beta_2}K_i^{\beta_3} \tag{1}$$

where:

Y_i: sales of store i

A: total factor productivity (TFP)

F_i: floorspace of store i; L_i: labour input of store i; K_i: capital input of store i

Our basic econometric specification can be written as:

$$lnY_i = \beta_0 + \beta_1 \ln F_i + \beta_2 \ln L_i + \beta_3 \ln K_i + X_i'\gamma + Z_j'\delta + \varepsilon \tag{2}$$

where:

X'_i: vector of store specific controls (such as age of store)

Z'_j: vector of area specific controls

We would interpret positive coefficients γ and δ on the store- and location-specific variables and upward shifts in β_0 as signifying an increase in TFP[13], while a change in the quantity of, say, floorspace F would be associated with a change in capital and/or labour productivity. Equation (2) allows us to test our Proposition 2 that, all else held constant larger stores have higher sales and are more productive. A positive coefficient of β_1 implies that larger stores have a higher capital and/or labour productivity because a positive β_1 implies that output rises, holding both capital and labour constant. So, output per unit of labour input increases and/or output per unit of capital input increases as well.

There are two apparent limitations to our data. One is that our measure of capital is less than ideal; another is that our data is cross-sectional in that sales and inputs relate to only one year. The data has, however, three very substantial advantages: it covers all establishments but of only one firm; it is at the level of the individual store; and it includes the date each store was established, adding a time-dimension to our otherwise cross-sectional dataset. We can see, for

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[13] That is, we allow TFP to vary by store i and location j. TFP can be expressed as $A = e^{\beta_0 + X_i'\gamma + Z_j'\delta}$.

example, if productivity varies according to whether a given store was founded before or after TCF policies were introduced in England.

The desirability of single firm data is stressed by Javorcik (2004). She discusses some of the significant econometric problems identified in the literature when the store level data comes from numerous firms. Griliches and Mairesse (1995) argue that the choice of inputs may be potentially endogenous since they are selected by the producer who has specific knowledge about the productivity of say labour for that firm (compared to others) or in that particular market. This supports using single firm and establishment level data since the retail outlets of a large chain will be in many local markets. Griffith and Harmgart (2005) similarly argue for store level data. They also point out the need to include store age given the findings of Foster *et al*. (2002) that in the US productivity growth in retailing largely occurs in new stores (a nice irony for us since we find that in England new stores since about 1988 have been increasingly less productive). 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 we can include local market controls.[14] Moreover, the firm in question has a standardised national policy governing employment policies and its pricing, with equal prices across all stores.

Following equation (2), the main empirical specification on which we rely to identify the impact of TCF policies on productivity can be expressed as:

$$lnY_i = \beta_0 + \beta_1 lnF_i + \beta_2 lnL_i + \beta_3 lnK_i ++\beta_4(England_i)$$

$$+\beta_5\big(England_i \times Post\ Treatment_i\big)+\beta_6\big(Post\ Treatment_i\big) \qquad (3)$$

$$+ \beta_7(local\ planning\ restrictiveness)+ \beta_8\big(other\ controls\big) + \varepsilon$$

This specification exploits the variation in the implementation of TCF policies in England compared to Scotland and Northern Ireland. Our main hypothesis – Proposition 3 – requires that β_5 should be negative. As we argued above in Section 2, national restrictions on developing large format out-of-town supermarkets or shopping centres in England were introduced in a mild form in 1988 but really tightened sharply with the introduction of strict TCF policies in 1996. For this reason we have two 'Post Treatment' variables: whether a store was opening in England between 1988 and 1996 (first tightening); and whether a store was opened in England after 1996 (strict enforcement). The prediction is that the coefficient

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[14] In our empirical analysis we include fixed effects for local labour markets, identified as Travel to Work Areas (TTWAs). These covariates should effectively control for differences in labour productivity or availability across local labour markets.

on the second interaction effect for $England_i \times Post\ 1996_i$ should be more negative than the interaction effect for $England_i \times 1988 - 1996_i$.

As outlined in Section 3, more restrictive local planning, via generating barriers to entry, could have the effect of increasing sales per store. Our measure of local planning restrictiveness is the refusal rate of major residential projects from 1979 to 2008 (see Section 4 for the rationale). It is well known that there is a potential endogeneity problem with the refusal rate measure since the behaviour of developers may be influenced by the behaviour of LAs. Since applications cost significant resources, would-be developers may hold back from making applications in LAs 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.

This possible endogeneity of the refusal rate measure makes identification of causality problematic. Our identification strategy follows that adopted by Bertrand and Kramarz (2002)[15] and implemented by e.g. Sadun (2011) or Hilber and Vermeulen (2010, 2012), who used the same planning data and methodology as ours in a similar context. The logic for using political composition as an instrument is that Labour voters, who are more heavily weighted towards lower and middle incomes, traditionally care more about the availability of jobs, prices in shops and housing affordability and less about the protection of house values (fewer lower income residents own homes) by preventing development.[16] It may also be the case that concern for protecting green fields from development is a normal good. So higher income voters might be more concerned with preventing development on 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 the share of Labour seats affects store level output, the propensity of local store presence and store size only through planning restrictiveness.[17]

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[15] Bertrand and Kramarz (2002) used the voting proportions for right wing parties as an instrument for how restrictive a French département would likely be towards new retail entrants. They found a significant positive relationship. Here we are using what is in effect a mirror image instrument – the proportion of representation from the main left wing party.

[16] Homeowners have strong incentives to behave as NIMBYs (Not-In-My-Backyard) and oppose new residential construction nearby as more local housing supply or impeded views 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.

[17] One might be concerned that Labour voters differ from other voters with respect to their earnings and their probability of owning a car and that the two measures might be correlated with the refusal rate and, *at the same time*, directly related (e.g. through sorting of households with similar characteristics) to store size and the probability that there is a store of the supermarket chain in a particular LA. To address this concern we estimated models with earnings and car ownership in the first and second stage of our TSLS-estimates. The

Specifically, we use 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.

5.2. Results

Main results: The role of local planning restrictiveness

Table 2 sets out the results, at the LA level, analysing the impact of the variation in local restrictiveness, conditional on household numbers, on the probability of there being a local store (columns 1 and 2) and a range of store and chain related outcomes (columns 3 to 10). We only have the local regulatory restrictiveness measure for England and hence have to drop stores in Scotland, Wales and Northern Ireland. We report OLS specifications (uneven columns) and TSLS specifications (even columns) and use the strategy outlined in Section 5.1 above to identify the causal impact of local regulatory restrictiveness on the various dependent variables. In the models reported in columns (5) and (6), where the dependent variable is the average size of stores, we confine the analysis to LAs in which there is a store. This reduces the number of observations from 351 to 188.

The first stage results reported in the bottom panel of Table 2 confirm that the share of Labour seats is strongly and statistically highly significantly negatively correlated with local regulatory restrictiveness. The values of the Kleibergen-Paap F-statistic show that weak identification is not a problem. In all models we include local labour market (Travel to Work Area) fixed effects as well as controlling for household numbers measured either in absolute terms or as the natural log.

Table 2 about here

The results reported in the first four columns confirm that there is a strong and highly significant adverse effect of greater local restrictiveness on whether there is a store at all and, if there is, how many there are. A one standard deviation (SD) increase in the restrictiveness of the LA, applying the more reliable instrumented estimates reported in columns (2) and (4), reduces the probability of there being a store at all by nearly 26 percent and reduces the expected number of stores by 0.28. The results in column (6) confirm that stores in more restrictive LAs also tend to be smaller. Together these results suggest (column 8) a one SD increase in local restrictiveness reduces the total floor area of the chain's stores in the LA by some 42 percent. Since (see Table 3) as the planning restrictiveness of an LA increases, sales

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earnings and car ownership controls were insignificant and did not alter our results, so we dropped them from our final specifications.

per store are higher per unit area of space because of the monopoly effect of increased barriers to entry, the reduction in total chain sales is proportionately less. A one SD increase in LA restrictiveness is associated with a reduction in the chain's sales in that LA of 32 percent.

The impact of increased restrictiveness on the average size of stores is statistically only significant at the 10 percent level and only in the IV specification. Nevertheless, it appears to be non-trivial. A one SD increase in local restrictiveness causes a 10.9 percent reduction in mean store size with the loss in productivity that implies, given the results reported in Table 3 below, showing that, all else equal, more space in a store increases sales.

Main results: The role of Town Centre First Policies

We report the results of our main empirical specification (Equation 3) in Table 3. The dependent variable is the log of store sales. Since we include the instrumented local planning restrictiveness measure as a control we show results for both OLS and TSLS with the first stage results in the bottom panel of the table.

Our key explanatory variables of interest are the interaction terms of whether a store is in England with a dummy for whether it was opened after the first restrictions on out-of-town development were introduced in 1988; or whether it was opened after full blown TCF policies were introduced in 1996. Thus we attempt to capture the peculiar situation in which the policy change started, first moderately, only in England but then came into full force in England while in Scotland and Northern Ireland *strict* enforcement of TCF never came into force.

Our key findings are as follows: The effect of post-1996 interacted with the store being in England is always significant and negative. The impact of the store being in England and opening between 1988 and 1996 is always negative but only significant when the country time trends are included. In our preferred specification (5), where we include the instrumented effect of local planning restrictiveness and separate country time trends, both effects are significant at least at the 5 percent level. Not only are they significant but they are large in absolute terms. The estimated value of the coefficient on a post-1996 store in England compared to a post-1996 store in Scotland or Northern Ireland indicates that TCF policies reduced store sales by some 32 percent all else equal. So given its size, labour inputs and all other factors there was a loss of 32 percent in TFP for a representative store in

England after 1996 (compared to the counterfactual of the situation with no policy prior to 1988); and a significant loss of nearly 15 percent if opened between 1988 and 1996.

This very large absolute loss of output is in addition to any losses associated with greater local planning restrictiveness, not associated to TFC policies. As we saw from the results reported in Table 2 an increase in local restrictiveness had a very substantial adverse effect on the chain's sales in the affected LA. This does not mean, however, that the effect of local restrictiveness on store sales is negative. As discussed in Section 3, we would expect that sales per store all else equal should be greater in more restrictive LAs because of the local monopoly effect. We test this proposition directly by including as a control variable our measure of LA restrictiveness for stores located in England. Since we do not have this variable for Scotland or Northern Ireland, we interact a dummy for England with the restrictiveness measure and set the variable to zero for stores located outside England. The coefficient on the refusal rate measure is positive in all specifications and statistically significant in the TSLS specifications reported in columns (4) and (5). This finding suggests that tighter local regulation induced barriers to entry and these barriers increased sales of affected stores.

We include in addition a range of appropriate further controls, starting with measures of the three input factors: the net floor area of the store, labour inputs measured as employment in FTEs (employment) and our proxy for capital inputs – storage area. The positive coefficients for both labour and floorspace (land) inputs are significant in all specifications and in our preferred model (5) both are statistically significant at the 1 percent level. They do not in aggregate differ significantly from a value of 1, implying constant returns to scale. However the coefficient estimate for space inputs at 0.152 suggests that a 10 percent increase in supermarket size, measured as net floorspace, is associated with an increase in sales, all else equal, of some 1.5 percent. Bigger supermarkets have a higher labour and/or capital productivity. The capital inputs proxy is not significant in any of the models reported here (nor in the Appendix tables – see Appendix B).

Another potentially important control is the presence of a mezzanine floor; it is widely believed in the retail trade that mezzanine floors tend to generate less sales per unit area than the ground floor does. The sign on this variable is always negative but statistically only significant in two of the models reported in Appendix Table A1. Other controls are: total opening hours (hours) and a dummy variable for non-food format stores (non-food format). The latter dummy is included because non-food stores differ from food format stores in

various ways (e.g. their logistics) that may affect the relevant characteristics of their specific production function; the dummy captures unobserved characteristics that are unique to the store type. We also control for some characteristics of the stores' catchment areas: total population within a 10-minute drive time and the impact of more local competition (competition). This measures the proximity of the store in question to the nearest five stores in the two main chains with which our store group competes most closely. Although the coefficients on all these controls have the expected signs, in the cases of the mezzanine dummy and the measure of local competition they are generally not significant. As explained in footnote 17 we also experimented with additional controls but since they were not significant and did not alter results of interest, exclude them from the models reported here.

Table 3 about here

We also add area fixed effects. The argument for including these 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.

In addition, in two models including our preferred model (5) we include a time trend for store age measured as years since opening, separately for Scotland and Northern Ireland combined and England. We experimented extensively with different functional forms for the time trends but in the models reported in Table 3 a simple linear trend worked best. For English stores it was negative but non-significant: for stores in Scotland and Northern Ireland it was positive and significant. Stores in those two countries, all else controlled for, were more productive, the more modern they were: this was not true of stores in England.

Additional specifications and robustness checks

As noted above, our main specifications reported in Table 3 have two sets of interactions: for stores in England that opened between 1988 and 1996 and for those that opened after 1996. In the Appendix Tables A1 and A2 we replicate these specifications but include only one break point; either post 1988 or post 1996. Interpreting the findings in Tables A1 and A2 we can conclude that (i) specifying the models in the way done in Table 3 appears not only to capture more accurately the actual policy changes but clearly works better[18]; (ii) the results in the two Appendix Tables are consistent with our main findings in that the pre/post-1988

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[18] We should thank both the editor and a referee who suggested we might be able to improve the specification of the model along these lines.

effect in Appendix Table A1 is of a similar magnitude to the pre-1988/1988-1996 effect in Table 3 and the aggregate effect (pre/post-1988 and pre/post-1996) of the two Appendix Tables is of a similar magnitude to the pre-1988/post-1996 effect reported in Table 3.

We carried out a large number of additional robustness checks and report the most relevant of these in Appendix B (Tables A3-A7). Specifically, we report results for specifications with (i) linear and quadratic time-trends (Table A3), (ii) standard errors clustered by UK country[19] (Table A4), (iii) the various controls interacted with the treatment/control-group variable and the pre/post-dummy variable respectively (Table A5) and (iv) using restrictiveness measures that are derived from applications for major *retail* developments (Tables A6 and A7). The key results are essentially the same in all cases, although, in Tables A6 and A7 − replicating Tables 2 and 3 using the retail specific refusal rate − identification of the refusal rate measure is somewhat weak in some specifications and significance levels are lower. See the Tables for more details.

5.3. Comparison of results and interpretation

Estimated impact on productivity and comparison with Haskel and Sadun (2012)

The quantitative estimates of the impact of TCF policies on total factor productivity in supermarkets (Table 3) can be directly converted into the implied productivity loss for a representative post-1996 store in England. A coefficient estimate for the interaction of post-1996 opening and the store being located in England of 0.319 implies a loss of output, all else equal, of 31.9 percent as a result of TCF policies. How does this compare to the results of previous studies? As noted in the introduction, Haskel and Sadun (2012) estimate a loss of 0.4 percent p.a. in TFP growth from 1997 to 2003. Projecting this estimate, implies an aggregate loss of output for the retail sector as a whole and for the period between 1996 and 2008 of 5.3 percent (=1.004^13). In our sample of English stores 49.4 percent of all stores opened after 1996 and we estimate the lost output in 2008 per post-1996 store (compared to pre-1988) to be 31.9 percent, suggesting an aggregate loss in output due to strict TCF policies and for the retail chain as a whole of 15.8 percent. At first glance, our estimates of lost output are thus significantly higher than those by Haskel and Sadun (2012). If we compare post-

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[19] Since one of our control variables is country-specific, in principle it would seem appropriate to cluster our standard errors at the country-level. However, this is problematic since then we would cluster on only 3 clusters, which is far too few for the standard cluster adjustment to be reliable, likely introducing a few-cluster-bias, implying that the standard errors will be too small on average (i.e., they are biased downward) (see for example Angrist and Pischke, 2009, Chapter 8.2.3 "Fewer than 42 Clusters"). When we ignore this warning and we cluster at the country level, we indeed end up with very small standard errors (see Table U2). As a conservative rule of thumb, we opted to use the larger of robust and clustered standard errors as our measure of precision.

1996 with pre-1996 (like Haskel and Sadun, 2012) and not with pre-1988, we obtain an aggregate loss in output of 8.5 percent, more in line with Haskel and Sadun's (2012) estimates. If we also take into account that our retail chain has a much smaller stock of old stores compared to the retail sector as a whole (see Section 2), then the estimated effects of the two studies are considerably closer. While Haskel and Sadun's (2012) estimates focus on the aggregate effects for the retail sector (and are likely to underestimate the effect since they do not take into account the separate effect of the first tightening in 1988), our estimates highlight the fact that the policies had a very substantial adverse effect for those stores that were subjected to strict TCF policy, and, since our data provider has a comparatively large stock of new stores, had a very substantial adverse effect for their supermarket chain. This, however, ignores our additional estimates of likely chain level output loss associated with the variation in local planning restrictiveness across LAs.

Table 4 about here

Table 4 provides additional insights. It brings together the estimates of both Table 2 and Table 3 as they relate to store and chain sales. In addition to the 31.9 percent loss of output associated with TCF policies there is also the impact of variations in restrictiveness with which the planning system is operated locally. Allowing however for three partially offsetting influences – i) the reduced number of stores; ii) the reduction in space in a given a store; and iii) the increased sales per unit area of store space in more restrictive LAs – we find that a one SD increase in restrictiveness causes a 31.9 percent loss of sales. Some of this loss of sales to the chain in more restrictive LAs, however, might be compensated for with higher sales in neighbouring, less restrictive, LAs; so we cannot think of the 31.9 percent reduction of chain sales in a given LA as representing a net loss to the chain as a whole. Unlike the loss of sales associated with TCF policies, moreover, we cannot think of this as just representing a loss of TFP. Increased land prices and the resulting smaller stores and more intensive use of space may increase labour productivity (stores are still profit maximising given the change in relative prices).

Interpretation of key findings in terms of productivity loss and likely impact of survival bias

At this point we should perhaps discuss in more depth the origins of the productivity penalty induced by TCF policies. What the data are telling us is that controlling for all other factors, including store size, sales per store fell systematically for stores founded in England after out-of-town stores first became restricted in 1988 but fell even more substantially after TCF policies came into force in their full rigour; and that store size itself matters for sales per store

all else equal. These productivity effects, however, must significantly manifest themselves in terms of higher logistics and site operation costs and loss of consumer welfare; we are only capturing the lower sales these increased costs and higher *real* prices reflect. The real price to consumers of course is not just the price paid at the check-out but all the costs incurred in the shopping experience including the trip costs. The hypothesis is that stores were constrained to less productive sites but the impact on logistic costs for the company is only captured in our data in the form of lower sales. What appears to be completely captured is the impact on customer experiences, the costs they bear as transport costs to stores and the pleasure or discomfort they obtain from the shopping experience. In-town stores are generally more difficult to get to, require more carrying of purchases and are likely to be more subject to stock control problems (storage facilities are smaller and delivery systems less efficient; see Bell and Hilber, 2006, for the analogy of the consumer's housing related storage constraints problem). Because they are smaller, the range of goods, especially pack sizes, may be less attractive for customers. Equally out-of-town stores, easy to reach by car (and lorry), allow quicker and less stressful shopping and a greater chance of finding items the customer needs because storage, stocking 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 not fully measured.[20]

A seemingly plausible objection to our interpretation of these results is that our findings relating to post 1988 or post 1996 store productivity were affected by survival bias. Only the most productive older stores survive so the sample of more recent stores includes some which are less productive and are likely to be closed at some future date.

This is implausible for four reasons. The first is that it should affect our 'control group' (stores in Scotland and Northern Ireland) as much as it affects the 'treated' group (English stores) so any selection bias should in principle be differenced out. The second reason is that we have evidence showing that the 'needs' test introduced as an element of TCF policy, provided some barrier to entry and conveyed a degree of monopoly to existing English stores. In so far as this is relevant then it would imply a greater probability of less productive stores in England surviving to our sample date of 2008 than would have been the case elsewhere in

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[20] Additional store specific costs would likely be negatively capitalized into land prices, consistent with our observation that land prices are lowest for city centre stores.

the UK. This would generate a downward bias to our estimates of output losses generated by TCF policies and so add force to our claim that our estimates are, if anything, conservative.

A third reason for not thinking survival selection bias is a significant problem, is the inclusion of the country specific time trends. We see that for Scotland and Northern Ireland there is the expected finding that more modern stores are significantly more productive. This is consistent with the US work on the growth of retail productivity of Foster *et al*. 2002 - that productivity increases are to a significant extent embodied in new stores. For stores in England, however, there is no such significant positive time trend – rather it is negative if non-significant.

A final point is that while the most obvious explanation of why – despite embodied technical progress – older stores might appear to be more productive is that the chain exploited the most productive locations as it expanded over time, we do not find any support for that in the data. The most obvious measure of an attractive and more productive 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 locational attractiveness and store age in England. In the less constrained rest of the UK there is some positive relationship.

6. Conclusions

The results strongly suggest that planning policies – in particular Town Centre First (TCF) policies – directly cause a significant reduction in both total factor productivity and – separately – labour productivity in retailing – at least in the case of the large supermarket sector. The fact that more restrictive TCF policies came earlier and have been substantially more rigid with respect to store locations in England than in Scotland or Northern Ireland provides us with in effect a form of natural experiment. We exploit this to estimate a model that is DiD in spirit. The results of this imply a loss of TFP of 31.9 percent for a representative post-1996 English store. This, however, is likely to be an underestimate since it implicitly assumes that the policies in Scotland and Northern Ireland were neutral with respect to town centre retail location. As Roger Tym and Partners (2006) makes clear, in Scotland at least, restrictions on out-of-town locations were introduced in 1996 (compared to 1988 in England) and policy became increasingly restrictive from 1998 although never as

rigidly imposed as in England. In addition, if interpreted as an estimate of the total loss of output or productivity, it implicitly assumes that pre-existing planning policy via its general restriction on land supply for urban uses, had had no impact on the economic efficiency of the retail sector prior to 1988; an assumption which other evidence (see, for example, Hall *et al*. 1973 or Cheshire and Sheppard, 1986) suggests is not the case.

In addition we need to consider the effects of the differential restrictiveness with which policies are applied across LAs. We have shown that if output is measured as sales – a measure supported by the fact that the store group whose data we analyse has a firm policy of equal mark-ups in all stores – then output rises with store size, all else equal. Store size is in turn affected by the restrictiveness with which LAs apply planning policies. We can only estimate these effects in England and they do not translate so easily into direct measures of lost output and TFP. They are nevertheless substantial. A one SD increase in measured restrictiveness at the level of the LA causes a reduction in the size of individual stores of 10.9 percent and there is a nearly 26 percent lower chance of there being a store at all, although the barrier to entry tighter local planning policies impose raises sales per unit area of those stores that are permitted. Netting out the effect of all three of these factors suggests that a one SD increase in LA restrictiveness causes a loss of chain sales of 31.9 percent within the LA concerned. This is of course not a pure loss in sales – it is in part a 'displacement effect' – the supermarket chain will be more likely to open up its stores in less restrictive local authorities, imposing longer shopping trips onto consumers who live in restrictive locations.

Following the financial crisis and recession of 2007 there is talk of a 'lost decade' of output being imposed on European economies. What we have shown here is that in one very important sector of the British economy – supermarkets and groceries – policy has imposed considerably more than a lost decade of output all on its own.

This, of course, is a gross economic cost, not a measure of net costs. Restrictive planning policies are in principle designed to generate benefits not measured here. When TCF policies were introduced it was claimed that town centre locations for retail would improve sustainability by allowing 'linked trips' and use of public transport and would ensure access to shops for poorer households who were less likely to have cars (ODPM, 2004). The two benefits the policy was expected to generate, therefore, were a reduction in the carbon footprint of retail and an improvement in equity. We are at present engaged in a rigorous evaluation and attempt to quantify these expected benefits – particularly the carbon footprint impact of TCF policy. Provisional results (see Cheshire *et al*., 2013) suggest that the carbon

footprint effects are probably negative: TCF policies caused an increase in the average length of shopping trips in England. This should not be too surprising given the continuing increase in car ownership and the fact that some 60 percent of all shopping trips are made by car. This in turn interacts with population decentralisation (Anas and Moses 1978; Cheshire, 1995).

The great advantage of estimating a credible, if lower bound value for the total cost of planning policies in terms of retail productivity, however, 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, 2011, shows, it reduces employment of independent retailers in town centres) but it would seem important to have an estimate of the corresponding costs associated with such benefits. Given that we estimate the costs to be very considerable, the case for trying to quantify any benefits is made stronger. Moreover in so far as we have indications of the mechanisms which lead to the high costs (especially the micromanagement of store locations and prevention of our-of-town larger formats) it might be possible to think about ways of achieving any benefits at lower cost.

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TABLES

Table 1
Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Local authority (LA)-level dataset (Tables 2 and A6)					
Store present	351	0.54	0.50	0	1
Number of stores	351	0.77	0.95	0	6
Total net floor area of all stores	351	36801	47992	0	288692
Average net floor area [4]	188	48029	14836	15926	101091
Total sales of all stores	351	743165	948982	0	5375933
Refusal rate of major residential projects, 1979-2008	351	0.25	0.086	0.073	0.51
Share Labour seats, 2000-2007 [3]	351	0.26	0.24	0	0.94
Total number of households, 2001	351	58087	38514	10463	390792
Store-level dataset (Tables 3, A1, A2, A3, A4, A5 and A7)					
Weekly sales (£)	331	931683	404409	73978	2056014
England only	269	969706	400669	73978	2056014
Employment (FTE)	331	215	84	32	471
Net floorspace (sq. ft.)	331	46810	17235	8313	101091
England only	269	48019	17014	8313	101091
Storage area (sq. ft.)	331	35111	15652	4410	107412
Non-food format (dummy)	331	0.051	0.22	0	1
Mezzanine (dummy)	331	0.16	0.37	0	1
Total weekly opening hours	331	121	29	64	168
Population within 10 min. drive time	331	83697	43765	5993	229246
Competition variable [1]	331	4.77	2.93	0.29	18.75
Store in England (# = 269)	331	0.81	0.39	0	1
Store in Scotland (# = 48)	331	0.15	0.35	0	1
Store in Northern Ireland (# = 14)	331	0.042	0.20	0	1
Years since first opening	331	14.8	10.6	1	43
Store opened up b/w 1988 and 1996	331	0.20	0.40	0	1
Store opened up after 1996	331	0.51	0.50	0	1
Refusal rate for major residential projects, 1979-2008 [2]	269	0.21	0.073	0.084	0.50
Share Labour seats, 2000-2007 [2/3]	269	0.39	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] Refusal rate and share Labour seats are measured at the LA of the store location. Both measures are for English stores only. [3] Share Labour seats based on local election years 2000, 2002, 2003, 2004, 2006 and 2007. The years 2001 and 2005 are excluded as local elections coincided with General Elections. [4] Sample restricted to LAs that have at least one store.

Table 2
Impact of Local Planning Constraints on Local Presence of Retail Chain

Dependent variable:	OLS	TSLS (2nd)	OLS	TSLS (2nd)	OLS	TSLS (2nd)	OLS	TSLS (2nd)	OLS	TSLS (2nd)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Store in LA=yes	Store in LA=yes	Number of stores in LA	Number of stores in LA	Average net floor space	Average net floor space	Total net floor space in LA	Total net floor space in LA	Total sales in LA *in £1000*	Total sales in LA *in £1000*
Refusal rate *(scaled to 0-100)*	-0.0215*** (0.00543)	**-0.0353*** (0.00791)**	-0.0312*** (0.00998)	**-0.0388*** (0.0120)**	-264.5 (388.0)	**-721.5* (402.0)**	-1,540*** (481.1)	**-2,110*** (590.4)**	-28.57*** (8.652)	**-32.46*** (11.67)**
Log(number of households)	0.251*** (0.0850)	0.163** (0.0732)			-820.4 (5,269)	-2,576 (3,735)				
Number of households			0.0102*** (0.00199)	0.00973*** (0.00159)			578.4*** (102.6)	539.5*** (86.22)	11.67*** (1.831)	11.41*** (1.508)
TTWA FEs & constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.532		0.627		0.491		0.634		0.647	

					TSLS: *First stage* Dependent variable: Refusal rate *(scaled to 0-100)*					
Share Labour seats *(scaled to 0-100)*		-0.180*** (0.0225)		-0.189*** (0.0220)		-0.177*** (0.0313)		-0.189*** (0.0220)		-0.189*** (0.0220)
Controls and FEs		Yes		Yes		Yes		Yes		Yes
R-squared		0.744		0.739		0.826		0.739		0.739
Kleibergen-Paap rk Wald F		63.89		73.97		32.17		73.97		73.97
Observations	351	351	351	351	188	188	351	351	351	351

Notes: **Bold** coefficients are instrumented. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Columns (5) and (6) report specifications for the sub-sample of local authorities with store presence.

Table 3
Impact of Town Centre First and Local Planning Constraints
on Store-Level Output (N=331)

	Dependent variable: Log(sales)				
	OLS			TSLS: *Second stage*	
	(1)	(2)	(3)	(4)	(5)
England ×	-0.0270	-0.0270	-0.156**	-0.0273	-0.146**
Opened 1988-1996	(0.0442)	(0.0442)	(0.0768)	(0.0331)	(0.0575)
England ×	-0.0929**	-0.0929**	-0.339***	-0.0929***	-0.319***
Post 1996	(0.0446)	(0.0448)	(0.128)	(0.0340)	(0.0947)
Store opened b/w	0.0358	0.0359	0.159**	0.0365	0.156***
1988-1996	(0.0386)	(0.0386)	(0.0719)	(0.0288)	(0.0532)
Store opened post 1996	0.0459	0.0458	0.273**	0.0453	0.265***
	(0.0411)	(0.0413)	(0.111)	(0.0313)	(0.0815)
Store in England ×		0.0653	0.0512	**0.399***	**0.405***
refusal rate		(0.184)	(0.182)	**(0.215)**	**(0.214)**
Net floorspace	0.131*	0.133*	0.140*	0.143**	0.152***
	(0.0728)	(0.0744)	(0.0749)	(0.0562)	(0.0567)
Storage area	0.00374	0.00316	0.00282	0.000189	0.000380
	(0.0315)	(0.0317)	(0.0324)	(0.0242)	(0.0247)
Employment	0.894***	0.892***	0.880***	0.881***	0.865***
	(0.0677)	(0.0698)	(0.0725)	(0.0539)	(0.0560)
Mezzanine	-0.0316	-0.0320	-0.0297	-0.0343	-0.0317
dummy	(0.0306)	(0.0305)	(0.0306)	(0.0227)	(0.0227)
Non-food format	-0.222**	-0.225**	-0.242**	-0.239***	-0.257***
dummy	(0.0959)	(0.0981)	(0.100)	(0.0742)	(0.0755)
Total weekly opening	0.000990**	0.000991**	0.000975**	0.000993***	0.000997***
hours	(0.000459)	(0.000462)	(0.000475)	(0.000360)	(0.000369)
Population within	0.0760***	0.0775***	0.0727***	0.0854***	0.0811***
10 minute drive time	(0.0211)	(0.0217)	(0.0214)	(0.0170)	(0.0170)
Competition variable	-0.00455	-0.00446	-0.00520	-0.00402	-0.00459*
	(0.00334)	(0.00336)	(0.00347)	(0.00263)	(0.00271)
Store in England × years			-0.000811		-0.000178
since opening			(0.00313)		(0.00235)
Store in Scotland or			0.00947**		0.00921***
Northern Ireland × years			(0.00458)		(0.00341)
since opening					
England & TTWA fixed	Yes	Yes	Yes	Yes	Yes
effects & constant					
R-squared	0.981	0.981	0.982		

				TSLS: *First stage*	
				Dependent variable: Store in England × refusal rate	
Store in England ×				-0.177***	-0.177***
share Labour seats				(0.0259)	(0.0253)
Controls and FEs (incl. instr.)				Yes	Yes
R-squared				0.923	0.925
Kleibergen-Paap rk Wald F				46.78	49.02

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Stores in Wales are dropped from the sample.

Table 4
Quantitative Effects

Effect	Underlying specifications	Magnitude of effect	Notes
[1] Impact of TCF policy via affecting TFP directly (relative impact England vs. Scotland/NI):	Table 3 (4)	-31.9%	Estimate of loss in TFP due to TCF policy: Post 1996 compared to pre 1988
[1a] Impact of first tightening in 1988	Table 3 (4)	-14.6%	1988-1996 compared to pre 1988
[1b] Additional impact of second tightening in 1996	Table 3 (4)	-17.3%	Post 1996 compared to 1988-1996
[2] Impact of local planning constraints on sales of incumbent stores (per store)	Table 3(4)	+£28,952 in weekly sales (+3.0%)	One standard deviation increase in local restrictiveness
[3] Impact of local planning constraints on likelihood of store presence in local authority (LA)	Table 2(2)	-25.8%	One standard deviation increase in local restrictiveness
[4] Impact of local planning constraints on number of stores in LA	Table 2(4)	-0.28 stores	One standard deviation increase in local restrictiveness
[5] Impact of local planning constraints on net floor space of average store in LA	Table 2(6)	-5,267 sq. ft. (-10.9%)	One standard deviation increase in local restrictiveness
[6] Impact of local planning constraints on total net floor area in LA (through reducing number of stores and floor space of stores)	Table 2(8)	-15,403 sq. ft. (-41.9%)	One standard deviation increase in local restrictiveness
[7] Impact of local planning constraints on total sales in LA	Table 2(10)	-£236,958 in weekly sales (-31.9%)	One standard deviation increase in local restrictiveness

FIGURES

Figure 1
Number of Applications for Major Retail Developments, 1979-2008
(mean per local planning authority per year)
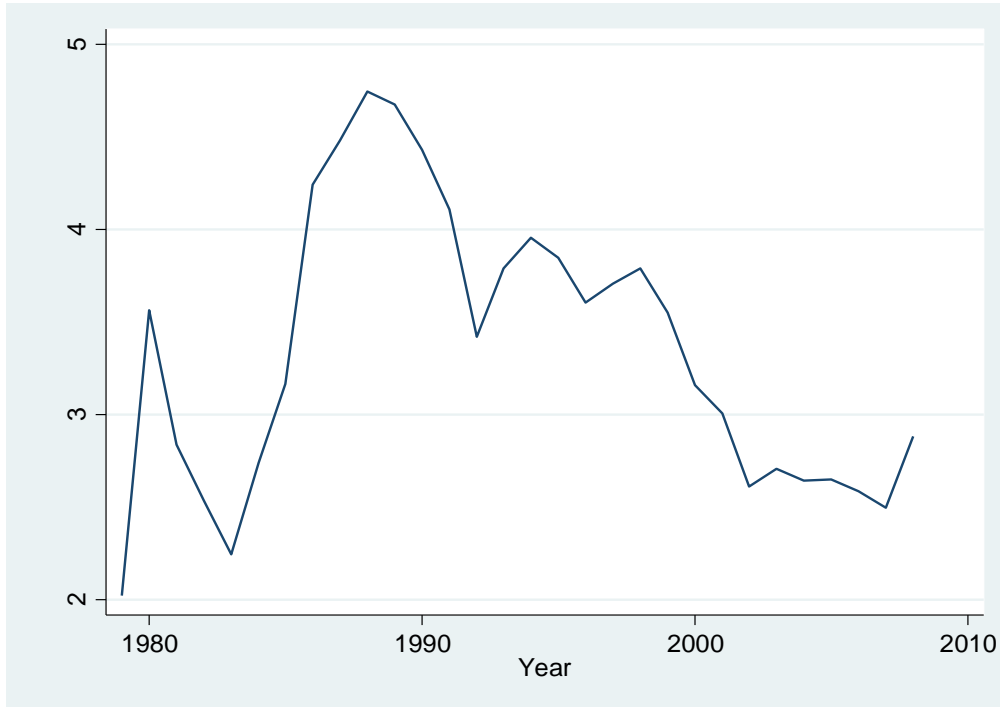
Source: Department for Communities and Local Government (DCLG)

APPENDICES

APPENDIX A:
Town Centre First Policies and How They Varied Across the UK

There are useful 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 rather closely, differences between these two countries and Northern Ireland and Scotland are significant. 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 (LAs). As discussed below, LAs in England vary considerably in the restrictiveness with which they interpret national policies. In all four UK countries planning policies are implemented by means of 'development control' – that is, each proposed development[1] is considered individually by the LA and is then either 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.

The key details of retail sector planning policies as they have developed since 1947 in each country of the UK are summarised in what follows. The basic features of Britain's land use planning system were set in the 1947 Town and Country Planning Act. This expropriated development rights, introduced categories of land use defined in statute; provided for local plans and the process of development control; and most importantly allocated urban land between each legal use category and established 'urban envelopes' or 'growth boundaries'. It also provided for Greenbelts but the boundaries of these were delimited during the 1950s as local plans were prepared.

Thus even in the mid-1980s the UK had had a system of supply constraints for land, acting independently of prices, for more than a generation. The construction of the

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[1] 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.

motorway (highway) system from about 1960, growth of car ownership and use[2] associated with residential decentralisation, created strong forces favouring the development of out-of-town, large format supermarkets and shopping centres. Policy makers responded specifically to restrict such developments in England from 1988.

England:

1988 – Policy which had previously accepted the commercial logic of out-of-town retail changed in 1988 to direct new out-of-town retail development to Brownfield or 'regeneration sites';

1993 – Policy was changed to positively direct new retail development to town centres on the grounds that the free market would 'under provide' in-town retail development (ODPM, 2004);

1996 – Strict Town Centre First policy was introduced in PPG6 (PPG stands for Planning Policy Guidance, replaced with Planning Policy Statements, now abolished and incorporated in the National Planning Policy Framework) (Department of the Environment, 1996). This, crucially, brought in both the 'needs' and 'sequential' tests and dropped any mention of 'avoiding unnecessary regulation'. 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. It can be argued this erected a barrier to entry into local markets. 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. A site was only defined as 'suitable' if it was identified for retail use in the local plan. The fact that such a site might be owned by a rival supermarket chain did not render it 'unsuitable'. As ODPM (2004) stated: "PPG6… (was) increasingly used by LAs as a development control tool to prevent out-of-centre development, instead of as a basis for positive planning for town centres. It became all but impossible to develop large-format out-of-town stores in England."

Wales:

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[2] Total car miles increased by 39 percent from 1970 to 1980; by 56 percent during the 1980s; 12 percent during the 1990s and a further 7 percent from 2000 to 2008 (Department for Transport, 2012).

Policy followed changes in England closely except that guidance gave more emphasis to the aim of a competitive retail sector and enforcement at the local level appears to have been rather more flexible.

Scotland:

1996 – A form of Town Centre First policy, significantly weaker than that in England, was introduced. There was an explicit aim of maintaining a 'competitive and innovative retail sector' and a statement that it was not the role of planning to 'protect existing interests or restrain competition' but did steer local planners to favour town centre locations for new retail by introducing a form of the 'sequential' test.

1998 – A revised policy gave more emphasis to directing retail development to Town Centres and added leisure uses to those where the preferred location for development was in Town Centres in the name of 'sustainability' and access via public transport; but the guidance continued to instruct planners to assist in maintaining 'an efficient, competitive and innovative retail sector offering consumer choice'; the 'sequential' test was maintained but the 'needs' test was not introduced.

2006 – Policy became slightly more restrictive towards the development of out-of-town retail while remaining significantly more flexible than that in England. There was no 'needs' test introduced and out-of-town development was permitted when there was access by public transport.

Northern Ireland:

1996 - A form of Town Centre First policy was introduced. This remained more flexible than in England. Critically, however, policy distinguished between comparison shopping and food: "Food superstores, however, rely on the close proximity of adequate car parking and for this reason locations within existing town centres may be inappropriate. Edge-of-centre sites may provide a preferred alternative in many towns ..." (Competition Commission, 2000). There was emphasis given to new developments not leading to a significant loss of investment in existing centres and accessibility by transport other than cars but the policy, especially for supermarkets, was much less restrictive even than in Scotland.

APPENDIX B:
Appendix Tables

Table A1
Post-1988 Treatment Only (N=331)

	OLS			TSLS: *Second stage*	
	Dependent variable: Log(sales)				
	(1)	(2)	(3)	(4)	(5)
England × Post 1988	-0.0798**	-0.0797**	-0.128*	-0.0793***	-0.120**
	(0.0394)	(0.0395)	(0.0723)	(0.0300)	(0.0541)
Store opened post 1988	0.0483	0.0484	0.135**	0.0484*	0.135***
	(0.0363)	(0.0364)	(0.0675)	(0.0277)	(0.0502)
Store in England × refusal rate		0.0538	0.0811	**0.367**	**0.397***
		(0.193)	(0.189)	**(0.230)**	**(0.225)**
Net floorspace	0.123*	0.124*	0.142*	0.134**	0.153***
	(0.0719)	(0.0737)	(0.0753)	(0.0556)	(0.0569)
Storage area	-0.000699	-0.00119	0.00879	-0.00407	0.00677
	(0.0317)	(0.0319)	(0.0331)	(0.0244)	(0.0252)
Employment	0.916***	0.914***	0.880***	0.904***	0.866***
	(0.0665)	(0.0687)	(0.0718)	(0.0531)	(0.0553)
Mezzanine dummy	-0.0388	-0.0392	-0.0365	-0.0416*	-0.0383*
	(0.0304)	(0.0304)	(0.0309)	(0.0227)	(0.0229)
Non-food format dummy	-0.208**	-0.210**	-0.230**	-0.224***	-0.244***
	(0.0952)	(0.0975)	(0.0997)	(0.0739)	(0.0752)
Total weekly opening hours	0.000926*	0.000925*	0.000961**	0.000925**	0.000974***
	(0.000481)	(0.000484)	(0.000486)	(0.000378)	(0.000377)
Population within 10 minute drive time	0.0803***	0.0815***	0.0784***	0.0889***	0.0854***
	(0.0213)	(0.0218)	(0.0219)	(0.0174)	(0.0173)
Competition variable	-0.00406	-0.00399	-0.00425	-0.00356	-0.00378
	(0.00342)	(0.00345)	(0.00341)	(0.00271)	(0.00267)
Store in England × years since opening			0.00229		0.00270*
			(0.00195)		(0.00152)
Store in Scotland or N. Ireland × yrs since opening			0.00441		0.00441*
			(0.00304)		(0.00230)
England & TTWA fixed effects & constant	Yes	Yes	Yes	Yes	Yes
R-squared	0.981	0.981	0.981		

				TSLS: *First stage*	
				Dependent variable: Store in England × refusal rate	
Store in England × share Labour seats				-0.177***	-0.176***
				(0.0257)	(0.0255)
Controls and FEs (included instr.)				Yes	Yes
R-squared				0.923	0.924
Kleibergen-Paap rk Wald F				47.52	47.35

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Stores in Wales are dropped from the sample.

Table A2
Post-1996 Treatment Only (N=331)

	Dependent variable: Log(sales)				
	OLS			TSLS: *Second stage*	
	(1)	(2)	(3)	(4)	(5)
England × Post 1996	-0.0832**	-0.0832**	-0.144*	-0.0831***	-0.135**
	(0.0372)	(0.0373)	(0.0738)	(0.0284)	(0.0539)
Store opened post 1996	0.0328	0.0327	0.0783	0.0319	0.0747
	(0.0348)	(0.0349)	(0.0631)	(0.0265)	(0.0461)
Store in England × refusal rate		0.0645	0.0555	**0.400***	**0.403***
		(0.184)	(0.183)	**(0.216)**	**(0.215)**
Net floorspace	0.133*	0.135*	0.134*	0.145***	0.146***
	(0.0724)	(0.0740)	(0.0745)	(0.0561)	(0.0564)
Storage area	0.00126	0.000672	-0.000459	-0.00238	-0.00353
	(0.0314)	(0.0316)	(0.0320)	(0.0243)	(0.0245)
Employment	0.896***	0.893***	0.895***	0.882***	0.881***
	(0.0676)	(0.0698)	(0.0716)	(0.0541)	(0.0555)
Mezzanine dummy	-0.0317	-0.0321	-0.0314	-0.0344	-0.0337
	(0.0303)	(0.0302)	(0.0306)	(0.0226)	(0.0227)
Non-food format dummy	-0.221**	-0.223**	-0.226**	-0.238***	-0.241***
	(0.0956)	(0.0978)	(0.0989)	(0.0743)	(0.0748)
Total weekly opening hours	0.00103**	0.00103**	0.00103**	0.00104***	0.00104***
	(0.000453)	(0.000455)	(0.000471)	(0.000355)	(0.000368)
Population within 10 minutes drive time	0.0765***	0.0781***	0.0764***	0.0860***	0.0848***
	(0.0207)	(0.0213)	(0.0212)	(0.0169)	(0.0169)
Competition variable	-0.00442	-0.00433	-0.00467	-0.00389	-0.00411
	(0.00328)	(0.00331)	(0.00343)	(0.00260)	(0.00269)
Store in England × years since opening			-0.000849		-0.000529
			(0.00219)		(0.00163)
Store in Scotland or Northern Ireland × years since opening			0.00234		0.00221
			(0.00295)		(0.00221)
England & TTWA fixed effects & constant	Yes	Yes	Yes	Yes	Yes
R-squared	0.981	0.981	0.981		

				TSLS: *First stage*	
				Dependent variable: Store in England × refusal rate	
Store in England × share Labour seats				-0.177***	-0.178***
				(0.0259)	(0.0262)
Controls and FEs (included instr.)				Yes	Yes
R-squared				0.923	0.924
Kleibergen-Paap rk Wald F				47.08	45.96

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stores in Wales are dropped from the sample.

Table A3
Base Specifications – with Quadratic Country Trends

	TSLS: *Second stage* Dependent variable: Log(sales)		
	(1) Stepwise	(2) Post 1988	(3) Post 1996
England × Post 1988		-0.144**	
		(0.0677)	
England × Opened 1988-1996	-0.154*		
	(0.0819)		
England × Post 1996	-0.303***		-0.142**
	(0.105)		(0.0599)
Store opened post 1988		0.155**	
		(0.0631)	
Store opened b/w 1988-1996	0.156**		
	(0.0777)		
Store opened post 1996	0.274***		0.111**
	(0.0935)		(0.0488)
Store in England ×	0.402*	0.397*	0.405*
refusal rate	(0.208)	(0.214)	(0.209)
Net floorspace	0.164***	0.163***	0.168***
	(0.0582)	(0.0577)	(0.0582)
Storage area	0.00263	0.0119	0.00121
	(0.0251)	(0.0254)	(0.0252)
Employment	0.836***	0.830***	0.836***
	(0.0621)	(0.0603)	(0.0623)
Mezzanine	-0.0318	-0.0366	-0.0334
dummy	(0.0222)	(0.0223)	(0.0221)
Non-food format	-0.275***	-0.270***	-0.275***
dummy	(0.0783)	(0.0778)	(0.0784)
Total weekly opening hours	0.00103***	0.000967***	0.00103***
	(0.000365)	(0.000367)	(0.000363)
Population within 10 minutes	0.0770***	0.0795***	0.0770***
drive time	(0.0170)	(0.0171)	(0.0168)
Competition variable	-0.00482*	-0.00468*	-0.00467*
	(0.00261)	(0.00257)	(0.00262)
Store in England × years since opening	0.00730	0.0105***	0.00711
	(0.00525)	(0.00336)	(0.00520)
Store in England × years since opening	-0.000175	-0.000217**	-0.000173
squared	(0.000111)	(8.82e-05)	(0.000109)
Store in Scotland or Northern Ireland ×	0.0127*	0.00766	0.0152**
years since opening	(0.00660)	(0.00530)	(0.00682)
Store in Scotland or NI × years since	-8.73e-05	-6.49e-05	-0.000338*
opening squared	(0.000221)	(0.000188)	(0.000173)
England & TTWA fixed effects & constant	Yes	Yes	Yes
R-squared	0.974	0.974	0.973

	TSLS: *First stage* Dependent variable: Store in England × refusal rate		
Store in England × Share Labour seats	-0.178***	-0.176***	-0.178***
	(0.0256)	(0.0257)	(0.0263)
Controls and FEs (included instr.)	Yes	Yes	Yes
R-squared	0.925	0.924	0.924
Kleibergen-Paap rk Wald F	48.25	46.92	45.69

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stores in Wales are dropped from the sample.

	Dependent variable: Log(sales)				
	OLS			TSLS: *Second stage*	
	(1)	(2)	(3)	(4)	(5)
England × Opened 1988-1996	-0.0270**	-0.0270**	-0.156***	-0.0273***	-0.146***
	(0.00621)	(0.00626)	(0.0124)	(0.00400)	(0.00527)
England × Post 1996	-0.0929***	-0.0929***	-0.339***	-0.0929***	-0.319***
	(0.000918)	(0.000915)	(0.0207)	(0.000559)	(0.00984)
Store opened b/w 1988-1996	0.0358*	0.0359*	0.159***	0.0365***	0.156***
	(0.0103)	(0.0102)	(0.00889)	(0.00585)	(0.00485)
Store opened post 1996	0.0459***	0.0458***	0.273***	0.0453***	0.265***
	(0.00154)	(0.00145)	(0.0159)	(0.000675)	(0.00995)
Store in England × refusal rate		0.0653*	0.0512	**0.399***	**0.405***
		(0.0205)	(0.0181)	**(0.0133)**	**(0.00902)**
Net floorspace	0.131**	0.133**	0.140**	0.143***	0.152***
	(0.0168)	(0.0164)	(0.0146)	(0.0112)	(0.00608)
Storage area	0.00374	0.00316	0.00282	0.000189	0.000380
	(0.00734)	(0.00745)	(0.00605)	(0.00451)	(0.00372)
Employment	0.894***	0.892***	0.880***	0.881***	0.865***
	(0.0346)	(0.0346)	(0.00640)	(0.0237)	(0.00350)
Mezzanine dummy	-0.0316	-0.0320	-0.0297	-0.0343***	-0.0317**
	(0.0186)	(0.0186)	(0.0251)	(0.0117)	(0.0152)
Non-food format dummy	-0.222**	-0.225**	-0.242***	-0.239***	-0.257***
	(0.0252)	(0.0247)	(0.00971)	(0.0168)	(0.00394)
Total weekly opening hours	0.000990**	0.000991**	0.000975***	0.000993***	0.000997***
	(0.000102)	(0.000103)	(5.23e-05)	(6.65e-05)	(3.19e-05)
Population within 10 minute drive time	0.0760**	0.0775**	0.0727**	0.0854***	0.0811***
	(0.0151)	(0.0154)	(0.0122)	(0.00911)	(0.00855)
Competition variable	-0.00455*	-0.00446*	-0.00520**	-0.00402***	-0.00459***
	(0.00147)	(0.00146)	(0.00109)	(0.000810)	(0.000545)
Store in England × years since opening			-0.000811		-0.000178
			(0.000784)		(0.000327)
Store in Scotland or N. Ireland × yrs since opening			0.00947***		0.00921***
			(0.000596)		(0.000428)
England & TTWA fixed effects & constant	Yes	Yes	Yes	Yes	Yes
R-squared	0.981	0.981	0.982		

				TSLS: *First stage*	
				Dependent variable: Store in England × refusal rate	
Store in England × share Labour seats				-0.177***	-0.177***
				(0.00347)	(0.00484)
Controls and FEs (included instr.)				Yes	Yes
R-squared				0.923	0.924
Kleibergen-Paap rk Wald F				27.53	29.15

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stores in Wales are dropped from the sample.

Table A5
Base Specifications – with Controls Interacted (N=331)

	TSLS: *Second stage* Dependent variable: Log(sales)					
	(1)	(2)	(3)	(4)	(5)	(6)
England × Opened 1988-1996	-0.140**	-0.173**	-0.134**	-0.146**	-0.140**	-0.185**
	(0.0645)	(0.0685)	(0.0618)	(0.0659)	(0.0684)	(0.0801)
England × Post 1996	-0.325***	-0.370***	-0.331***	-0.367***	-0.351***	-0.433***
	(0.0980)	(0.105)	(0.0980)	(0.107)	(0.101)	(0.122)
Store opened b/w 1988-1996	0.147**	0.179***	-0.288	-0.270	-0.296	-0.345
	(0.0595)	(0.0634)	(0.727)	(0.700)	(0.723)	(0.701)
Store opened post 1996	0.266***	0.312***	-0.219	-0.682	-0.215	-0.726
	(0.0844)	(0.0928)	(0.650)	(0.687)	(0.656)	(0.706)
Store in England × refusal rate	**0.384***	**0.409***	**0.367***	**0.385**	**0.338**	**0.399**
	(0.219)	**(0.225)**	**(0.222)**	**(0.234)**	**(0.228)**	**(0.253)**
Store in England × years since opening	-0.000551	-0.000486	-8.67e-05	-1.53e-06	-0.000503	-0.000253
	(0.00239)	(0.00240)	(0.00240)	(0.00245)	(0.00241)	(0.00247)
Store in Scotland or NI × years since opening	0.00929**	0.0121***	0.0106***	0.0112***	0.0113***	0.0150***
	(0.00364)	(0.00396)	(0.00383)	(0.00420)	(0.00408)	(0.00467)
Controls (as in Table 2)	Yes	Yes	Yes	Yes	Yes	Yes
Inputs × England	Yes					
All controls × England		Yes				
Inputs × 2 treatment period dummies			Yes			
All controls × 2 treatment periods				Yes		
Inputs × England + inputs × 2 treatment periods					Yes	
All controls × England + all contr. × 2 periods						Yes
England & TTWA fixed effects & constant	Yes	Yes	Yes	Yes	Yes	Yes

	TSLS: *First stage* Dependent variable: Store in England × refusal rate					
Store in England × share Labour seats	-0.175***	-0.173***	-0.178***	-0.175***	-0.176***	-0.169***
	(0.0257)	(0.0262)	(0.0260)	(0.0272)	(0.0263)	(0.0280)
Controls and FEs (included instruments)	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.925	0.927	0.925	0.928	0.926	0.930
Kleibergen-Paap rk Wald F	46.66	43.84	47.17	41.35	44.61	36.47

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stores in Wales are dropped from the sample.

Table A6

Impact of Local Planning Constraints on Local Presence of Retail Chain – *Using retail refusal rate*

Dependent variable:	OLS (1)	TSLS (2nd) (2)	OLS (3)	TSLS (2nd) (4)	OLS (5)	TSLS (2nd) (6)	OLS (7)	TSLS (2nd) (8)	OLS (9)	TSLS (2nd) (10)
	Store in LA=yes	Store in LA=yes	Number of stores in LA	Number of stores in LA	Average net floor space	Average net floor space	Total net floor space in LA	Total net floor space in LA	Total sales in LA *in £1000*	Total sales in LA *in £1000*
Refusal rate for *retail* projects *(scaled 0-100)*	-0.0143*** (0.00365)	**-0.0511*** (0.0119)**	-0.0163*** (0.00588)	**-0.0576*** (0.0184)**	48.25 (324.4)	**-1,244 (769.1)**	-666.7** (310.3)	**-3,134*** (954.3)**	-11.60* (6.127)	**-48.20*** (18.21)**
Log(number of households)	0.355*** (0.0769)	0.270*** (0.0720)			184.4 (5,198)	484.9 (3,743)				
Number of households			0.0121*** (0.00220)	0.0113*** (0.00161)			670.8*** (99.28)	624.5*** (83.50)	13.40*** (1.706)	12.71*** (1.426)
TTWA FEs & constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.518		0.611		0.486		0.613		0.628	
				TSLS: First stage						
				Dependent variable: Refusal rate *(scaled to 0-100)*						
Share Labour seats *(scaled to 0-100)*		-0.124*** (0.0315)		-0.127*** (0.0303)		-0.103** (0.0444)		-0.127*** (0.0303)		-0.127*** (0.0303)
Controls and FEs		Yes		Yes		Yes		Yes		Yes
R-squared		0.527		0.527		0.664		0.527		0.527
Kleibergen-Paap rk Wald F		15.65 [a]		17.69 [b]		5.37 [b]		17.69 [c]		17.69 [b]
Observations	351	351	351	351	188	188	351	351	351	351

Notes: **Bold** coefficients are instrumented. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Columns (5) and (6) report specifications for the sub-sample of local authorities with store presence. Stock-Yogo weak ID test critical values (relevant maximum IV-size): [a] max. 10% bias: 16.38; max. 15% bias: 8.96; [b] max. 25% bias: 5.53; [c] max. 10% bias: 16.38. Test statistics indicate weak identification of refusal rate variable in column (6).

Table A7
Impact of Town Centre First and Local Planning Constraints
on Store-Level Output – *Using retail refusal rate* (N=331)

	Dependent variable: Log(sales)				
	OLS			TSLS: *Second stage*	
	(1)	(2)	(3)	(4)	(5)
England × Opened 1988-1996	-0.0270	-0.0270	-0.158**	-0.0250	-0.147**
	(0.0442)	(0.0443)	(0.0769)	(0.0347)	(0.0585)
England × Post 1996	-0.0929**	-0.0929**	-0.343***	-0.0925***	-0.321***
	(0.0446)	(0.0447)	(0.129)	(0.0350)	(0.0961)
Store opened b/w 1988-1996	0.0358	0.0356	0.159**	0.0395	0.169***
	(0.0386)	(0.0387)	(0.0723)	(0.0298)	(0.0535)
Store opened post 1996	0.0459	0.0457	0.273**	0.0482	0.287***
	(0.0411)	(0.0412)	(0.112)	(0.0318)	(0.0820)
Store in England × refusal rate		-0.0268	-0.0302	**0.619***	**0.630***
		(0.147)	(0.149)	**(0.343)**	**(0.341)**
Net floorspace	0.131*	0.130*	0.136*	0.153**	0.166***
	(0.0728)	(0.0741)	(0.0744)	(0.0600)	(0.0616)
Storage area	0.00374	0.00411	0.00350	-0.00471	-0.00368
	(0.0315)	(0.0317)	(0.0323)	(0.0259)	(0.0262)
Employment	0.894***	0.895***	0.883***	0.881***	0.860***
	(0.0677)	(0.0687)	(0.0718)	(0.0548)	(0.0574)
Mezzanine dummy	-0.0316	-0.0311	-0.0289	-0.0423*	-0.0390
	(0.0306)	(0.0310)	(0.0310)	(0.0251)	(0.0250)
Non-food format dummy	-0.222**	-0.222**	-0.240**	-0.221***	-0.241***
	(0.0959)	(0.0961)	(0.0981)	(0.0745)	(0.0758)
Total weekly opening hours	0.000990**	0.000991**	0.000971**	0.000970***	0.000998***
	(0.000459)	(0.000459)	(0.000475)	(0.000365)	(0.000371)
Population within 10 minute drive time	0.0760***	0.0762***	0.0718***	0.0706***	0.0656***
	(0.0211)	(0.0212)	(0.0211)	(0.0176)	(0.0176)
Competition variable	-0.00455	-0.00461	-0.00537	-0.00314	-0.00357
	(0.00334)	(0.00339)	(0.00351)	(0.00259)	(0.00271)
Store in England × years since opening			-0.000976		0.000606
			(0.00317)		(0.00250)
Store in Scotland or NI × years since opening			0.00948**		0.0100***
			(0.00461)		(0.00344)
England & TTWA fixed effects & constant	Yes	Yes	Yes	Yes	Yes
R-squared	0.981	0.981	0.982		

				TSLS: *First stage*	
				Dependent variable: Store in England × refusal rate	
Store in England × share Labour seats				-0.114***	-0.114***
				(0.0332)	(0.0329)
Controls and FEs (incl. instr.)				Yes	Yes
R-squared				0.844	0.848
Kleibergen-Paap rk Wald F				11.88 [a]	12.07 [a]

Notes: **Bold** coefficients are instrumented. All regressors (except hours, competition, refusal rate and dummies) are in logs so that they can be interpreted as elasticities. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Stores in Wales are dropped from the sample. Stock-Yogo weak ID test critical values (relevant maximum IV-size): [a] max. 10% bias: 16.38; max. 15% bias: 8.96.