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LAND USE REGULATION AND PRODUCTIVITY – LAND MATTERS:

EVIDENCE FROM A UK SUPERMARKET CHAIN

Paul Cheshire [a)], Christian Hilber [a)] and Ioannis Kaplanis [b)]

May 2012

Abstract

We use store-specific data for a major UK supermarket chain to estimate the impact of planning on store output. Using the quasi-natural experiment of the variation in policies between England and other UK countries, we isolate the impact of Town Centre First policies. We find that space contributes directly to store productivity; and planning policies in England directly reduce output both by reducing store sizes and forcing stores onto less productive sites. We estimate that since the late 1980s planning policies have imposed a loss of output of at least 18.3 to 24.9% - more than a "lost decade's" growth.

JEL codes: D2, L51, L81, R32.

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1 INTRODUCTION

This paper contributes to two important current policy concerns. 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.

Introductory economics tells us there are three factors of production: land, labour and capital. Unless a student of agricultural economics, land as a factor of production will likely never be mentioned again. Yet space for some industries is a significant input and that would seem to be true of retailing. This is a sizable sector of all OECD economies. On a reasonable measure of size – employment – it is the second largest industry in the UK. Land use regulation in the UK intentionally restricts the availability of land for retail. In English cities in the mid-1980s the most expensive land for retail cost 250 times as much as the most expensive retail land in comparable US cities (Cheshire and Sheppard, 1986). In addition, English – Scotland and Northern Ireland are different – 'Town Centre First' (TCF) policies concentrate retail development on particular sites in central locations.

The control exercised on the number of sites is also likely to introduce a specific barrier to entry into new markets. 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 British system of land use planning has explicitly aimed to 'contain' urban areas since 1947. It imposes direct restrictions on the supply of land for each, legally defined, category of use. This increases the cost of space in all categories of development: notably residential, commercial, wholesale, industrial and retail. Obviously the greater is demand for land for a particular use in a particular location, the greater will be the price given this fiat-determined supply of land. Over the past 20 years a literature has developed analysing the economic effects of these restrictions. Most of this work has related to the residential sector but more recently studies have begun to analyse the costs in other sectors.

Cheshire and Hilber (2008), for example, examined the office sector and concluded that British land use regulation (planning) imposed additional costs substantially higher than in any other country for which it was possible to get the requisite data. 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. In 2005 total occupation costs for office space in Birmingham were some 44 percent higher than in Manhattan. Given that land is a relatively more important input into retail than into office-based activities, first principles and the observed price of land for retail use in Britain suggest such costs may be significantly greater in the retail sector. Not only do general containment policies restrict the supply of land for retail but, particularly since 1996 in England, rigid TCF policies have micromanaged retail to specific sites in designated 'town centres' and virtually prohibited large scale out-of-town retail development.

Griffith and Harmgart (2008) and Haskel and Sadun (2009) 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 retail sector. Perhaps overlooked, because hidden in a detailed appendix, is the work of the Competition Commission (2008, Appendix 4.4). They had full access to a very wide range of store specific data for the four main supermarket groups for the period May 2005 to May 2006 covering store sizes from 280 to 6,000 m^2. 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).

The contribution of the present work is that, unlike previous academic researchers we have access to a wide range of individual store level data complete with full locational details. We also have full planning decision data for all English local authorities from 1979 to 2008 which allows us to analyse the impact of cross sectional variation in planning restrictiveness within England. Furthermore the significant difference in both timing and restrictiveness of TCF policies in England compared to other countries of the UK helps us identify the specific impact of TCF policies on store output.

An earlier report, Competition Commission (2000), devoted considerable space to the role of the planning system as a drag on competition in the grocery/supermarket sector and collected a vast quantity of useful and relevant data. Appendix 12.7 of this

report, for example, contains careful comparisons of land costs for retail development in various Continental European countries calibrated on a basis as far as possible comparable with those in the UK. The principles of urban economics predict that land costs for any given use will fall with distance from the centre of a city and also fall as city size falls. According to the Competition Commission (2000, Appendix 12.7), land costs in France followed this spatial pattern. Estimates for Germany and the Netherlands produced similar spatial patterns and also comparable land values to those reported for France. Average land costs in Britain were five to ten times higher than those in France and declined with neither city size nor distance from city centres.

Thus we already have strong evidence that productivity in supermarkets increases with store size, other things equal, and that land and space costs in Britain are an order of magnitude higher than those in Continental European countries and a further order of magnitude greater than in the US (though here the existing evidence is old). From other work on the impacts of land use planning policy on the costs of space in Britain it may be reasonable to assume that (i) the inflated land costs are caused by planning policies, (ii) direct controls on store sites and sizes in combination with higher planning induced-land costs cause the substitution of space out of production, and (iii) these factors are jointly responsible for reducing output and productivity in the sector. But to date the link to 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, 2009) is based on firm rather than store level data. Nevertheless, their estimates suggest a loss of 0.4 percent p.a. in TFP growth from 1997 to 2003.

It is the purpose of this paper to address both the wider issue of output loss and the particular issue of causation. As noted above we do this in large part by exploiting the difference in timing of the introduction and in the rigor of application of TCF policies in England compared to Northern Ireland and Scotland, utilising a Difference-in-Difference (DiD) approach. In addition, however, we use an Instrumental Variables approach to try to pin down causation between variation in local restrictiveness and foregone output.

Underlying our analysis is the estimation of a production function explained in detail in Section 5. Some of the impacts of planning policies will affect TFP while others, such as more expensive land, may only influence the productivity of particular factors – chiefly labour. We explain in detail how we interpret the various impacts we observe on specific forms of productivity in the discussion of equation (2) in Section 5. All our measured impacts are in the form of foregone output but in what follows – unless we specifically qualify it – we use the term 'productivity' in a general sense to include both TFP and the productivity of a specific factor or factors.

It should be stressed that we are attempting to quantify only the costs of planning policies – not the value of any benefits that they may produce although we briefly discuss this issue in the concluding section. 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.

The paper proceeds as follows. Section 2 briefly sets out the key elements of British planning policies with respect to retail and summarises some of the findings so far as to their effects. The next section establishes more formally our hypotheses and our methodological approach, especially with respect to identifying the causal processes

at work and the specific role of planning policies. Section 4 describes the data we use. Section 5 presents the main analysis and an estimation of output losses from three main sources: higher space costs; direct controls on store sizes; and micromanagement of store locations to particular sites in town centres – although we cannot differentiate here between this and barriers to entry created by policy. The estimates are based on two alternative approaches, one more conservative the other perhaps more realistic. The final section summarises conclusions and policy implications.

2 EXISTING LAND USE POLICIES: THEIR EVOLUTION AND SOME IMPACTS

We need to know something of the particular form and timing of planning policies and how they are implemented if we are to develop useful hypotheses as to their economic impact. 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 (LPAs). As discussed below, LPAs 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 LPA

[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.

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 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';

[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).

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 LPAs 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:

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.

As can be seen from the outline above, policy towards out-of-town supermarket and retail development in England gradually tightened from 1988 with the radical change in policy coming in 1996. This strongly redirected retail (and other traditional town centre uses) to town centres (as defined by planners). Far from attempting to avoid 'unnecessary regulation' as previous policies had done, it put the emphasis firmly on 'town centre first'. According to ODPM (2004, page 21) the underlying rationale for the change in policy was that town centre sites were the most 'sustainable': "…on the premise that town centres are the most accessible locations for alternative [that is non-car] means of transport and facilitate 'linked trips' thereby reducing the need to travel."

As Figure 1 shows the 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. Since the revised PPG6 of 1996 applied only to new

developments, however, applications for store extensions boomed. The Competition Commission (2000) reports – based on its sample of LPAs – that in 1997 and 1998 there was nearly a fivefold increase in applications for foodstore extensions compared to the preceding five year period. The sample of LPAs surveyed in ODPM (2004) shows an increase from zero extension-applications per LPA in 1994 to 10 in 1998. There must, therefore, be a presumption this favoured incumbents by restricting entry. 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.

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 productive and also less energy efficient.

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

distance to functionally measured city centres; they actually increase at the extreme urban periphery. This suggests that space was most restricted in out-of-town locations where stores were likely most productive, so space costs actually rose with distance from actual town centres.

3 HYPOTHESES AND APPROACH TO TESTING

The hypotheses we are interested in testing are as follows. The first is to confirm the findings of the Competition Commission (2008) that all else held constant, larger stores are associated with higher sales and productivity. We wish to do this, however, in a way which allows us to test our second hypothesis: that the operation of the planning system has a causal role in reducing store sizes. Our third hypothesis is that the planning system – especially TCF policies – reduces TFP directly. In so far as the evidence supports these hypotheses, we can use our estimates to quantify the reduction in total output in the supermarket sector – or more accurately in the major supermarket group for which we have data – generated by planning policies.

There are three routes by which planning policies might reduce productivity in retailing. Policies may both directly restrict store size or format and site characteristics via TCF policies[3]; secondly the various policies may favour incumbents and generate a barrier to entry as analysed by Bertrand and Kramarz (2002) for France or Schivardi and Viviano (2011) for Italy although in the cases which they analyse, regulation is directly on entry rather than via land use planning policies; thirdly the restriction on space for retail may increase the price of such space and so cause it to be substituted out of production, further reducing productivity in the

[3] As an illustration someone who was a planner working for a major supermarket group in the 1970s informs us in a private communication that in that era they would easily be able to persuade LPAs to allow a proposed store to be moved closer to a roundabout on a major road which could improve sales substantially. This became very difficult or impossible after about 1990.

sector. The first two routes would reduce total factor productivity while the third would reduce labour productivity. In practice these three routes reduce to two since we cannot differentiate between the first two: the impact of TCF policies on forcing stores to less productive locations or smaller sites and their impact on restricting entry.[4] So in summary:

1. TCF policies may impede entry and force stores (by the sequential test, for example, or just by forcing location to be in town centres or on particular sites within town centres) to be on smaller and/or less productive sites than they would otherwise have selected. As discussed in Section 5 this effect would work mainly via reduced consumer welfare, reducing store sales, other things equal.
2. Separately, containment policies, by increasing the price of space in general, will tend to reduce store sizes. Retailers may still successfully choose profit maximising store sizes but the higher cost of space causes it to be substituted out of production. This increases costs and leads to lower output and efficiency losses compared to the space use that would have been employed had the price of space not been increased by the constraint on land supply.

To test these hypotheses we use detailed store level data with exact store location so other geographic/spatial data, which is relevant and may influence store sales and productivity, can be included in the analysis. Furthermore we need store location because of the fact that the characteristics of the location with respect to the centre of urban areas may plausibly be causally linked to store productivity and the planning

[4] Any such restriction on entry, by increasing local market power of individual stores, would be likely to increase product prices and so might increase our observed measure of output. To the extent that this was the case, we would underestimate the true economic cost of land use regulation. This links to the issue raised in the literature about the difficulty of measuring retail productivity (Griffith and Harmgart, 2005; Reynolds *et al.*, 2005). However, in so far as planning induced constraints directly reduce store sizes and force stores onto sub-optimal sites this will unambiguously reduce sales.

system is operated at the level of Local Planning Authorities (LPAs) and (despite a national policy) may vary in its restrictiveness from LPA to LPA.

4 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.

Some key summary statistics are shown in Table 1. In total there are 357 stores in the UK with all or most variables reported for 2008. Out of the total of 357 stores, 336 are food-formats and 21 are non-food formats. Since non-food formats are quite different to food-format stores, they are considered as a special case and are either excluded from the analysis or a dummy is added. From the food-format stores, there are 55 defined by the company as ‘small stores’, 252 as ‘superstores’ and 29 as ‘supercentres’. The small type stores have a mean floorspace of 25,000 sq. ft., the superstores 49,000 sq. ft. and the supercentres 85,000 sq. ft. Overall, net floorspace 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. See Section 5 for further rationale for this assumption.

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

Others have used planning variables in their analyses of the economic impact of the planning system (see, for example, Cheshire and Sheppard, 1989; Preston *et al*., 1996 or Hilber and Vermeulen, 2010). The most obvious variable to use is the refusal rate although it might be expected that more restrictive LPAs would also have more delayed decisions so that the delay and refusal rates would be positively correlated.

Given the cyclicality of application rates for development one might think of the mean refusal rate for a longer time period as the best indicator for the individual LPA.

It is well known, however, that there is a potential endogeneity problem with the refusal rate measure since the behaviour of developers may be influenced by the behaviour of LPAs. Since applications cost significant resources, would-be developers may hold back from making applications in LPAs known to be restrictive, so no refusal results. Indeed there may be prior negotiations before any application is made and when it is clear an application will not be likely to be successful it may not come forward. There is, however, a counterforce of restrictiveness. Although the probability of success may be lower in LPAs known to be more restrictive, thus discouraging would-be developers from applying, the payoff from successful applications will be higher because permissions are scarcer. This will tend to increase the flow of applications and – given that the LPA is restrictive – the refusal rate. Although we do not know *a priori* which of these two incentives will be stronger, we suspect the 'discouraged developer effect' should prevail. Consistent with this conjecture, the analysis of store locations reported in Table 4 reveals that greater LPA-level regulatory restrictiveness, other things held equal, significantly reduces the probability of there being a store at all.

This possible endogeneity of the refusal rate measure makes identification of causality problematic. Our approach to this problem is to devise an instrument. Specifically, we exploit exogenous variation in regulatory restrictiveness arising from local differences in political control. A comparable identification strategy was first used by Bertrand and Kramarz (2002) and later, in a more comparable context, by Sadun (2008). We discuss this in more detail in Section 5.

5 RESULTS

Underlying the analysis in this section 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. We have only one year's data available so cannot use a panel approach and the natural log of sales (turnover) is used as the dependent variable. The supermarket chain whose data we have access to, however, has a rigid policy of uniform mark-ups by product across all stores, so sales per store should be closely correlated with gross margins and value added.[5]

The production function is as follows:

$$Y_i = AF_i^{\beta_1} L_i^{\beta_2} K_i^{\beta_3} \quad (1)$$

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:

$$lnY_i = \beta_0 + \beta_1 \ln F_i + \beta_2 \ln L_i + \beta_3 \ln K_i + X_i'\gamma + Z_j'\delta + \varepsilon \quad (2)$$

where:

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

Z'_j: vector of area specific controls

[5] The store group does vary the product mix by store so, for example, the largest pack sizes or not pre-packed fruit and vegetables may not be available in smaller stores: also they claim to match fuel prices with the lowest-priced local outlet so petrol and diesel prices vary.

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[6] while a change in the quantity of, say, floorspace F would be associated with a change in capital and/or labour productivity.

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 for our research: 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.

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 1990 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

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

relevant and we can include local market controls.[7] Moreover, the firm in question has a standardised national policy governing employment policies and its pricing, with equal prices across all stores.

The main results on which we rely to identify the impact of Town Centre First policies on productivity are those of the Difference-in-Difference (DiD) model. Following equation (2), our DiD-estimating equation can be expressed as:

$$\begin{aligned} lnY_i = {} & \beta_0 + \beta_1 lnF_i + \beta_2 lnL_i + \beta_3 lnK_i + + \beta_4 (England_i) \\ & + \beta_5 \left(England_i \times Post\ Treatment_i\right) + \beta_6 \left(Post\ Treatment_i\right) \\ & + \beta_7 \left(other\ controls\right) + \varepsilon \end{aligned} \tag{3}$$

This specification exploits the variation in the implementation of TCF policies in England compared to Scotland and Northern Ireland. Since policies in Wales are only somewhat differentiated from those in England, we exclude the few Welsh stores.[8] The results are reported in Table 2. In Appendix A Table A.1 we report the results of estimating our base specification (2), separately for English stores and the combined Scotland and Northern Ireland stores.

One problem for both these approaches is that we do not have exact information on labour hours per store, only a head count of salaried staff who we assume are full-time, and hourly paid staff who we assume are half time for reasons explained in Section 4. So we construct an estimate of full-time equivalent employment (FTE) by multiplying the headcount of hourly-paid staff by 0.5 and salaried staff by 1. We also experimented with other ways of estimating FTEs (for example simply aggregating up

[7] 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.

[8] However, results are qualitatively similar across all reported specifications if we include the Welsh stores with England.

all employees or using the Annual Survey of Hours and Earnings[9]) and concluded that the estimate of FTE employment is not particularly sensitive to this assumption. Using a multiplier of 0.5, however, yields – by a small margin - the best estimates in that the coefficient on FTE employment is most precisely estimated.

The measure of floorspace used is net floorspace. This is more sensible theoretically. Moreover as noted we are able to estimate storage space as the difference between gross and net floorspace. The DiD model reported in Table 2 includes some appropriate controls. The first 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 albeit only significant in the 'conventional' production function results reported in Table A.1 but not in the DiD model. Further relevant controls are labour inputs measured as employment in FTEs (employment), 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 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 coefficient on this control has the expected sign, it is only significant in the full production function approach reported in Table A.1 not in the DiD models reported in Table 2.

[9] We used the Annual Survey of Hours and Earnings data at the LPA level on hours worked for the specific occupational categories covering retail workers but concluded that the company's own data although somewhat approximate were more accurate than making implicit assumptions that workers in a given occupation and LPA worked similar hours regardless of which retailer/store employed them.

We also add two alternative sets of control variables to capture unobserved characteristics that relate to the age of the store. The first is in effect a continuous time trend. We experimented exhaustively with functional forms but found a simple quadratic fitted the data best. All higher order polynomial forms were statistically completely insignificant. The second set of controls is one dummy variable for each year of store opening, capturing non-linear effects that relate to store age. We also control for a key characteristic of store catchment areas – their 'market potential' measured as population within a 10 minute drive-time. In other models - reported in the Appendix B Tables B.1 to B.4 – we have included additional area controls including local car ownership measured as the share of households with cars within 15 minute drive time; and local income measured as average full time male earnings. These controls were insignificant in most models. Crucially, they have no impact on the key results of interest here so are omitted in the main models reported in Tables 2 to 4. All models reported in Table 2 also include Travel to Work Area fixed effects as do models (2) and (4) in Table A.1. The argument for including area fixed effects is that there may be unobserved (time-invariant) variables specific to certain areas. We use Travel to Work Areas (TTWAs) to capture these possible area effects on the grounds that TTWAs are defined to be economically self-contained in the sense that people who live within a given TTWA tend also to work in the same area; and so it may be supposed, tend to shop within that area too.

As expected, results indicate a significant and positive effect of both space and employment on output measured as sales. Larger stores, all else held constant, have stronger sales. The key result is the DiD-effect however. As described in Section 3 restrictions on out-of-town supermarkets began to be introduced in England from

1988 but were implemented with almost complete rigidity when Town Centre First policy was introduced in 1996. Policy attempts to steer retail to traditional town centres were introduced rather later and never as rigidly in Scotland and Northern Ireland. We therefore report results for two break points, 1988 and 1996, although we have experimented with intervening years and get broadly similar results. We observe that regardless of the break year selected English stores became significantly less productive - all else equal - to those in Scotland and Northern Ireland by about the same amount. The coefficients on the DiD variable are always statistically significant and point estimates of our preferred specifications reported in columns (3) and (6) of Table 2 are -0.097 and -0.095, respectively, implying a loss in TFP of about 9.6 percent. We note that this is an underestimate of TFP loss – not just a lower bound – to the extent that TCF policies in Scotland and Northern Ireland were also binding.

Table A.1 reports essentially similar results but does not use a DiD approach. The causal inference is therefore weaker (although one might argue it is necessary to find only one smoking gun to demonstrate causation). Instead we estimate models separately for the English stores and those in Scotland and Northern Ireland exploiting the fact that we know the year of opening of the store (and, therefore, whether the store's location and size likely were affected by TCF policies in the respective UK countries). For most of the key variables results are broadly similar with space and employment continuing always to be statistically significant. The point of particular interest is the effect of the year of opening or age of store variable and the squared term of this variable.

As noted in Section 2 we are observing something like a natural experiment. By comparing the results from the models estimated on the English stores (models

reported in columns 1 and 2) with those estimated on stores in Scotland and Northern Ireland (columns 3 and 4) in Table A.1, it becomes apparent that the effect of age of store on productivity is highly significant in England but not at all significant in Scotland and Northern Ireland.

For the sample of English stores the relationship between age of store and output is clearly quadratic (similar to the effects reported in columns (2) and (5) of Table 2).[10] The estimated best fit relationship for date of founding and output (based on Table A.1, column 2) implies that the oldest stores have – as would be expected – a lower output other things equal. Output, all else held constant, increases for stores founded during the 1960s and 1970s but only until around 1986. Output in stores founded after 1986 flattens and then begins to fall and the very newest stores have the lowest output of all. There is of course some error associated with estimating the peak store age for output (or productivity) but its growth closely reflects the period of innovation with larger format, out-of-town stores during the 1970s and 1980s and the peak and subsequent decline is entirely consistent with the DiD results reported in Table 2 strongly suggesting that one impact of the changes in planning policies in England has been to make stores less productive for any given size. An obvious interpretation is that this results from policy forcing retail to intrinsically less productive locations and sites and so reflects a policy imposed reduction in TFP in the supermarket sector.

However the estimated relationship between date of store foundation and output does not account for all of the observed reduction in store output observed from the early 1990s because the TCF policies in England additionally significantly reduced the average store size. This is illustrated in Figure 2 which shows the average size of

[10] As in columns (2) and (5) of Table 2, we exhaustively experimented with alternative functional forms but the quadratic form fitted the data best and higher order polynomials were statistically insignificant.

stores founded in each year from 1966. What we observe is that there were apparently two separate effects causing store productivity and output to fall as a result of the change in planning policies in England. The first was to regulate the micro-location of stores pushing them to town centres. This was associated with a loss of TFP because of less convenience for customer access and for logistics. Town centre sites are intrinsically less productive. This effect is captured in the quadratic relationship between store age and output all else – including store size - held equal. However all else was not held equal as evidenced by Figure 2. The policies not only pushed stores towards less productive town centre locations but they also controlled the particular sites stores could locate on and these were – being in town centres – on average smaller. So falling store size as a result of the micromanagement of store locations provided an additional reduction to the output we observe. This fall in output due to smaller store size can be interpreted as a fall in labour productivity since the effect is that of less output per unit of labour input. Summing up, micro-location as well as store size both matter, and matter significantly and, in the present case of enforced locations, adversely for store output and productivity.

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 after TCF policies began to seriously bite in England; and that store size itself matters for sales per store all else equal. This evidence from the DiD models in Table 2 is perhaps econometrically most persuasive on these points although since we are not comparing a ‘treated’ with an ‘untreated’ case but rather a strongly treated (England) and a modestly and later treated case (Scotland and Northern Ireland) the estimated

DiD coefficients will almost certainly underestimate the actual size of the impact on TFP of TCF policies. These productivity effects, however, must largely come through the consumer welfare side since we do not directly measure costs: only output measured by sales. The hypothesis is that stores were constrained to less productive sites but the impact on logistic costs for the company is not completely captured in our data. What appears to be completely captured is the impact on customer experiences and satisfaction. In-town stores are more difficult to get to, require more carrying of purchases and are likely to be more subject to stock control problems (storage facilities are smaller and delivery systems less efficient; see Bell and Hilber, 2006). 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.[11]

The interpretation of the relationship between year of store foundation and TFP is made more plausible still by another piece of evidence. The most obvious alternative explanation for why older stores are more productive could be that as the store group expanded and built more stores over time, it chose the most productive and attractive-to-customer locations first. However the evidence does not support this explanation. The most obvious measure of an attractive location is the population within a 10 minute drive time. The correlation between the age of the store and population within

[11] 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.

a 10 minute drive time for English stores is wholly non-significant (r= -0.019, p=0.76). That for stores in the rest of the UK is (r=0.260, p=0.014). In other words there is no significant relationship at all between the measure of location attractiveness and store age in England. In the less constrained rest of the UK there is some positive relationship although this is not significant at conventional levels. So, although in the less constrained rest of the UK there is some tendency for the older stores to be in locations with higher market potential, since this is included as an independent variable in Table 2, its impact is controlled for even in Scotland and Northern Ireland in the estimation of the store productivity - store age relationship.

The role of planning restrictiveness

We have persuasive evidence, therefore, that the tightening up on out-of-town stores in England which started in 1988, and the micromanagement of store locations imposed with the full-blooded TCF policies introduced in 1996, caused a significant decline of store-level productivity. Another issue is whether cross sectional variation in the restrictiveness of the planning system also influences store productivity. The most obvious way in which to investigate this is to see whether there is a direct relationship between indicators of planning restrictiveness at the LPA level and store size: does more restrictive local planning policy make stores smaller, all else equal? By constraining the supply of space, planning policies increase its price, thereby causing a substitution of space out of production. The more restrictively policies are applied by an LPA, the smaller might stores tend to be. While also having the effect of reducing productivity, this would be an 'efficient', cost minimising adaptation by stores to distorted factor prices[12]. Another possible outcome of more restrictively

[12] The circumstantial evidence is that the generalised 'containment' policies implemented in Britain since the 1947 Town and Country Planning Act were having the effect of constraining land supply and

applied policies might be of course that there is no store at all. The results of testing these two possibilities are investigated in Tables 3 and 4.

Table 3 shows the results of relating store size to the restrictiveness with which planning policy is locally applied using the data for food format stores only.[13] We have planning outcomes for every LPA in England from 1979 to 2008. Since we do not have this information for Scotland, Wales or Northern Ireland we have to drop stores in those countries from the analysis. We also drop those stores opened before the date our measures of local planning restrictiveness could have had any effect. We take this to be 1980 – so our sample is restricted to English stores founded after 1980. These two restrictions reduce the number of observations from 357 to 217. As is argued in Hilber and Vermeulen (2010) there are good reasons for taking the long term mean of measures of planning restrictiveness to eliminate one source of endogeneity, their fluctuation with the economic cycle. We therefore take the average refusal rate of major residential projects in an LPA for the period 1979-2008 as our measure of LPA restrictiveness (see Section 4 for the rationale of taking the refusal rate of major *residential* projects).

Because of endogeneity concerns with respect to the use of the refusal rate we use an 4 approach. Our identification strategy follows that adopted by Bertrand and Kramarz

increasing its price well before our measure of local planning restrictiveness starts in 1979. Such effects were discussed in Hall *et al.* (1973) and documented for 1984 in Cheshire and Sheppard (1986). The point is that while land prices may have been generally raised even by 1979 still cross sectional variation in planning restrictiveness since then would be related to systematic variation in retail space prices between LPAs.

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

(2002)[14] and implemented by Sadun (2008) who used the same planning data and methodology as ours in a similar context. Table 3 shows the results using the share of Labour councillors at the local elections over the period 2000-2008 as an instrument for the refusal rate of major applications for residential projects. The logic for using political composition as an instrument is (see Sadun; 2008, or Hilber and Vermeulen 2010) that low and middle income Labour voters traditionally care more about the availability of jobs, prices in shops and housing affordability and less about the protection of house values (fewer low income residents own homes) by preventing development.[15] It may also be the case that concern for protecting green fields from development is a normal good. 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, controlling for the other covariates (i.e. the other explanatory variables of store size[16]), the share of Labour seats affects retail store size only through planning restrictiveness. The first stage results reported in the bottom panel of Table 3 confirm that the share of Labour seats is strongly and statistically highly significantly

[14] Bertrand and Kramarz (2002) used the voting proportions for right wing parties as an instrument for how restrictive a French department 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.

[15] 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.

[16] 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 LPA. To address this concern we estimated models with earnings and car ownership in the first and second stage of our TSLS-estimates. The earnings and car ownership controls were typically insignificant and did not alter our results; so we dropped them from our final specifications. However, results with the two controls are available in the Appendix B Tables B.2 and B.3.

negatively correlated with regulatory restrictiveness. The values of the Kleibergen-Paap F-statistic show that weak identification is not a problem.

The top panel of Table 3 reports the results of the estimated effect of planning restrictiveness on store size. The model results reported in column (1) are estimated using OLS and without TTWA fixed effects or controls. This naïve estimate implies a negative and significant effect of the regulatory restrictiveness on store size. However, this estimate is likely biased. The results based on our 4 approach are reported in columns (2) to (4). The results reported in column (2) are based on the same model as in column (1) but are now estimated with TSLS, taking into account the likely endogeneity of the refusal rate. The model in column (3) includes both controls for exogenous influences on store size and also TTWA fixed effects. Finally, the model in column (4) additionally controls for the number of years since the store opened. The rationale for including this additional control variable is that we will capture the relationship between store age and size due to TCF policies. The coefficient on the refusal rate measure is negative and significant in all three IV-estimates. It is noticeably larger in the IV-estimates implying a downward bias introduced by the endogeneity of the refusal rate. The last model arguably provides the stiffest test. Model (4) would seem, therefore, to provide the best consistent estimate of the impact of cross sectional variation in LPA restrictiveness and to confirm that planning restrictiveness has a direct casual influence on store size and so on productivity in the supermarket sector. It thus provides evidence indicative of a causal relationship from more restrictive local planning policies to smaller store sizes.

However more restrictive local authorities may not just tend to make stores smaller; they may exclude them altogether. This is tested in Table 4. Again using the same IV

approach we test two ideas. The first, with results reported in columns (1) and (2) – using OLS and TSLS (based on the same IV-strategy) – of Table 4, is that greater restrictiveness reduces the probability of their being a store at all; the second, with results reported in columns (3) and (4), is that greater restrictiveness reduces the number of stores. The results point very strongly to the conclusion that there is a direct causal effect from more restrictive policies to there simply not being a supermarket or their being fewer supermarkets. This is not exactly measuring an impact of planning restrictiveness on store productivity although it does strongly suggest a loss of consumer welfare caused by a more restrictive local application of planning policies.

Estimated impact on productivity

These quantitative estimates of the impact of TCF policies on total factor productivity in supermarkets (Table 2), on the relationship between the age of a store and the store's normalised productivity (Table A.1) and that between LPA restrictiveness and store size can be converted into direct estimates of the overall impact of planning policies on output and productivity in the supermarket sector. To these we need to add a measure of the productivity impact of the direct reduction in store sizes following the introduction of TCF policies as illustrated in Figure 2. The results of this exercise are shown in Table 5.

The quantitative effects shown in panel [1] of Table 5 use the DiD results reported in Table 2 to estimate an average loss of TFP in English stores from TCF policies, store size held constant. For reasons noted above – that even in Scotland and Northern Ireland, there were policies designed to steer retailing to town centres, albeit less rigid and introduced later – the estimated loss of TFP of 9.6 percent is not just a very

conservative lower bound but almost certainly an underestimate of the impact in absolute terms. Panel [2] of Table 5 provides an alternative estimate of the impact on TFP of TCF policy in England again holding store size constant. It uses the relationship between age of a store and normalised productivity reported in Table A.1 to simulate what productivity for an average store in 2006 (chosen as the date of opening by which it could reasonably be assumed that the store would have reached full operating efficiency by 2008) would have been, if the rate of productivity had continued to grow between 1986 and 2006 at the rate observed in our data for the period 1966 to 1986 (0.46% per annum). This provides a counterfactual productivity estimate for 2006 stores. The implied loss of TFP of a representative 2006 English store on this basis is 16.2 percent. Panel [3] quantifies the impact on productivity of the smaller size TCF policies imposed on stores (see the discussion of Figure 2). The main driver of increasing store size was the continuing increase in car ownership and the use of more and larger lorries in logistics coupled with the completion of the motorway network. This in turn interacted with population decentralisation, itself influenced by the same factors (Anas and Moses 1978; Cheshire, 1995). The problem is that choosing the counterfactual is not straightforward. We have to assume some size the average store would have been in 2008 in the absence of TCF policies. We have chosen it to be as conservative as possible and assumed simply that if stores had continued to locate without the specific constraint on site size imposed by TCF policy then new stores founded after 1996 would have been as large but no larger than new stores founded between 1990 and 1995 were on average. This would, of course, only impact on the output of stores founded after 1996. The implications of this assumption for the additional loss in store sales imposed by TCF policy is shown in panel [3] of

Table 5. It represents a further loss of productivity – which we attribute to labour productivity – of 2.6 percent.

There are two reasons why even these values may be a conservative or lower bound estimate of the productivity losses imposed by TCF policies. Apart from the likelihood that as car ownership continued to rise after 1995, stores would have continued to get bigger (which we discount), as Haskel and Sadun (2009) report, productivity in the British retail sector actually grew in the first 5 years of the 1990s at a rate of 0.38% pa. This, however, compares with an annualised rate of productivity growth in the US of 0.49% and, in the US, this productivity growth accelerated sharply in the second half of the 1990s to 3.23% per annum (Haskel and Sadun, 2009). Given this evidence from the US, to assume even a constant rate of productivity growth in British retailing over the whole period 1966 to 2006 is likely to be a low rather than high estimate. The second factor is that we are only to a limited extent including additional costs imposed on the firm. These are likely to include more expensive logistics given that stores were increasingly located in more congested areas in town centres, farther from motorway access, and were smaller, with less storage space, so requiring more frequent re-stocking.

Thus the DiD based estimate of the hit to TFP of TCF policies (Panel [1]) is almost certainly an underestimate although it does provide a much more secure basis of identification than the loss of 16.2 percent (Panel [2]) derived from the straight comparison of results for English versus Scottish and Northern Irish stores reported in Table A.1. The assumptions underlying the further loss from directly forcing stores to be smaller (Panel [3]) is just based on a conservative assumption about how big stores

would have been by 2008 without the constraint of being forced onto particular sites in town centres.

There is however still another source of lost productivity associated with planning polices more generally. We should include an estimate of the impact of reduced store sizes in the more restrictive LPAs compared to the least restrictive. An estimate of this is shown in panel [4] of Table 5. To derive this, our baseline is the average predicted productivity assuming that all stores in the sample were located in LPAs with the same regulatory restrictiveness as observed in the least restrictive LPA.[17] We compare this counterfactual productivity (which is comparably higher as the counterfactual stores are bigger) to the predicted productivity based on the actually observed regulatory restrictiveness in each LPA. This comparison implies a loss of TFP of 6.1 percent for the store group overall. Given the implausibility of even the least restrictive LPA having had no impact on the price of retail land (for example see Appendix 12.7 of Competition Commission, 2000), again, this value seems likely to be a lower bound estimate. We should emphasise that we still include no allowance for the results reported in Table 4: that it is simply less likely that there will be any store in the more restrictive LPAs.

[17] It might be objected that the least restrictive LPA might not be realistically representative of the level of restrictiveness that could apply in the real world because either it is an outlier or it might represent some form of measurement error. However our measure of restrictiveness is the average of all values for each year from 1979 to 2008 so simple measurement error could have little if any impact; and even by 1979 policies constraining the supply of land for retail use had been in place in all English LPAs at least since the mid-1950s. Given the rise in car ownership and incomes between then and 1979 it is all but inconceivable that even in the least restrictive LPA (Middlesbrough) there was not an economically effective constraint on land supply. This conclusion is supported by the estimated price of land for retail development compared to that for industrial use in Darlington (another less prosperous city of the NE of England chosen because it had some of the least constraining land use policies observed in England then) and reported in Cheshire and Sheppard (1986). This cheapest retail land in Darlington was then £1.159 million per acre compared to £17,000 for the cheapest industrial land: the most expensive retail land was estimated at £13.539 million per acre compared to the most expensive industrial land at £20,000 per acre.

The final panels of Table 5 summarise these results. On the most conservative of assumptions TCF policies appear to have caused a loss of at least 12.2 percent in supermarket productivity. This is almost certainly however not a conservative lower bound but an underestimate since it assumes that there was no effect on store productivity in Scotland or Northern Ireland of policies there designed to steer retail development to town centres. The final figure for the impact on productivity of all planning policies, including cross sectional variation in LPA restrictiveness reported in the final panel of the table, is less conservative and has a slightly less firm econometric base but still we judge is likely to be a lower bound rather than an upper bound estimate for reasons given above. And even this figure of a total productivity loss of 24.9 percent makes no allowance for the impact on welfare of more restrictive application of planning policies simply excluding stores from local areas altogether.

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 DiD-model. The results of this imply a loss of TFP of some 9.6 percent with an additional 2.6 percent loss of labour productivity. 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, policy was

restrictive although introduced somewhat later and formulated significantly less rigidly than in England. A less conservative but less firmly based estimate of the impact of TCF policies on total factor productivity for English stores is a loss of 16.2 percent.

We have shown that if output is measured as turnover – a measure supported by the fact that the store group whose data we analyse here has a firm policy of equal mark-ups in all stores - then output rises with store size, all else equal. Store size in turn is affected by regulatory policies, arguably in two separate ways. Firstly, TCF policies in England that became very rigid after 1996 directly affected store size. Stores built since 1996 are significantly smaller compared to stores that opened prior to TCF policies becoming rigidly binding on the choice of site location, and this despite significant population decentralization and continued increase in car ownership and the use of more and larger lorries. Based on very conservative assumptions about the counterfactual, our simulations imply that store sales are 2.6 percent lower as a consequence of this adverse effect on the size of English stores since 1996.

Secondly, our evidence indicates that, independently of the central government's TCF policies the restrictiveness with which planning policies operate varies significantly by jurisdiction and the more restrictive local regimes not only made stores smaller (and so less productive) but tended to exclude them altogether. This was shown by using the mean 1979-2008 refusal rate for major residential developments for each LPA as a measure of 'regulatory restrictiveness'. One concern with the refusal rate measure is that it may be endogenous and that, as a consequence, the estimated impact of regulation on floorspace may be biased. In order to address this concern we employ an IV approach and exploit exogenous variation derived from the political

composition of local councils in charge of planning policy in order to identify the causal and unbiased effect of regulation on store size. Doing this we have reasonably established that more restrictive planning regimes generate smaller stores and smaller stores generate less output, all else hold constant. Our simulations imply that if all the stores in our sample were located in jurisdictions where policy was applied as in the least restrictive English local planning authority – still very restrictive by international standards – their combined output would be 6.1 percent higher on average. Adding this effect to the direct loss in productivity generated by the TCF policies in England since the late 1980s and the indirect effect of the same policies on store size, indicates an aggregate loss of productivity of at least 18.3 percent and more likely 24.9 percent since the late 1980s.

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 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 may also generate benefits not measured here. When TCF policy was 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. One further intended step in our research is to rigorously evaluate these expected benefits – particularly the carbon footprint impact of TCF policy.

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, 2008, 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. In particular it should help to think more systematically about what precisely such benefits might be and whether they could be achieved at lower cost to output and productivity.

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TABLES

Table 1
Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Store-level dataset (Tables 2, 3 and A.1)					
Weekly sales (£)	357	921115	406300	73978	2056014
Employment (FTE)	357	213	85	32	471
Net floorspace (sq. ft.)	357	46710	17352	8313	101091
Gross floorspace (sq. ft.)	357	81633	31095	15076	180000
Storage area (sq. ft.)	357	34923	15785	4410	107412
Net/gross floorspace (ratio)	357	0.58	0.07	0.33	0.83
Non-food format (dummy)	357	0.06	0.24	0	1
Mezzanine (dummy)	357	0.17	0.38	0	1
Years since first opening	357	14.4	10.5	1	43
Total weekly opening hours	357	119	29	64	168
Population within 10 minute drive time	357	81226	43706	5532	229246
Car ownership share within 15 minute drive time	357	0.70	0.08	0.45	0.88
Competition variable [1)]	357	4.97	3.49	0.29	23.30
Av. FT male weekly earnings in £	357	579.1	84.0	390.6	1104.4
Refusal rate for major residential projects, 1979-2008 [2)]	254	0.22	0.073	0.084	0.50
Share Labour seats, 2000-2007 [2)/3)]	254	0.38	0.23	0	0.94
Local authority-level dataset (Table 4)					
Store present	351	0.54	0.50	0	1
Number of stores	351	0.77	0.95	0	6
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 in LA, 2001	351	58087	38514	10463	390792
Male nominal earnings FT, 2001	351	468.4	83.8	305.4	819

Notes: [1)] Estimated by applying a distance decay function to the five nearest stores from each of the two main competing retail groups. [2)] Sample restricted to food format stores in England (Table 3). Share Labour seats based on local election years 2000, 2002, 2003, 2004, 2006 and 2007. [3)] The years 2001 and 2005 are excluded as local elections coincided with General Elections.

Table 2
Difference-in-Difference Specifications

	Dependent variable: Log(total sales)					
	Diff-in-diff: **pre/post 1988**			Diff-in-diff: **pre/post 1996**		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
England	-0.0470	-0.0881	-0.134*	-0.00964	-0.0862	0.173***
	(0.0678)	(0.0697)	(0.0771)	(0.0372)	(0.0702)	(0.0443)
England × Post 1988	-0.0798**	-0.0909**	-0.0968**			
	(0.0394)	(0.0393)	(0.0463)			
Post 1988	0.0483	0.0983**	0.283*			
	(0.0363)	(0.0475)	(0.155)			
England × Post 1996				-0.0832**	-0.0881**	-0.0947*
				(0.0372)	(0.0376)	(0.0488)
Post 1996				0.0328	0.0635	0.221
				(0.0348)	(0.0544)	(0.163)
Years since opening		0.00978**			0.00777	
		(0.00405)			(0.00604)	
Years since opening squared		-0.000203*			-0.000185	
		(0.000111)			(0.000133)	
Year of open. dummies	No	No	Yes	No	No	Yes
Net floorspace	0.123*	0.152**	0.179**	0.133*	0.149**	0.182**
	(0.0719)	(0.0742)	(0.0743)	(0.0724)	(0.0745)	(0.0748)
Storage area	-0.000699	0.0130	-0.0195	0.00126	0.00484	-0.0234
	(0.0317)	(0.0333)	(0.0355)	(0.0314)	(0.0322)	(0.0351)
Employment	0.916***	0.845***	0.860***	0.896***	0.859***	0.862***
	(0.0665)	(0.0741)	(0.0704)	(0.0676)	(0.0762)	(0.0706)
Mezzanine	-0.0388	-0.0337	-0.0441	-0.0317	-0.0313	-0.0473
dummy	(0.0304)	(0.0301)	(0.0345)	(0.0303)	(0.0299)	(0.0351)
Non-food format	-0.208**	-0.253**	-0.236***	-0.221**	-0.246**	-0.227***
dummy	(0.0952)	(0.0989)	(0.0805)	(0.0956)	(0.0981)	(0.0807)
Hours	0.000926*	0.000975**	0.000719	0.00103**	0.00104**	0.000787*
	(0.000481)	(0.000465)	(0.000468)	(0.000453)	(0.000459)	(0.000466)
Population within	0.0803***	0.0699***	0.0619***	0.0765***	0.0701***	0.0605***
10 min. drive time	(0.0213)	(0.0215)	(0.0233)	(0.0207)	(0.0210)	(0.0230)
Competition	-0.00406	-0.00507	-0.00443	-0.00442	-0.00490	-0.00440
	(0.00342)	(0.00329)	(0.00369)	(0.00328)	(0.00329)	(0.00369)
TTWA FEs and constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	331	331	331	331	331	331
R-squared	0.981	0.982	0.986	0.981	0.982	0.986

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

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

	OLS	TSLS: *Second stage* Dependent variable: log (net floorspace area)		
	(1)	(2)	(3)	(4)
Refusal rate:	-0.689*	-1.088*	-1.819*	-1.905*
major residential projects	(0.368)	(0.582)	(1.002)	(0.996)
Population within 10 minutes			0.111	0.0767
drive time			(0.0756)	(0.0749)
Competition			-0.0167*	-0.0162*
			(0.0101)	(0.00995)
Years since opening				0.0299**
				(0.0152)
Years since opening squared				-0.000816*
				(0.000503)
TTWA FEs	*No*	*No*	*Yes*	*Yes*
Observations	217	217	217	217
		TSLS: *First stage* Dependent variable: **refusal rate**		
Share Labour seats		-0.190***	-0.161***	-0.161***
		(0.015)	(0.031)	(0.031)
Controls and FEs (included instr.)		*No*	*Yes*	*Yes*
Kleibergen-Paap rk Wald F stat.		165.9	27.7	27.5

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

Table 4
Determinants of store presence propensity and number of stores in local authority

Dependent variable:	Presence of store in LA		Number of stores in LA	
	(1) OLS	(2) TSLS	(3) OLS	(4) TSLS
Refusal rate:	-2.455***	-3.877***	-3.117***	-3.879***
major residential projects	(0.514)	(0.745)	(0.998)	(1.196)
Number of households in	1.92e-06*	9.54e-07	1.02e-05***	9.73e-06***
local authority, 2001	(9.78e-07)	(7.46e-07)	(1.99e-06)	(1.59e-06)
TTWA FEs and constant	*Yes*	*Yes*	*Yes*	*Yes*
Observations	351	351	351	351
Adjusted R-squared	0.516		0.628	
		TSLS: *First stage*		
		Dependent variable: **refusal rate (major residential projects)**		
Share Labour seats		-0.189***		-0.189***
		(0.0220)		(0.0220)
Controls and FEs (included instr.)		*Yes*		*Yes*
Kleibergen-Paap rk Wald F stat.		74.0		74.0

Notes: **Instrumented variable in bold.** The refusal rate is calculated as the ratio of declined major residential project applications to the total number of applications and averaged over 1979-2008 (the period for which regulation data exist). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stock-Yogo weak ID test critical values: 10% maximal IV size: 16.38, 15% maximal IV size: 8.46, 20% maximal IV size: 6.66 and 25% maximal IV size: 5.53.

Table 5
Quantitative estimates of planning policy impact on retail output

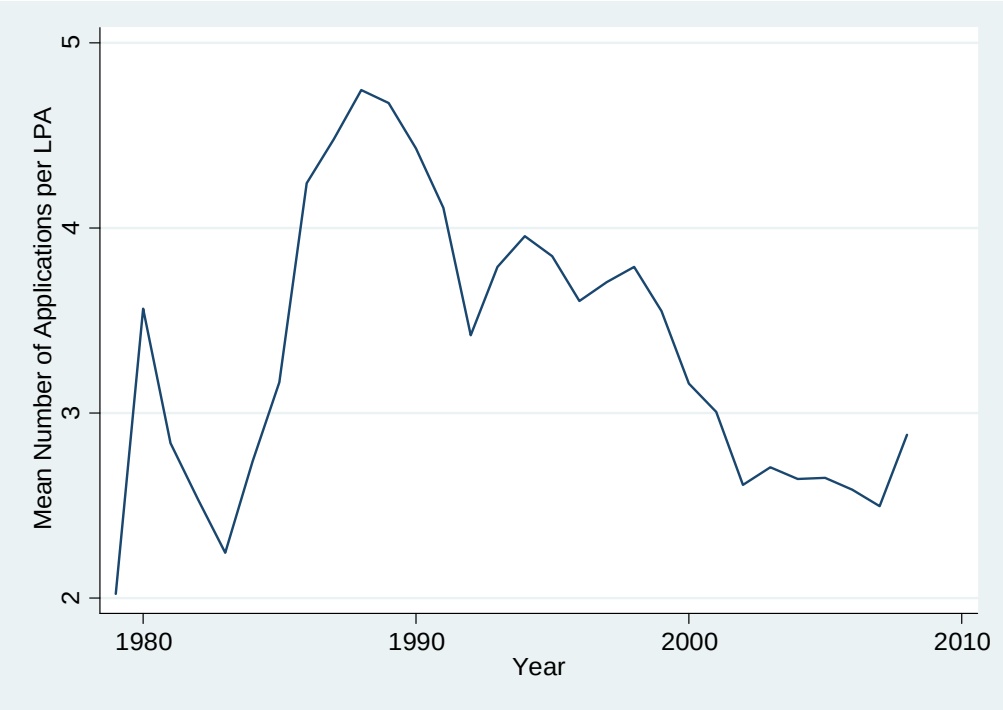
Effect	Underlying specifications	Output reduction (ceteris paribus)	Notes
[1] Impact of TCF policy via affecting TFP directly (**relative impact** England vs. Scotland/NI): *Difference-in-difference estimates of impact of TCF policy: Scotland/Northern Ireland vs. England*	Average of T2(3+6)	**-9.6%**	Lower bound estimate of **loss in TFP** due to TCF policy (assuming Scotland/NI are unconstrained)
[2] Impact of TCF policy in England via affecting TFP directly (**absolute impact** of TCF policy in England) based on effect of store age on output: *Estimate of impact of TCF policy in England based on effect of store age on output: Representative store built in 2006 but annual productivity growth since 1986 assumed at estimated rate for 1966-1986 (counterfactual) vs. representative store built in 2006*	TA.1 (2)	**-16.2%**	**Loss in TFP** due to TCF policy in England (estimate of total effect of impact in England using alternative estimates)
[3] Impact of TCF policy via affecting store size: *Compare representative store in 2008 with net floor area assumed to be the average of 1990-1995 (pre-TCF policy) with representative store in 2008 with net floor area assumed to be the average of 1996 onwards (post-TCF policy)*	Average of T2(3+6)	**-2.6%**	**Loss in labour productivity** due to reduction in store size as consequence of TCF policy
[4] Impact of local regulatory restrictiveness on store size and via store size on output: *Compare situation where all stores in sample are assumed to have lowest level of regulatory restrictiveness (Middlesbrough) vs. an average level of regulatory restrictiveness (regression sample average)*	Av. T2(3+6) + T3 (4)	**-6.1%**	**Loss in labour productivity** due to local regulatory constraints
Total Impact of planning policies (more conservative assumptions)	**[1]+[3]+[4]**	**-18.3%**	Assumes that TCF policies in Scotland and NI had no significant adverse effects. To the extent that TCF policies in Scotland and NI also had adverse effects, the 18.3% is an underestimate of the true negative impact
Total Impact of planning policies (less conservative assumptions)	**[2]+[3]+[4]**	**-24.9%**	Use [2] instead of [1] for calculation of total impact

FIGURES

Figure 1

Number of applications for major retail developments, 1979-2008

(mean per local planning authority per year)

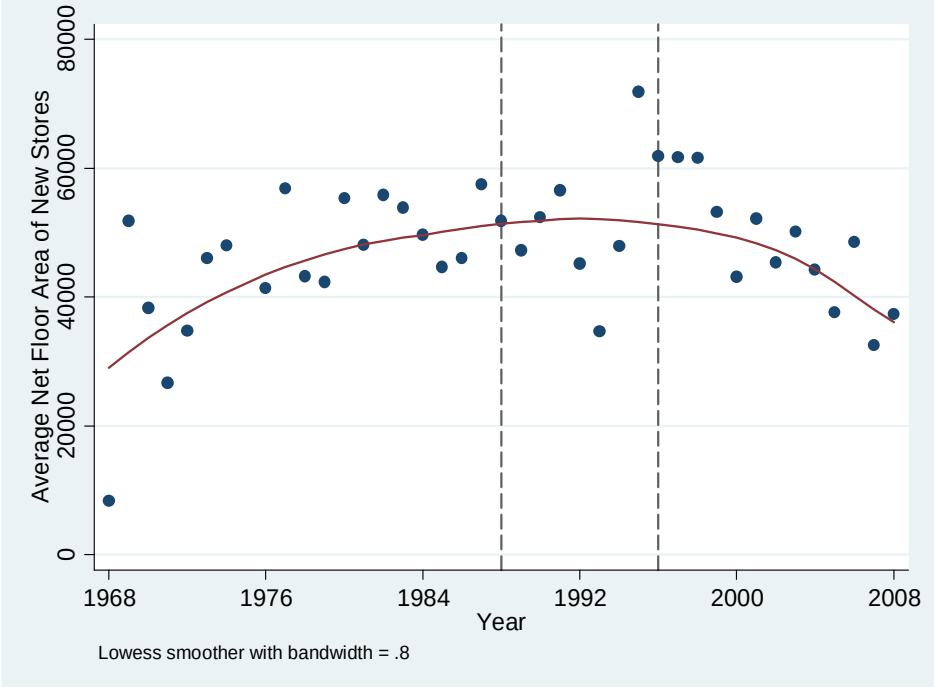


Source: Department for Communities and Local Government (DCLG)

Figure 2

Relationship between age of store and net floor area

(measured at sample mean; England only)



APPENDIX A

Table A.1
Determinants of store-level total sales

	Dependent variable: Log(total sales)			
	(1)	(2)	(3)	(4)
VARIABLES	England *No* FEs	England *With* FEs	Scotland and NI *No* FEs	Scotland and NI *With* FEs
Net floorspace	0.158**	0.151*	0.200**	0.156
	(0.0611)	(0.0845)	(0.0921)	(0.165)
Storage area	-0.0137	0.0109	-0.0289	0.0239
	(0.0253)	(0.0361)	(0.0646)	(0.0985)
Employment	0.847***	0.841***	0.932***	0.885***
	(0.0615)	(0.0859)	(0.113)	(0.152)
Mezzanine	-0.0378*	-0.0444	-0.0281	0.00882
Dummy	(0.0206)	(0.0349)	(0.0407)	(0.0671)
Non-food format	-0.265***	-0.254**	-0.185	-0.199
Dummy	(0.0909)	(0.121)	(0.118)	(0.170)
Hours	0.000899**	0.00106**	0.00150**	0.00114
	(0.000362)	(0.000512)	(0.000595)	(0.000988)
Years since opening	0.0121***	0.00992**	-0.00898	0.00242
	(0.00303)	(0.00428)	(0.00868)	(0.0120)
Years since opening	-0.000267***	-0.000221*	0.000246	-8.06e-05
Squared	(7.42e-05)	(0.000117)	(0.000248)	(0.000355)
Population within	0.0468***	0.0657**	0.0895***	0.0656
10 min. drive time	(0.0159)	(0.0264)	(0.0249)	(0.0511)
Competition	-0.00524**	-0.00558	-0.0176**	-0.00483
	0.158**	0.151*	0.200**	0.156
TTWA FEs	*No*	*Yes*	*No*	*Yes*
Northern Ireland				0.0142
				(0.101)
Observations	269	269	62	62
R-squared	0.965	0.980	0.968	0.986

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

APPENDIX B

Table B.1
Difference-in-Difference specifications with additional controls
(local car ownership-share and earnings)

	Dependent variable: Log(total sales)					
	Diff-in-diff: **pre/post 1988**			Diff-in-diff: **pre/post 1996**		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
England	0.0305	-0.0144	-0.0911	0.0169	-0.00729	-0.0976
	(0.0810)	(0.0813)	(0.0887)	(0.0778)	(0.0837)	(0.0891)
England × Post 1988	-0.0748*	-0.0858**	-0.0930**			
	(0.0398)	(0.0398)	(0.0449)			
Post 1988	0.0422	0.0878*	0.167			
	(0.0370)	(0.0472)	(0.172)			
England × Post 1996				-0.0784**	-0.0828**	-0.0903*
				(0.0379)	(0.0382)	(0.0485)
Post 1996				0.0275	0.0519	0.179
				(0.0361)	(0.0547)	(0.170)
Years since opening		0.00933**			0.00686	
		(0.00399)			(0.00600)	
Years since opening squared		-0.000198*			-0.000168	
		(0.000110)			(0.000132)	
Year of open. dummies	No	No	Yes	No	No	Yes
Net floorspace	0.125*	0.152**	0.175**	0.135*	0.148*	0.179**
	(0.0735)	(0.0757)	(0.0754)	(0.0738)	(0.0762)	(0.0760)
Storage area	-0.00247	0.0104	-0.0206	8.48e-05	0.00350	-0.0242
	(0.0312)	(0.0328)	(0.0353)	(0.0310)	(0.0317)	(0.0351)
Employment	0.920***	0.853***	0.870***	0.899***	0.867***	0.870***
	(0.0680)	(0.0753)	(0.0711)	(0.0687)	(0.0778)	(0.0714)
Mezzanine dummy	-0.0358	-0.0313	-0.0421	-0.0289	-0.0288	-0.0450
	(0.0307)	(0.0305)	(0.0349)	(0.0307)	(0.0305)	(0.0355)
Non-food format dummy	-0.206**	-0.248**	-0.227***	-0.218**	-0.242**	-0.221***
	(0.0977)	(0.102)	(0.0830)	(0.0977)	(0.101)	(0.0832)
Hours	0.000883*	0.000929**	0.000677	0.000980**	0.000982**	0.000750
	(0.000477)	(0.000465)	(0.000463)	(0.000452)	(0.000459)	(0.000463)
Population within 10 min. drive time	0.0783***	0.0681***	0.0581**	0.0746***	0.0690***	0.0581**
	(0.0221)	(0.0225)	(0.0244)	(0.0217)	(0.0217)	(0.0241)
Car ownership share share within 15 min.	-0.00138	-0.00134	-0.00140	-0.00137	-0.00127	-0.00116
	(0.00179)	(0.00175)	(0.00195)	(0.00178)	(0.00175)	(0.00196)
Competition	-0.00439	-0.00537	-0.00486	-0.00478	-0.00525	-0.00473
	(0.00346)	(0.00334)	(0.00386)	(0.00333)	(0.00336)	(0.00388)
Average FT male weekly earnings	-0.176**	-0.158**	-0.0806	-0.176**	-0.168**	-0.0885
	(0.0789)	(0.0741)	(0.0832)	(0.0751)	(0.0736)	(0.0811)
TTWA FEs and constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	331	331	331	331	331	331
R-squared	0.981	0.982	0.986	0.982	0.982	0.986

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

Table B.2
Determinants of net floor area with additional controls
(local car ownership-share and earnings)

	TSLS: *Second stage* Dependent variable: log (net floorspace area)	
	(1)	(2)
Refusal rate:	-1.088*	**-2.038***
major residential projects	(0.582)	**(1.205)**
Population within 10 minutes		0.121*
drive time		(0.0729)
Car ownership share		0.00575
share within 15 min.		(0.00621)
Competition		-0.0150
		(0.0103)
Average FT male		0.254
weekly earnings		(0.314)
TTWA FEs	*No*	*Yes*
Observations	217	217
	TSLS: *First stage* Dependent variable: **refusal rate (major residential projects)**	
Share Labour seats	-0.190***	-0.139***
	(0.015)	(0.030)
Controls and FEs (included instr.)	*No*	*Yes*
Kleibergen-Paap rk Wald F stat.	165.9	21.3

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

Table B.3
Determinants of store presence propensity and number of stores in local authority (with local earnings control)

Dependent variable:	Presence of store in LA		Number of stores in LA	
	(1)	(2)	(3)	(4)
	OLS	TSLS (2nd stage)	OLS	TSLS (2nd stage)
Refusal rate:	-2.529***	-3.858***	-3.247***	-3.848***
major residential projects	(0.510)	(0.733)	(0.996)	(1.175)
Number of households in local	2.05e-06**	1.18e-06	1.05e-05***	1.01e-05***
authority, 2001	(9.97e-07)	(7.31e-07)	(2.00e-06)	(1.56e-06)
Average FT male weekly	-0.000793	-0.000946*	-0.00139	-0.00146*
earnings, 2001	(0.000636)	(0.000506)	(0.000999)	(0.000777)
TTWA FEs and constant	*Yes*	*Yes*	*Yes*	*Yes*
Observations	351	351	351	351
Adj. R-squared	0.522		0.632	
		TSLS: *First stage*		
		Dependent variable: **refusal rate (major residential projects)**		
Share Labour seats		-0.190		-0.190
		(0.221)		(0.221)
Controls and FEs (included instr.)		*Yes*		*Yes*
Kleibergen-Paap rk Wald F stat.		73.5		73.5

Notes: **Instrumented variable in bold.** The refusal rate is calculated as the ratio of declined major residential project applications to the total number of applications and averaged over 1979-2008 (the period for which regulation data exist). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Stock-Yogo weak ID test critical values: 10% maximal IV size: 16.38, 15% maximal IV size: 8.46, 20% maximal IV size: 6.66 and 25% maximal IV size: 5.53.

Table B.4
Determinants of store-level total sales with additional controls
(local car ownership-share and earnings)

	Dependent variable: Log(total sales)			
	(1)	(2)	(3)	(4)
VARIABLES	England *No* FEs	England *With* FEs	Scotland and NI *No* FEs	Scotland and NI *With* FEs
Net floorspace	0.158**	0.152*	0.207**	0.160
	(0.0640)	(0.0862)	(0.0914)	(0.175)
Storage area	-0.0132	0.0128	-0.0439	0.00563
	(0.0256)	(0.0355)	(0.0741)	(0.121)
Employment	0.845***	0.841***	0.944***	0.918***
	(0.0632)	(0.0870)	(0.108)	(0.179)
Mezzanine	-0.0376*	-0.0418	-0.0381	0.0115
dummy	(0.0209)	(0.0354)	(0.0470)	(0.0733)
Non-food format	-0.265***	-0.252**	-0.186	-0.182
dummy	(0.0917)	(0.124)	(0.118)	(0.174)
Hours	0.000921**	0.00108**	0.00150**	0.000907
	(0.000361)	(0.000511)	(0.000586)	(0.00128)
Years since opening	0.0122***	0.00971**	-0.00972	0.00390
	(0.00303)	(0.00420)	(0.00905)	(0.0128)
Years since opening	-0.000269***	-0.000214*	0.000263	-0.000130
squared	(7.36e-05)	(0.000116)	(0.000263)	(0.000372)
Population within	0.0529***	0.0669**	0.0734**	0.0470
10 min. drive time	(0.0186)	(0.0273)	(0.0275)	(0.0555)
Car ownership share	0.000746	-0.00107	-0.00241	-0.00393
share within 15 min.	(0.000945)	(0.00200)	(0.00218)	(0.00460)
Competition	-0.00517**	-0.00584*	-0.0157*	-0.00559
	(0.00243)	(0.00351)	(0.00930)	(0.0160)
Average FT male	-0.00713	-0.176*	-0.0899	-0.120
weekly earnings	(0.0488)	(0.0896)	(0.106)	(0.224)
TTWA FEs	*No*	*Yes*	*No*	*Yes*
Northern Ireland				0.0142
				(0.101)
Observations	269	269	62	62
R-squared	0.966	0.980	0.969	0.987

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