The impact of local competition on grocery store profit margin

Introduction

1. This appendix examines how local competition affects grocery store profit margins. Using empirical analysis we find that as the degree of local competition intensifies, store profit margins decline. This suggests that the extent of the local competitive constraint faced by individual grocery stores determines store profits.

2. Previous results of a similar analysis have been included in the working paper on market definition published in May 2007 and on margin concentration published in April 2007. This appendix relies on the same methodology, but the analysis has been refined in light of comments received from various parties during this investigation. The results presented in this appendix corroborate the outcomes of these previous analyses.

3. This analysis is based on store margin data for stores over 280 sq metres for the four major grocery retailers: Asda, Morrisons, Sainsbury's and Tesco. The outcomes of various regression analyses confirm: *(a)* that competition is local, with a competitor having a stronger effect when there is only one other fascia in the local area than when there are several and when it is geographically closer; *(b)* that the four major retailers exert significant competitive constraint on each other's stores; and finally *(c)* that large competing stores exert significant competitive constraint on other large grocery stores.

Local competition and store profit margin

4. The main result of this analysis shows that the greater the degree of local competition, the lower is store profit margin. The outcomes of our regressions show that when a grocery store faces little competition, it tends to earn a high profit margin.

5. We estimate several regressions, each time using a slightly different measure of local concentration. These concentration measures are:

- the number of competing fascias within a 10-minute drive-time (isochrone) from the store in the centre of this isochrone (centre store);
- the number of competing stores within a 10-minute drive-time from the centre store;
- the combined net sales area of rival stores within a 10-minute drive-time from the centre store; and
- the share of competitors' net sales area within a 10-minute drive-time from the centre store.

6. Regardless of the concentration measure that we include in the model, the results consistently indicate that high concentration causes high store margins. All results are statistically significant. The results are summarized in Table 1.

TABLE 1 **Impact of local concentration on store profit margin**

	Number of competing fascias over 280 sq metres within 10 mins	*Number of competitor stores within 10 mins*	*Combined net sales area ('000) of competitors within 10 mins*	*Share of competitors' net sales area in total net sales area within 10 mins*
Effect on store profit margin	–0.0096***	–0.0034***	–0.0026***	–0.1545***
t-statistics	(–3.05)	(–2.93)	(–3.06)	(–2.99)

Source: CC analysis.

*p <0.10; ** p <0.05; *** p <0.01.

7. When the model includes the number of rival fascias within a 10-minute drive-time of the centre store, the results indicate that each additional fascia reduces profit margin

by about 1 per cent (precisely 0.96 per cent). If, instead, we employ the number of competing stores within a 10-minute isochrone, the results indicate that each additional store reduces profit margin by 0.34 per cent.

8. To compare these results, the last two columns of Table 1 reproduce the econometric results when local concentration is measured with the net sales area of local competing stores and the share of competitors' sales area in total sales area. The effect of increasing competitors' net sales area or their share of net sales area will reduce the centre store profit margin. In Annex 1 we provide a more detailed discussion of these results.

9. Our empirical analysis also shows that the effect of an additional competitor is much larger for a monopoly store than for a store that already has two competitors within a 10-minute isochrone. An additional fascia will reduce profit margin by at least 2.85 per cent for a monopoly store, whereas an extra competitor will reduce profit margin by 2 per cent when the centre store already faces two competing fascias. These results are discussed in more details in Annex 1.

Geographic dimension of competition

10. Our empirical analysis also suggests that the location of competing stores has an impact on store profit margin. The further away the competitors are, the higher the profit margin of the centre store.

11. We present the results of two modified versions of the margin regressions which account for the distance to the third nearest competitor. In each case, the distance (measured in drive-time) of these stores to the centre store affects store profit margin positively. For example, using the results of the first model reproduced in Table 2, when the third nearest competitor is located 1 minute closer to the centre store, the

profit margin declines by 1.08 per cent. These results are further discussed in Annex 1.

TABLE 2 **Impact of competitor's location on store profit margin**

	Drive time to third nearest competitor	
Model	I	II
Effect on profit margin	0.0108***	0.0072***
t-statistics	(–2.9)	(–3.52)

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.

The role of competitors' size and fascia for store profit margin

12. The analysis shows that Asda, Morrisons, Sainsbury's and Tesco exert a stronger competitive effect on each other than the group of all fascias (see Part C of Supplement 1 for a description of the other fascias that are included in this analysis). The effect on margin of one of these four fascias is estimated to be at least 3.42 per cent. The results, which are displayed in Table 3, suggest that the effect of the other fascias is small, if present at all.

TABLE 3 **Impact of competitor size on store profit margin**

	Number of AMST† competing fascias within 10 mins	*Number of other (not AMST) competing fascias within 10 mins (No4FS)*
Effect on profit margin	–0.0342***	0.0009
t-statistics	(–3.37)	(0.15)

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
†Asda, Morrisons, Sainsbury's, Tesco.

13. Our analysis also shows that competing large stores have a significant impact on the profit margin of other large stores, while smaller size stores do not appear to have any statistically significant effect. This suggests that small stores exert little if any competitive constraint on large grocery stores.

14. The results of the margin regressions are presented in Table 4. We assess the effect of large stores with net sales area greater than 1,400 sq metres and 2,000 sq metres on corresponding store profit margin. The impact of an additional rival that is more than 1,400 sq metres reduces margin by 3.37 per cent, whereas an extra small size competitor has no statistically significant impact on store margin. If, instead, we use 2,000 sq metres as the demarcation to define large stores, the impact of an additional large rival store on profit margin is slightly bigger (4.19 per cent), whereas the number of small competing stores does not have a statistically significant effect. These results are further discussed in detail in Annex 1.

TABLE 4 **Impact of competitor size on store profit margin**

	Number of competing fascias over 1,400 sq metres	*Number of competing fascias between 280 and 1,400 sq metres*	*Number of competing fascias over 2,000 sq metres*	*Number of competing fascias between 280 and 2,000 sq metres*
Model	I	I	II	II
Effect on profit margin	–0.0337**	0.0044	–0.0419**	0.0011
t-statistics	(–2.48)	–0.48	(–2.54)	–0.13

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.

The empirical model

1. In the industrial organization literature, models of market concentration have been derived from two-stage oligopoly games.[1] In the first stage of the game firms decide whether to operate on the market. This decision is based on their expectation about profit level in the second stage. In the second stage, firms compete either on price or quantity or on any other strategic short-term variable. And based on the number of rivals they face and the type of competition, firms adjust the strategic variables to maximize profits. The second stage decision determines sales and thus profit margins. These two-stage models are well suited to industries which are in long-run equilibrium and thus not too much affected by dynamic considerations.

2. We derive an empirical model to estimate the relationship between local market structure and grocery store profit margin. A two-stage oligopoly game highlights the fact that market structure is endogenous. That is, the second stage payoff will determine the entry decision in the first stage. Using the general predictions of these entry models, we estimate a reduced-form profit function to assess how local concentration measures affect grocery stores' profits.

Effect of market structure on store profit

3. In the first stage firms will decide to enter as long as the expected profit is no less than the payoff of their next best alternative (normalized to zero). Entry is thus determined by the following profit condition:

$$Total\ \Pr ofit = Total\ \mathrm{Re}venue - Total\ Costs = V(X, MS) - FC \geq 0$$

[1]For an overview, see Berry and Reiss 'Empirical Models of Entry and Market Structure' forthcoming *Volume III, Handbook of Industrial Organisation*. Useful references also include Bresnahan, T F and P C Reiss (1990) 'Entry in Monopoly Markets', *Review of Economic Studies*, 57, Bresnahan, T F and P C Reiss (1991) 'Entry and Competition in Concentrated Markets', *Journal of Political Economy*, 99 (5) and Mazzeo, M (2002) 'Competitive Outcomes in Product-Differentiated Oligopoly', *Review of Economics and Statistics*, 84 (4).

where V(.) is a variable profit function and FC represents the firm's fixed costs. Variable profit depends on demand and cost variables, included in X, and the equilibrium number and type of entrants in the market (market structure, MS). Under free entry total profits will be close to zero in long-run equilibrium. However, positive profits can be earned when there are barriers to entry.

4. In the second stage, entrants compete in the market. The more intense this competition, the lower profits will be. For example, in the traditional Cournot oligopoly game, as the number of rival firms increases, price will decline towards marginal cost. As prices go down, so do profits, reducing entry opportunities. As fixed costs are unaffected by competition in the market, a monopolist will thus earn a higher variable profit than when a store faces competition, or more generally:

$$V^1 \geq V^2 \geq V^3 \ldots,$$

where V^i is the individual variable profit with i firms in the market.

5. Exactly how variable profits will be affected by competitors depends on the functional form of the demand and cost functions as well as on the nature of competition in the second stage and thereby on the type of entrants. If firms supply homogenous products and compete à la Cournot, profits are only affected by the number of competitors and not by their identity. In contrast, when firms are in different markets, profits are not affected by entry and a third possibility is when products are heterogeneous but substitutable to a certain degree. The more similar a competitor's offer, the fiercer the competitive pressure from this competitor.

6. The retail offer in the grocery market is not homogeneous and the impact of the competitor will generally be stronger the closer the two firms compete in terms of geographic and product dimension. For example, stores that are closer geographically will tend to compete for the same set of customers. Alternatively,

some grocery stores offer a limited range of products and as a result do not compete effectively with stores that carry a larger range of products. As fascia, size and the location of a competitor are decided upon entry and cannot be altered in the short term, these form part of the market structure.

Store margin, PQRS and uniform prices

7. Once in the market, grocery stores compete not only on price but also on non-price dimensions. The product sold by a grocery store is a 'retail offer' that summarizes a multidimensional product comprised of price level, range, quality and service. The 'retail offer' varies therefore along the PQRS dimension that can be altered relatively easily in the short run. As a result, in the second stage of the game, stores compete on price but also on quality, range and service (QRS). Any change of these variables contributes to a store attracting or losing customers.

8. Although the major grocery retailers set prices centrally and uniformly for all their stores across the country, there is evidence that PQRS varies depending on the local competitive conditions (also see Appendix 5.1). For a start, prices may not be completely uniform. There is evidence that grocery retailers have launched local vouchering campaigns that only affected a subset of stores. Alternatively, stores may stock only a certain range of products, offering consumers only the most expensive items in the product category. We also heard that in case of supply shortage, some retailers will only stock the product in stores located in the most competitive environment. These strategic decisions do not affect the price of particular items, but they do have an effect on consumer expenditure, and contribute to higher store revenues. Quality of service is also a factor that affects the retail offer. It is understood that retailers undertake management reviews and will locate the better managers, also the most expensive ones, in areas where local competition is more vigorous.

9. Tesco submitted to the CC that there was no relationship between PQRS variables and local market structure.[2] However, PQRS is notoriously difficult to measure. And it is the results of a collective effect of various types of actions. In a more competitive environment, effort in keeping store cleanliness to a high standard, maintaining store service quality, servicing a broader range of products will translate into higher costs, and thus lower profits. Alternatively, a store facing little local competition will not need to engage in 'extra' activities to attract customers. Fewer vouchering campaigns, less attention to stock, reduced range of products on the shelves, high-margin items on the shelves etc may be the result. The more idiosyncratic the activity is to the market, the less easily it will be picked up in individual PQRS variables. If it has an effect, it will, however, show up in the aggregate profit measure we use.

Econometric specification

10. The previous discussion showed that imposing a simple model of competition (eg Cournot competition) may not be sensible to reflect the competitive interaction between grocery stores. Because the 'retail offer', and therefore competition, varies over several dimensions and not just prices, we therefore assume a reduced-form profit function that can capture more complex forms of competition. The downside of not deriving the profit equation from specific demand and cost functions is that the coefficient estimates on the control variables do not have clear economic meaning. However, for the purpose of this analysis, we are interested in the effect of local market concentration on store profit margins.

11. The size of the market is a key factor in determining the number of firms in a market. Under equally competitive situations, the greater the market size, the higher the number of firms it can support. Our main interest lies in how the number of firms

[2]Tesco submitted extensive analyses showing that nine measures of PQRS do not vary with measure of local market concentration. These submissions are discussed further in Appendix 5.1.

affects the ability to exercise market power and not in how many firms a local market can support. To exclude market size effects we therefore use the variable profit margin (and a proxy to the Lerner Index) as the dependent variable instead of the variable profit, assuming a linear cost function:

$$\pi = \frac{V}{Total\ \text{Re}venues} = \frac{pq - cq}{pq} = \frac{p - c}{p}$$

where q are units sold, p is the unit price and c represents the unit cost. As a higher variable profit translates into a higher profit margin, profit margins will likewise decrease with the number of competitors: $\pi^1 \geq \pi^2 \geq \pi^3 \ldots$.

12. The variable profit margin will capture changes in all aspects of the retail offer. For example, the margin will change with any price change, but it also picks up the effect of the range of available products as the price represents an average price over the assortment of the store.[3] If a store offers a range of products on which the retailer earns a higher margin, it will likely have higher margins at that store than average. Alternatively, local promotional activities or higher service activity will lead a store to incur greater costs.

13. Profit margin is unaffected by variables in X which purely relate to the size of the market.[4] We will in the following paragraphs denote those variables in X which affect margin by Z while those related to size are denoted by S. Z will include store characteristics, local demographic variables and cost shifters to control for variations

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[3]More formally, this can be seen from: $\pi = \frac{\sum_j p_j q_j - \sum_j c_j q_j}{\sum_j p_j q_j} = \frac{\sum_j p_j \frac{q_j}{\bar{q}} - \sum_j c_j \frac{q_j}{\bar{q}}}{\sum_j p_j \frac{q_j}{\bar{q}}} = \frac{\bar{p}_x - \bar{c}_x}{\bar{p}_x}$, where j indicates the product and $\bar{p}_x$ and $\bar{c}_x$ denominate sales share weighted averages.

[4]Tesco submitted that if fixed costs are included in the variable cost measure, volume effects remain as these costs can be shared across a smaller or wider base. Tesco told us that if volume effects remained, then a relationship between margins and local concentration could be explained by volume, rather than local competitive responses. We received extensive information from Tesco on how it planned its staff allocation to a store and which part of labour volume did not respond to changes in sales volume. Based on this information, Tesco said that around 60 per cent of the value of these labour costs was fixed.

in local conditions.[5] We assume that a grocery store's profit margin will be composed of a linear function in the control variables Z and of the function $g(\theta;MS)$ which captures the effect of the local market structure (MS). We thus start from the following baseline specification for the profit margin of store i which also includes an error term to account for unobserved heterogeneity:

$$\pi_i = Z_i\beta + g(\theta;MS_i) + \varepsilon_i$$

14. The main interest of this profit equation lies in the function $g(.)$ and the variables included in MS. If a firm is in the same market as another firm, its profit margin upon entry will be affected by this competitor; otherwise variables describing the presence and/or characteristics of this competitor have no effect.

Endogeneity issue

15. The error term in the margin equation is likely to be correlated with the variables included in $g(.)$. As we discussed above, this is because the firm's entry decision is affected by expected profit in the second stage and this is also true for its competitors, thus competitor variables are 'endogenous'. Assume, for example, that there are unobserved effects which affect profit. In markets where there is a high realization of these shocks, there will be more entry as profits are higher. When the number of competitors is included in $g(.)$, for example, the OLS estimator is biased upward. The number of competitors and the error term are positively correlated, while we expect the true coefficient on the number of competitor variable to be negative. The OLS estimate will therefore understate the true relationship between the number of competitors and store margin.

[5]The latter coefficient estimate for these variables should be interpreted with caution as some reflect both costs and demand conditions and it is thus not obvious which sign they should take.

16. To alleviate the bias, we use an instrumental variable estimator. More specifically, we use Generalized Method of Moments (GMM) estimation to also account for possible heteroscedasticity.[6] The GMM estimator uses 'auxiliary' variables instead of the endogenous variables, so-called instruments. In a simple setting without heteroscedasticity it can be thought of as a two-stage estimation process: in the first step, the endogenous variables are regressed on the instruments; in the second step, estimates for the endogenous variables instead of the variables themselves are used together with the other exogenous control variables (eg store and area characteristics) in regressing the centre stores margin.

17. The IV methodology requires finding instrumental variables that are correlated with the number of competitors but are not directly related to variable profit margin. In particular, these instruments should not be correlated with the error term in the margin equation. As our setting makes clear, variables that affect the size of the market (S) are good candidates. In principle, they will be correlated with the number of stores. The population living within various distances of the competitors' stores is an obvious candidate. It will influence the competitors' entry decision but will be likely to be uncorrelated with the unobservable factors that affect store i's margin.

18. In Figure 1 we describe how we count the number of competitors for store i and determine the instrumental variables that we use to instrument for this variable. For each store for which we observe the profit margin, we draw an isochrone around that store. The isochrone represents the boundaries of a local area and in the centre of that isochrone is the centre store. The isochrone is computed using software that calculates how much time it would take to drive from the store to the borders of the local area. Unlike Figure 1, an isochrone is unlikely to be a perfect circle. It will take

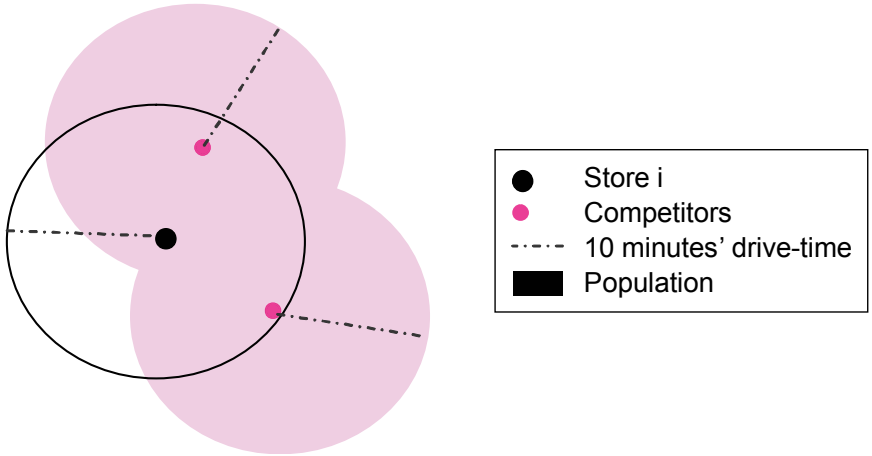
[6] Heteroscedasticity describes a situation when the variance of the regression error term differs across observations. In the presence of heteroscedasticity, the regression estimates are unbiased but the standard errors of the estimates are biased.

into account the major road arteries. We then count the number of rival stores that lie within that isochrone. Because these stores are sufficiently close to the centre store, they arguably compete for the same customers.

19. As instruments, we use the total population and the population density in an isochrone of 10 minutes around the competitors' stores. Figure 1 describes how population size around the competing stores has been computed. We do not double count the population living in the area where the two competitor isochrones overlap but count the total population circumscribed by the two isochrones.

FIGURE 1

Population count and instrumental variables



Source: CC.

20. For each regression, we will apply test statistics to help evaluate the validity of these instruments. In particular, we systematically test the results for under- and over-identification. Under-identification is tested by the Anderson (1984) canonical correlations test (id-statistic). The null hypothesis of this test is that the model is under-identified, meaning that the instruments are not correlated with the endogenous variables. A Sargan-Hansen test (j-statistic) is used to test for over-identification. The joint null hypothesis of this test is that the instruments are valid

instruments, ie uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation.[7]

21. IV regressions can only distinguish effects that the instruments can also help identify. For example, if we want to isolate the impact of small stores from that of large stores, the instruments would have to be different for small and for large stores. While it might be the case that small stores tend to locate in more densely populated areas, it is unlikely that the size of the population or the population density systematically differs for an Asda or a Tesco store. Precisely, this implies that it might be very difficult to identify the impact of large stores and that of small stores separately. The same reservation applies to identifying the effect of different fascia.

Description of data

22. This analysis uses store margin data from the four major chains of grocery stores: Asda, Morrisons, Sainsbury's, Tesco (AMST). In past inquiries, the CC has determined that stores of these four retailers compete against one another. As we have only very limited data on convenience stores, we will concentrate on grocery stores with net sales area greater than 280 sq metres. We also exclude stores whose size is greater than 6,000 sq metres. The main reason is that we have access only to overall store margins, including both grocery and non-grocery products. Because very large stores sell many non-grocery items, it seems reasonable to exclude these to focus on grocery profit margins.

[7]This test can only be carried out if we have a surfeit of instruments, that is, more instruments than endogenous variables. All other variables are necessary for identification and can thus not be tested. Under the GMM procedure, the test statistic corresponds to the value of the objective function evaluated at the efficient GMM estimator. When this statistic is too big the instruments do not satisfy the moment conditions and thus the model is not suitable. This can either be because the instruments are not truly exogenous or because they are incorrectly excluded from the main equation. Under conditional homoscedasticity this statistic is equivalent to the Sargan statistic. The Sargan statistic corresponds to the uncentred R_u^2 of regressing the residuals from the IV regression on the instruments times the number of observations (nR_u^2).

23. In previous inquiries, the CC used a cut-off point at 1,400 sq metres to delineate the relevant market for one-stop shop stores. Under this definition, all stores with net sales area greater than 1,400 sq metres are part of the same product market. Asda and Morrisons only have stores greater than 1,400 sq metres and most of their stores have a net sales area larger than 2,000 sq metres. In contrast, Tesco and Sainsbury's store sizes are spread over a greater range. The size distribution is a continuum for these two grocery retailers with no clear cut-off between 280 and 2,000 sq metres. We display the store size distribution for all the retailers in Appendix 3.1.

24. The dataset is a cross-section containing margin data for the period May 2005 to April 2006. We use yearly averages for the variable profit margin. In Parts C and D of Supplement 1, we describe how the profit margins have been calculated from accounting data. Even though we compute margin the same way for all fascias, due to differences in accounting and reporting, the margins are not exactly equivalent across fascia. We include fascia-specific dummies to account for these possible differences.

25. We also collected store characteristics for the month of February 2006. We assume that these characteristics do not change over the sample period. For our regression analysis we only use a few of these variables which explain variations in store margins, namely store size (net sales area) and dummies for a petrol forecourt, toilets or an ATM in the store.[8] Unlike our previous model specifications, we no longer include staff per net sales area because this variable is a strategic variable that can be altered in the short run. This variable is arguably endogenous. Instead we differentiate the fascia dummies further to account for the format, ie we include

[8]The estimated coefficients for these variables will incorporate the effect of other omitted store characteristics in case the two variables are correlated. For example, toilets are highly correlated with the presences of a restaurant or coffee shop in the store.

dummies for Asda, Morrisons, Sainsbury's, Sainsbury's Local, Tesco Extra, Tesco Metro and Tesco Superstore, and include local cost shifters (see below) which pick up a lot of this variation.[9]

26. There is little information on local cost conditions available from public sources. For example, wages for the retail and repair sector are available only at a regional level. Instead of using these variables, we allocate an area specification to each grocery store based on census information for a wide range of socio-economic indicators (such as age, share of ethnic groups, population density, household composition, rent, house type, educational level and profession, unemployment rate). This area specification is taken from the National Statistics Area Specification statistic and is carried out at the local authority level. The categories are 'Cities and Services', 'London Suburbs', 'London Centre', 'London Cosmopolitan', 'Prospering UK', 'Coastal and Countryside', 'Mining and Manufacturing', and 'Northern Ireland Countryside'.[10] Besides local cost variation, these dummies will pick up variation in local demand conditions. To account for variation in demand, we also include the mean income of the people living in a 10-minute isochrone around the centre store.

27. We use different variables to proxy for the market structure. For each store, we delineate a local area around that store using drive-time in minutes. As described before, this local area is known as an isochrone. If not otherwise mentioned, we count all rival stores above 280 sq metres in a 10-minute isochrone. Further information that we have on these stores is their net sales area and the fascia they belong to. For the number of competing fascias we count Aldi, Asda, Co-op, Iceland, Lidl, Morrisons, M&S, Netto, Sainsbury's, Somerfield, Spar, Tesco and Waitrose

[9]When using all the variables mentioned in the following paragraph together with the format dummies, we are able to explain 53 per cent of the variation in staff per net sales area. An alternative would be to keep staff per net sales area in and instrument for it. Table 6 in Supplement 1 shows that the competitive effects are even more pronounced in such a specification.
[10]In fact, each local authority level is classified in these eight categories. More information can be found under www.statistics.gov.uk/about/methodology_by_theme/area_classification/about.asp#geographic.

separately while we aggregate all the others into a competing fascia called 'Other'. As we use yearly averages, these variables will be non-integer if there was entry during the year.

28. For a more complete description of the data set, see Supplements 1, Parts C and D. The supplement also provides summary statistics in Part B.

Econometric results

29. In this section we present the results of various regressions that relate grocery store margin and different measures of local concentration. We begin with a general analysis of the form of competitors' impact on the centre store's margin using a 10-minute isochrone. We then proceed with a more in-depth analysis of the geographic dimension of competition and the location of rival stores. In the last sub-section we discuss how store heterogeneity may impact grocery store margins.

Competitors' impact on centre store's margin

30. Table 1 presents a set of results using different market structure variables. Regardless of which concentration measure we include in the empirical model, the results show that high concentration causes high store profit margins.

31. The first column of Table 1 reproduces the results when local concentration is described by a linear function in the number of rival fascias (stores above 280 sq metres) within a 10-minute isochrone around the centre store. The number of competing fascia within a 10-minute isochrone affects a store's variable profit margin negatively. Each additional fascia reduces profit margin by 0.96 per cent. The next column presents the results using the number of competing stores instead. In this case, an additional rival store reduces profit margin by 0.34 per cent. As there are, on average, 1.4 stores per competing fascia, the fascia effect is stronger, meaning that

two competitors from different fascias have a greater negative effect on margins than two random competitors.

TABLE 1 **Variable profit of AMTS stores above 280 sq metres: impact of number of fascia, number of stores, sales area of stores and share in sales area—10-minute drive-time**

	(1)	*(2)*	*(3)*	*(4)*
	Ln(yrl. margin)	*Ln(yrl. margin)*	*Ln(yrl. margin)*	*Ln(yrl. margin)*
Control variables	Yes	Yes	Yes	Yes
Number of competing fascias over 280 sq metres within 10 mins	–0.0096***			
Number of competitor stores within 10 mins		–0.0034***		
Combined net sales area ('000) of competitors within 10 mins			–0.0026***	
Share of competitors' net sales area in total net sales area within 10 mins				–0.1545***
				(–2.99)

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t-statistics in parentheses.
Instruments: Population and population density in a 10-minute isochrone around all competitors above 280 sq metres within 10 minutes.

32. In comparison, the last two columns of Table 1 reproduce our results when concentration is measured with the net sales area of local competing stores and the share of the competitors' sales area in total sales area. Each additional 1,000 sq metres of competitor sales area reduces store margins by 0.26 per cent. In the sample, the average store of a competitor has a net sales area of 1,290 sq metres and its margin effect should be 0.34 per cent, which is the same as the coefficient estimate for the number of stores.

33. Turning to the share that competitors have of total net sales area in the isochrone, the coefficient estimate is negative and statistically significant. This result implies that increasing the share of the competitors from the average 62 to 72 per cent reduces the centre stores margin by 1.55 per cent. One way to illustrate these results is to use the following example. Entry of a competitor store of 1,000 sq metres where the local incumbent monopoly store is also 1,000 sq metres reduces the monopolist store margin by 7.7 per cent. Adding a second rival store of the same size—that is,

1,000 sq metres—further reduces the margin of the centre store by only 2.6 per cent. As this example suggests, the effect of the first entrant and the second entrant will be different.

34. In Supplement 1, Part A, we provide the full regression results from which the results reproduced in Table 1 are drawn. From the t-statistics we see that the predictive power of the different competitor variables is about the same. Further, the validity of the instruments cannot be rejected. The instrumental variables explain the number of stores (id-statistic of 1,321) and also the number of fascias (id-statistic of 573). The results of the j-statistic show that the model is slightly better specified when using the number of competing fascias or net sales area compared with the number of competitors or the area share.

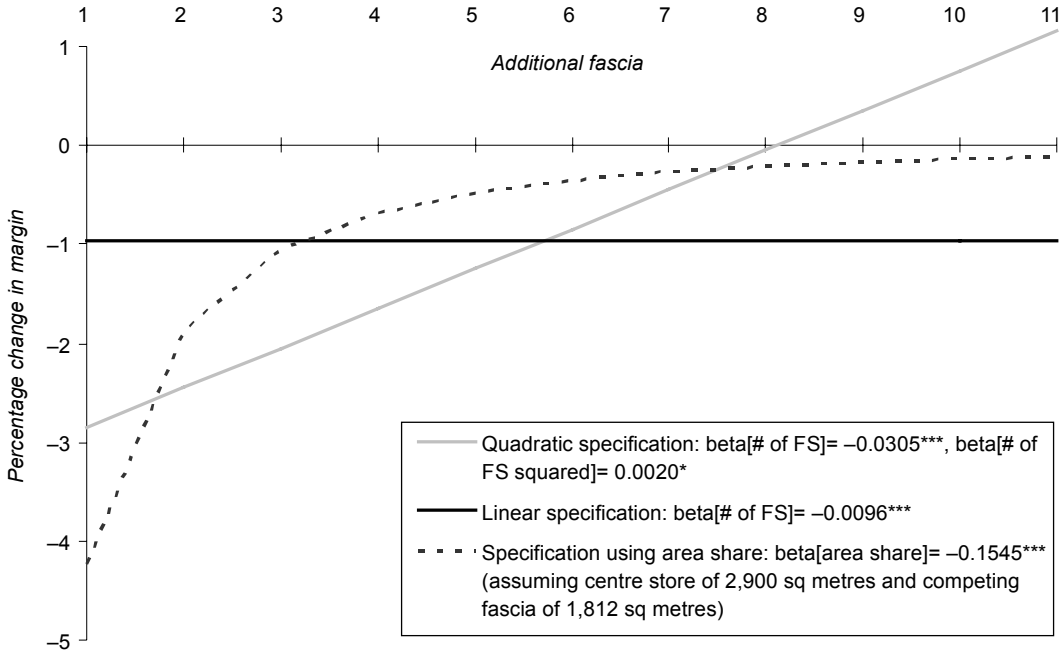
35. Work in the academic literature has shown that the effect of the first new entrant—that is, the move from monopoly to duopoly—has a much stronger effect than that of any further entrant (eg Bresnahan and Reiss (JPE 1991)). As we discussed above, the specification including the share of net sales area can be interpreted to show that the first entrant has a stronger effect on the incumbent store margin than any following one. Using a more flexible functional form in the number of competing fascia (FS), namely both a linear and a quadratic term, we assess how the effect varies with the number of fascia.[11] Figure 6 shows the results using these various specifications. The competitive effect of an additional fascia differs considerably, according to how many fascias are already present in the market. For example, relying on the quadratic specification a change from monopoly to duopoly reduces margin by 2.85 per cent (grey line) which is three times greater than the prediction of the linear specification (black line). When we move from two to three competitors, the

[11]More formally, we use a 2nd order polynomial in the number of competing fascias, that is the number of competing fascias and the square of the number of competing fascias.

effect on store profit margin is slightly more than 2 per cent. The effect declines as the number of competing fascias increases. This result indicates that monopoly stores have greater profit margin than those that face at least one competitor, everything else being constant.

FIGURE 6

Effect of an additional fascia on centre store's margin



Note: The black horizontal line (linear specification) displays the results of a model that assumes that each additional fascia reduces the incumbent store profit margin by 0.96 per cent. This impact is the same irrespective of the number of competing fascias the centre store faces. We also estimated a model that allows the impact of additional fascias to vary depending on the number of fascias already present. The results are summarized by the grey, positively sloped line (quadratic specification). The grey line shows that a change from monopoly to duopoly reduces margin by 2.85 per cent, which is three times as much as the black line predicts. The effect declines as the number of competing fascias increases. The dotted line is the result of another model that measures how the competitors' share of net sales area in a 10-minute isochrone affects store profit margin. This result also indicates that monopoly stores have greater profit margin than those that face at least one competitor, everything else being constant.
Source: CC analysis.

36. The results shown in Figure 6 support the notion that the effect of additional competing fascias on profit margin is likely to be non-linear. Our quadratic specification is only an approximation of this effect. Previous results where we used a dummy for the presence of a competitor and obtained very strong effects,[12] as well as the size of the coefficient estimate of the share of net sales area, seem to suggest

[12]Our new instruments do not work well when we include a dummy for the presence of a competing fascia (high j-statistics).

that the difference in effect might be even stronger. In paragraph 33 we discussed, using an example, that under the area share measure the effect of the first and second entrant will be different. The dotted line in Figure 6 shows this effect over the whole range of possible fascias in the market. We see that the effect is highly non-linear.[13] Tracing out any further non-linearities using more flexible functional forms than the area share (eg using higher order terms in the number of competing fascias[14] or dummy variables which indicate a monopoly, a duopoly or more competitors), though, fails as the instruments have not enough (identifying) power to differentiate between these variables.

37. In summary, the results presented in this section suggest that the number of local rivals has a statistically significant negative effect on the centre store's variable profit margin. Even though prices are set nationally, this constitutes evidence that, after controlling for local cost and demand conditions, stores compete locally. There is further evidence that the effect of a new fascia depends on how many fascias there are already in the market and is strongest when moving from monopoly to duopoly. The effect of the first new entrant on margin is estimated to be at least 2.85 per cent.

Geographic dimension of retail competition

38. To further assess the importance of the geographic dimension of competition, we alter the market structure variable to study the effect of close nearby stores.[15] For this purpose, we construct variables that describe the characteristics of the nearest competing stores,[16] namely the size of the three nearest competitors and the drive-

[13]We assumed the centre store to be 2,900 sq metres, the average size of centre stores in our sample, and the competing fascia to be of 1,812 sq metres, the average fascia size in our sample.
[14]When we include FS^3 or FS^4, all coefficients are not statistically significant any more. Furthermore, the sign and size of the coefficients depends on the choice of instruments. (Above we use the population around the competitor stores (PP), PP^2, PP^3, PP^4 and PP^5. Using less terms or the density as well slightly worsens the results but does not materially change them. When introducing higher order terms for the competitor variables, this is not true any more.)
[15]See Part C of Supplement 1 for more detail on how we construct this variable.
[16]Pinske, J, Slade, M and C Brett (2002) 'Spatial Price Competition: A Semiparametric Approach', *Econometrica*, 70 (3) report that nearest neighbour variables are best in explaining competitive effects in the US wholesale gasoline market.

time to these stores from the centre store. As instruments, we now use the number of people living around these stores and the population density around these stores.

39. Table 2 presents the results of this model specification. We see that the larger the three closest competitors, the greater the impact on the centre store's margin. When the combined size of the three nearest stores is changed from equal to double the size of the centre store, the profit margin of that centre store declines by 6.78 per cent.

TABLE 2 **Variable profit of AMTS stores above 280 sq metres—nearest neighbours**

	(1) Ln(yrl. margin)	*(2) Ln(yrl. margin)*
Control variables	Yes	Yes
Size of the 3 nearest competitors over 280 sq metres relative to own size (ex own fascia)	–0.0678***	
Drive-time to the 3 nearest competitors over 280 sq metres (ex own fascia)	0.0108***	0.0072***
	(2.90)	(3.52)

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.
Instruments: (1) Population and population density around the nearest and the second nearest neighbour and around the nearest, the second nearest and the third nearest neighbour, respectively. (2) Population density around the third nearest neighbour and dummy for urban or rural area.

40. The third nearest neighbour is on average 7 minutes away from the centre store. We opt for the third-nearest neighbour as it comprises the effect of the first-, second- and third-nearest neighbours as well, which by definition must be even closer. The distance of these stores to the centre store affects the margin of the store in the centre positively, that is, the farther away the competitor, the smaller the impact it has. When the third closest store is located 1 minute closer to the centre store, the centre store's margin is reduced by 1.08 per cent.

41. From the first stage regression we see that the explanatory power of the instruments is low, especially for the relative size variable. We therefore potentially face an identification problem due to weak instruments. We ran the regression again, this

time only using the drive-time to the third-nearest neighbour. As instruments, we use the population density in a 10-minute isochrone around this store and a dummy for an urban or rural area. We assume that in urban areas competitors will, on average, locate closer together. The result of this specification is provided in column (2) and shows that the drive-time still has a significant positive effect on the centre store's profit, but at 0.7 per cent margin reduction per minute the effect is smaller than before. (In Supplement 1, Part A, for comparison, we also reproduce the specification of column (1) using the addition instrument urban/rural.)

42. We conclude from these specifications that competitive pressure is higher, the closer a competitor's store. This result is consistent with the notion that markets are local.

Competitor heterogeneity and competitive effect

43. Thus far, except for geographic location, the empirical model essentially assumes that all stores are equivalent in their impact on the centre store. In this section we introduce an element of heterogeneity by acknowledging different fascias and different sizes. Because the instruments are unlikely to trace out subtle effects, we use this analysis to assess the impact of some specific groups of competitors on the centre store's margin.

44. Table 3 presents the regression results when we set apart the combined effect of AMST from that of other fascias. The results in the first column show that the AMST rivals have a very strong negative effect on the centre store's margin, whereas the other competitors have no statistically significant effect at all. A new AMST competing fascia reduces the centre store margins by 3.4 per cent. The second column presents a non-linear specification. In this case, the effect of the first new entrant is estimated to be 4.6 per cent. This effect is, however, not statistically

significant. We note that we cannot determine whether the effect is truly not statistically significant or if it is due to the high correlation of the instruments.

TABLE 3 **Variable profit of AMTS stores above 280 sq metres: impact of AMST competing fascia—10 minutes' drive-time**

	(1) *Ln(yrl. margin)*	*(2)* *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(4)* *Ln(yrl. margin)*
Control variables	Yes		Yes	Yes
Number of AMST competing fascia within 10 mins (4FS)	–0.0342***	–0.0373*	–0.0322***	–0.0481**
	(–3.37)	(–1.94)	(–4.49)	(–2.53)
Number of other (not AMST) competing fascia within 10 mins (No4FS)	0.0009	–0.0089		
	(0.15)	(–0.64)		
$4FS^2$		–0.0005		0.0058
		(–0.05)		(0.69)
$NO4FS^2$		0.0016		
		(0.81)		

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.
Instruments: Population and population density in a 10-minute isochrone around the AMST competitors and around the other than AMST competitor group within 10 minutes.

45. As discussed before, our instrumental variable may not let us isolate subtle effects. When there is more than one endogenous variable in the regression, our standard test statistic for under-identification (id-statistic) will have difficulties identifying such a problem. The high correlation (0.79/0.82) between the instruments that are supposed to identify the effect of AMST competitors (population/density around these stores) and those that are meant to identify the effect of the others (population/density around these stores) points to a potential problem of weak identification.

46. The bias introduced by weak identification goes in the same direction as the OLS bias.[17] As a result, the coefficient estimates will understate the true negative effect (coefficients will be biased upward). This could explain the positive coefficient of the non-AMST group of fascias variable. While we can conclude from the estimates above that the effect of the AMST group is bigger than that of all competitors, we would not be able to conclude that the effect of the AMST group plus Waitrose is

[17]See, for example, Staiger, D and J Stock (1997) 'Instrumental Variables Regression with Weak Instruments', *Econometrica*, 65 (3).

stronger or weaker even if the coefficient estimate would be smaller (which is the case). This is because the weak identification problem remains. For completeness, we present the estimation results for other fascia groups in Supplement 1, Part A.

47. If the group of non-AMST competitors has no significant effect on the AMST centre stores, this variable can be omitted. Such a specification (linear and quadratic) is reproduced in columns (3) and (4). However, by wrongly excluding this variable, we introduce an omitted variables bias.[18] We note that the estimated competitive effects are hardly different from the first two specifications. This means that either we do not face any bias in both specifications or the biases go in the same direction.

48. Apart from fascia, stores also differ in their sizes, measured by the net sales area. Different store sizes tend to provide a different 'retail offer'. Large stores may include a butcher or delicatessen counter, they may home a crèche or a pharmacy in their premises, and other type of retail services. In addition, bigger stores tend to carry a broader range of products, offering more choice and allowing one-stop shoppers to do their weekly shopping. Alternatively, smaller stores are easier to access and might be conceived as more convenient for smaller or top-up purchases. Usually the time spent shopping in a smaller store is shorter, and it is easier to find the product one is looking for. We discuss evidence that show variation of the retail offer with store size in Section 4 of the main report.

[18]To illustrate the effect of this omitted variables bias, assume a regression with only two regressors, the number of AMST competing fascias and all other fascias. In case the other fascias are omitted from the regression, its effect is picked up by the included variable and the expected coefficient estimate is given by:

$$E\left[\beta_{Big4}\right] = \beta_{Big4} + \beta_{Other\ than\ Big4}\rho\frac{\sqrt{\sum(\#\ fascia\ other\ than\ Big4)^2}}{\sqrt{\sum(\#\ Big4\ fascia)^2}}$$

which, given a positive correlation (eg for the group of AMST compared with the 'No AMST' the correlation coefficient is 0.53), overstates the true negative effect in case $\beta_{Other\ than\ Big4} < 0$. In case there are more regressors which are also correlated with the omitted variable the direction of the bias is not easily determined any more.

49. To assess the importance of competitors' store size on own store margins, we specify the market structure as a linear function of stores above a certain size. We now only use the margins of centre stores of the corresponding size class. The first two columns of Table 4 report the results for stores above 1,400 sq metres, while the last two columns report the results for stores greater than 2,000 sq metres. The weak instrument problem discussed above with the fascia effects is also present. For each store size the difference in the coefficient estimate between a specification where the other group of stores is included (columns (1) and (3)) and that where this variable is omitted (columns (2) and (4)) is slightly bigger, suggesting an upward bias in the coefficient estimate in columns (2) and (4). However, the weak instruments bias goes in the same direction as the OLS bias. We can thus conclude that a store above 1,400 sq metres reduces the margin of other AMST stores above 1,400 sq metres by at least 3.37 per cent and thus has a bigger effect than the group of all fascias. Column (3) shows that the effect is even stronger when only including stores above 2,000 sq metres.

TABLE 4 **Variable profit of AMTS stores above 1,400/2,000 sq metres: competitor effects for group of competitor stores above 1,400/2,000 sq metres—10 minutes' drive-time**

	(1) *Ln(yrl. margin)*	*(2)* *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(4)* *Ln(yrl. margin)*
Control variables	Yes	Yes	Yes	Yes
Number of competing fascias over 1,400 sq metres within 10 mins	–0.0337** (–2.48)	–0.0268*** (–3.14)		
Number of competing fascias between 280 and 1,400 sq metres within 10 mins	0.0044 (0.48)			
Number of competing fascias over 2,000 sq metres within 10 mins			–0.0419** (–2.54)	–0.0404*** (–3.16)
Number of competing fascias between 280 and 2,000 sq metres within 10 mins			0.0011 (0.13)	

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.
Instruments: Population and population density in a 10-minute isochrone around competitor stores above 1,400 and below 1,400 sq metres, and above 2,000 and below 2,000 sq metres, respectively within 10 minutes.

50. This analysis shows that the retail offer is not homogenous. Different fascias exert different competitive pressure. An AMST competing fascia reduces the centre store's margin by at least 3.4 per cent; a competing fascia of above 2,000 sq metres reduces the centre store's margin by at least 4.2 per cent.

Regression output and data

PART A. Econometric results

TABLE 1 **Variable profit of AMTS stores above 280 sq metres: impact of number of fascias, number of stores, sales area of stores, share in sales area and non-linear effects—10-minute drive-time**

	(1) *Ln(yrl. margin)*	*(2)* *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(4)* *Ln(yrl. margin)*	*(5)* *Ln(yrl. margin)*
Constant (includes effect of Asda and of Cities and Services)	–2.3506***	–2.3860***	–2.3886***	–2.2863***	–2.3156***
	(–47.02)	(–52.07)	(–53.10)	(–35.39)	(–50.01)
Tesco Extra	0.3165***	0.3153***	0.3154***	0.3110***	0.3154***
	(23.81)	(23.82)	(24.11)	(22.99)	(23.20)
Tesco Metro	0.2298***	0.2261***	0.2286***	0.2313***	0.2389***
	(8.76)	(8.60)	(8.75)	(8.71)	(9.11)
Morrisons	0.2905***	0.2854***	0.2860***	0.2882***	0.2908***
	(21.54)	(21.64)	(21.91)	(21.46)	(21.51)
Sainsbury's	0.1349***	0.1317***	0.1324***	0.1364***	0.1371***
	(8.68)	(8.61)	(8.75)	(8.68)	(8.74)
Sainsbury's Local	0.4289***	0.4286***	0.4207***	0.4392***	0.4387***
	(9.61)	(9.19)	(9.42)	(9.22)	(9.78)
Tesco Superstore	0.3346***	0.3339***	0.3343***	0.3312***	0.3359***
	(22.63)	(22.56)	(22.77)	(22.22)	(22.59)
London suburbs	–0.0781***	–0.0826***	–0.0839***	–0.0775***	–0.0784***
	(–3.77)	(–4.02)	(–4.11)	(–3.78)	(–3.77)
London centre	0.0189	0.0156	0.0129	0.0164	0.0273*
	(1.33)	(1.08)	(0.89)	(1.13)	(1.82)
London cosmopolitan	–0.1426***	–0.1437***	–0.1476***	–0.1379***	–0.1354***
	(–3.38)	(–3.41)	(–3.63)	(–3.35)	(–3.20)
Prospering UK	–0.0025	–0.0053	–0.0033	–0.0004	–0.0030
	(–0.21)	(–0.43)	(–0.28)	(–0.03)	(–0.25)
Coastal and countryside	0.0495***	0.0515***	0.0519***	0.0523***	0.0484***
	(3.55)	(3.72)	(3.82)	(3.70)	(3.48)
Mining and manufacturing	–0.0212*	–0.0226*	–0.0226*	–0.0208	–0.0229*
	(–1.67)	(–1.77)	(–1.79)	(–1.62)	(–1.82)
Northern Ireland countryside	–0.0692	–0.0588	–0.0579	–0.0892	–0.0871
	(–0.91)	(–0.78)	(–0.76)	(–1.10)	(–1.16)
Mean income of people living within 10 mins (£'000)	0.0078***	0.0085***	0.0084***	0.0078***	0.0078***
	(6.97)	(8.03)	(8.10)	(6.97)	(6.90)
Store size ('000 sq m)	0.0230***	0.0205***	0.0212***	0.0174***	0.0257***
	(3.66)	(3.40)	(3.52)	(2.98)	(4.12)
Petrol forecourt	–0.0761***	–0.0755***	–0.0744***	–0.0739***	–0.0761***
	(–7.76)	(–7.67)	(–7.65)	(–7.50)	(–7.70)
Toilets	0.0482**	0.0524***	0.0517***	0.0454**	0.0459**
	(2.43)	(2.62)	(2.62)	(2.27)	(2.34)
ATM	0.0682***	0.0661***	0.0667***	0.0698***	0.0687***
	(4.02)	(3.87)	(3.94)	(4.07)	(4.02)
Number of competing fascias over 280 sq metres within 10 mins	–0.0096***				–0.0305***
	(–3.05)				(–2.75)
Number of competitor stores within 10 mins		–0.0034***			
		(–2.93)			
Combined net sales area ('000) of competitors within 10 mins			–0.0026***		
			(–3.06)		
Share of competitors' net sales area in total net sales area within 10 mins				–0.1545***	
				(–2.99)	
FS^2					0.0020*
					(1.67)
Observations	1,435	1,435	1,435	1,435	1,435
idstat	573.200	1320.807	1029.353	239.254	364.809
idp	0.000	0.000	0.000	0.000	0.000

j	0.705	1.232	0.652	1.261	4.676
jp	0.401	0.267	0.419	0.262	0.197
Instruments	Population and population density in a 10-min isochrone around all competitors above 280 sq m within 10 min	As in (1)	As in (1)	As in (1)	Population (PP), PP^2, PP^3, PP^4 and PP^5 in a 10-min isochrone around all competitors above 280 sq m within 10 min

Source: CC analysis.

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* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.

TABLE 2 **Variable profit of AMTS stores above 280 sq metres—nearest neighbours**

	(1) *Ln(yrl. margin)*	*(1b)* *ln_margin_yrl*	*(2)* *ln_margin_yrl*
Constant (includes effect of Asda and of Cities and Services)	–2.2235*** (–22.75)	–2.2186*** (–23.32)	–2.4439*** (–55.61)
Tesco Extra	0.3245*** (21.77)	0.3250*** (22.07)	0.3114*** (23.90)
Tesco Metro	0.3132*** (7.73)	0.3139*** (7.76)	0.2308*** (8.84)
Morrisons	0.2654*** (15.45)	0.2644*** (16.04)	0.2903*** (21.88)
Sainsbury's	0.1222*** (6.72)	0.1208*** (7.17)	0.1379*** (8.68)
Sainsbury's Local	0.6883*** (5.98)	0.6892*** (5.96)	0.4371*** (9.37)
Tesco Superstore	0.2978*** (15.26)	0.2973*** (15.33)	0.3328*** (22.65)
London suburbs	–0.0825*** (–3.63)	–0.0835*** (–3.75)	–0.0692*** (–3.24)
London centre	0.0078 (0.46)	0.0077 (0.46)	0.0230 (1.61)
London cosmopolitan	–0.1496*** (–3.87)	–0.1511*** (–3.97)	–0.1295*** (–3.12)
Prospering UK	0.0022 (0.17)	0.0023 (0.17)	0.0044 (0.37)
Coastal and countryside	0.0668*** (3.10)	0.0679*** (3.24)	0.0547*** (4.14)
Mining and manufacturing	–0.0142 (–1.02)	–0.0143 (–1.02)	–0.0129 (–1.03)
Northern Ireland countryside	–0.1455* (–1.73)	–0.1413* (–1.75)	–0.0944 (–1.19)
Mean income of people living within 10 mins (£'000)	0.0088*** (5.92)	0.0090*** (6.59)	0.0077*** (6.87)
Store size ('000 sq metres)	–0.0123 (–0.72)	–0.0135 (–0.84)	0.0254*** (3.98)
Petrol forecourt	–0.0708*** (–5.28)	–0.0697*** (–5.66)	–0.0831*** (–8.14)
Toilets	–0.0189 (–0.66)	–0.0178 (–0.63)	0.0369* (1.78)
ATM	0.0624*** (2.66)	0.0615*** (2.66)	0.0681*** (4.04)
Size of 3 nearest competitors over 280 sq metres relative to own size (ex own fascia)	–0.0678*** (–2.70)	–0.0688*** (–2.78)	
Drive-time to 3 nearest competitors over 280 sq metres (ex own fascia)	0.0108*** (2.90)	0.0103*** (4.24)	0.0072*** (3.52)
Observations	1,435	1,435	1,435
idstat	20.821	22.850	183.133
idp	0.001	0.001	0.000
j	1.759	1.799	0.216
jp	0.780	0.876	0.642
Instruments	Population and population density around the nearest, the second nearest and the third nearest neighbour	Population and population density around the nearest, the second nearest and the third nearest neighbour and dummy for urban or rural area	Population density around the third nearest neighbour and dummy for urban or rural area

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.

TABLE 3 **Variable profit of AMTS stores above 280 sq metres: competitor effects for group of AMST competing fascias—10 minutes' drive-time**

	(1) *Ln(yrl. margin)*	*(2)* *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(4)* *Ln(yrl. margin)*
Constant	–2.3709***	–2.3645***	–2.3680***	–2.3716***
	(–47.74)	(–49.48)	(–51.84)	(–53.56)
Tesco Extra	0.3089***	0.3078***	0.3105***	0.3094***
	(22.45)	(22.08)	(23.19)	(23.09)
Tesco Metro	0.2344***	0.2401***	0.2326***	0.2408***
	(9.11)	(9.32)	(9.02)	(9.40)
Morrisons	0.2894***	0.2883***	0.2884***	0.2905***
	(21.63)	(21.17)	(22.12)	(22.40)
Sainsbury's	0.1348***	0.1340***	0.1324***	0.1356***
	(8.97)	(8.50)	(8.86)	(9.06)
Sainsbury's Local	0.4227***	0.4249***	0.4201***	0.4273***
	(10.05)	(9.92)	(10.09)	(10.33)
Tesco Superstore	0.3330***	0.3334***	0.3313***	0.3340***
	(22.90)	(22.57)	(22.84)	(23.17)
London suburbs	–0.0776***	–0.0799***	–0.0788***	–0.0785***
	(–3.86)	(–3.95)	(–3.90)	(–3.88)
London centre	0.0157	0.0206	0.0157	0.0202
	(1.10)	(1.39)	(1.12)	(1.39)
London cosmopolitan	–0.1348***	–0.1449***	–0.1467***	–0.1427***
	(–3.56)	(–3.54)	(–3.66)	(–3.53)
Prospering UK	0.0016	0.0025	0.0003	0.0004
	(0.14)	(0.21)	(0.03)	(0.03)
Coastal and countryside	0.0519***	0.0524***	0.0508***	0.0512***
	(3.75)	(3.82)	(3.86)	(3.91)
Mining and manufacturing	–0.0205	–0.0213*	–0.0214*	–0.0218*
	(–1.63)	(–1.71)	(–1.71)	(–1.77)
Northern Ireland countryside	–0.0634	–0.0682	–0.0650	–0.0644
	(–0.81)	(–0.88)	(–0.84)	(–0.83)
Mean income of people living within 10 mins (£'000)	0.0080***	0.0081***	0.0081***	0.0081***
	(7.36)	(7.23)	(7.80)	(7.77)
Store size ('000 sq metres)	0.0256***	0.0265***	0.0241***	0.0262***
	(4.45)	(4.37)	(4.08)	(4.50)
Petrol forecourt	–0.0759***	–0.0757***	–0.0754***	–0.0754***
	(–7.89)	(–7.73)	(–7.87)	(–7.78)
Toilets	0.0469**	0.0485**	0.0487**	0.0488**
	(2.46)	(2.57)	(2.53)	(2.55)
ATM	0.0651***	0.0651***	0.0652***	0.0666***
	(3.86)	(3.89)	(3.88)	(3.98)
Number of AMST competing fascia within 10 mins (4FS)	–0.0342***	–0.0373*	–0.0322***	–0.0481**
	(–3.37)	(–1.94)	(–4.49)	(–2.53)
Number of other (not AMST) competing fascia within 10 mins (NO4FS)	0.0009	–0.0089		
	(0.15)	(–0.64)		
$4FS^2$		–0.0005		0.0058
		(–0.05)		(0.69)
$NO4FS^2$		0.0016		
		(0.81)		
Observations	1,435	1,435	1,435	1,435
idstat	358.646	201.775	847.214	376.901
idp	0.000	0.000	0.000	0.000
j	0.983	6.973	0.004	5.148
jp	0.612	0.323	0.948	0.161
Instruments	Population and population density in a 10-minute isochrone around the AMST competitors and around the other than AMST competitor group within 10 minutes	Population (PP), PP^2, PP^3, PP^4 and PP^5 in a 10-minute isochrone around the AMST competitors and around the other than AMST competitor group within 10 minutes	Population and population density in a 10-minute isochrone around the AMST competitors within 10 minutes	Population (PP), PP^2, PP^3, PP^4 and PP^5 in a 10-minute isochrone around the AMST competitors within 10 minutes

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.

TABLE 4 **Variable profit of AMTS stores above 280 sq metres: competitor effects for other groups of competitors—10 minutes' drive-time**

	(2) *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(4)* *Ln(yrl. margin)*
Constant (includes effect of Asda and of Cities and Services)	–2.4044***	–2.3955***	–2.4276***
	(–42.86)	(–41.20)	(–43.67)
Tesco Extra	0.3118***	0.3138***	0.3150***
	(22.86)	(23.04)	(24.21)
Tesco Metro	0.2334***	0.2361***	0.2206***
	(9.04)	(9.13)	(8.40)
Morrisons	0.2893***	0.2932***	0.2815***
	(21.51)	(22.21)	(21.57)
Sainsbury's	0.1362***	0.1400***	0.1227***
	(9.08)	(9.40)	(7.97)
Sainsbury's Local	0.4274***	0.4380***	0.4032***
	(9.96)	(10.31)	(8.91)
Tesco Superstore	0.3336***	0.3360***	0.3306***
	(22.87)	(23.16)	(22.75)
London suburbs	–0.0779***	–0.0789***	–0.0831***
	(–3.85)	(–3.85)	(–3.94)
London centre	0.0187	0.0203	0.0239
	(1.32)	(1.43)	(1.63)
London cosmopolitan	–0.1374***	–0.1312***	–0.1657***
	(–3.62)	(–3.36)	(–4.15)
Prospering UK	0.0019	0.0007	0.0041
	(0.16)	(0.06)	(0.33)
Coastal and countryside	0.0544***	0.0544***	0.0676***
	(3.88)	(3.78)	(4.56)
Mining and manufacturing	–0.0204	–0.0205	–0.0161
	(–1.61)	(–1.63)	(–1.24)
Northern Ireland countryside	–0.0620	–0.0640	–0.0359
	(–0.80)	(–0.83)	(–0.46)
Mean income of people living within 10 mins (£'000)	0.0091***	0.0089***	0.0094***
	(6.90)	(6.25)	(6.75)
Store size ('000 sq metres)	0.0243***	0.0255***	0.0163***
	(4.20)	(4.40)	(2.73)
Petrol forecourt	–0.0759***	–0.0775***	–0.0722***
	(–7.84)	(–8.00)	(–7.46)
Toilets	0.0465**	0.0451**	0.0550***
	(2.41)	(2.32)	(2.76)
ATM	0.0670***	0.0668***	0.0649***
	(3.99)	(3.93)	(3.84)
Number of AMST and Waitrose competing fascia within 10 mins	0.0003		
	(0.05)		
Number of other (not AMST and Waitrose) competing fascia within 10 mins	–0.0281***		
	(–3.02)		
Number of AMST, Waitrose and M&S competing fascia within 10 mins		–0.0018	
		(–0.26)	
Number of other (not AMST, Waitrose and M&S) competing fascia within 10 mins		–0.0201***	
		(–2.88)	
Number of AMST, Waitrose, M&S, Somerfield and Co-op competing fascia within 10 mins			0.0013
			(0.14)
Number of other (not AMST, Waitrose, M&S, Somerfield and Co-op) competing fascia within 10 mins			–0.0028
			(–0.43)
Observations	1,435	1,435	1,435
idstat	348.705	387.571	210.325
idp	0.000	0.000	0.000
j	1.368	2.242	2.603
jp	0.505	0.326	0.272
Instruments	Population and population density in a 10 minutes isochrone around the relevant focus fascia group and around the complementary group within 10 minutes		

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.

TABLE 5 **Variable profit of AMTS stores above 1,400/2,000 sq metres: competitor effects for group of competitor stores above 1,400/2,000 sq metres—10 minutes' drive-time**

	(3) *Ln(yrl. margin)*	*(2)* *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(1)* *Ln(yrl. margin)*
Constant (includes effect of Asda and of Cities and Services)	–2.3661***	–2.3505***	–2.3459***	–2.3419***
	(–38.57)	(–44.81)	(–36.88)	(–36.56)
Tesco Extra	0.3162***	0.3173***	0.3181***	0.3185***
	(22.74)	(23.14)	(21.37)	(21.10)
Tesco Metro	0.1768***	0.1716***	0.0819	0.0794
	(4.57)	(4.43)	(1.16)	(1.15)
Morrisons	0.2898***	0.2893***	0.2949***	0.2946***
	(23.32)	(23.15)	(22.72)	(22.59)
Sainsbury's	0.1270***	0.1261***	0.1185***	0.1178***
	(8.94)	(8.65)	(7.92)	(7.93)
Tesco Superstore	0.3396***	0.3385***	0.3401***	0.3397***
	(25.20)	(24.68)	(24.10)	(24.31)
London suburbs	–0.0709***	–0.0698***	–0.0638***	–0.0631***
	(–3.25)	(–3.32)	(–2.66)	(–2.67)
London centre	0.0106	0.0118	0.0052	0.0063
	(0.65)	(0.72)	(0.30)	(0.37)
London cosmopolitan	–0.1581***	–0.1610***	–0.1499***	–0.1528***
	(–3.15)	(–3.13)	(–2.69)	(–2.67)
Prospering UK	0.0169	0.0154	0.0196	0.0190
	(1.36)	(1.25)	(1.50)	(1.48)
Coastal and countryside	0.0607***	0.0581***	0.0542***	0.0534***
	(3.87)	(3.99)	(3.44)	(3.48)
Mining and manufacturing	–0.0069	–0.0068	–0.0013	–0.0015
	(–0.52)	(–0.52)	(–0.09)	(–0.11)
Northern Ireland countryside	–0.0752	–0.0781	–0.0997	–0.1025
	(–0.89)	(–0.93)	(–1.05)	(–1.08)
Mean income of people living within 10 mins (£'000)	0.0080***	0.0077***	0.0073***	0.0073***
	(5.43)	(6.12)	(5.14)	(4.98)
Store size ('000 sq metres)	0.0229***	0.0224***	0.0235***	0.0232***
	(3.84)	(3.66)	(3.31)	(3.20)
Petrol forecourt	–0.0758***	–0.0761***	–0.0799***	–0.0802***
	(–7.30)	(–7.38)	(–7.03)	(–7.20)
Toilets	0.0707***	0.0707***	0.0903**	0.0899**
	(2.65)	(2.63)	(2.47)	(2.44)
ATM	0.0211	0.0243	0.0137	0.0149
	(0.88)	(1.05)	(0.47)	(0.52)
Number of competing fascias over 1,400 sq metres within 10 mins	–0.0337**	–0.0268***		
	(–2.48)	(–3.14)		
Number of competing fascias between 280 and 1,400 sq metres within 10 mins	0.0044			
	(0.48)			
Number of competing fascias over 2,000 sq metres within 10 mins			–0.0419**	–0.0404***
			(–2.54)	(–3.16)
Number of competing fascias between 280 and 2,000 sq metres within 10 mins			0.0011	
			(0.13)	
Observations	1,183	1,183	1,042	1,042
idstat	142.636	360.256	161.246	220.454
idp	0.000	0.000	0.000	0.000
j	0.363	0.000	0.065	0.064
jp	0.834	0.988	0.968	0.800
Instruments	Population and population density in a 10 minute isochrone around competitor stores above 1,400 and below 1,400 sq metres within 10 minutes	Population and population density in a 10-minute isochrone around competitor stores above 1,400 sq metres within 10 minutes	Population and population density in a 10-minute isochrone around competitor stores above 2,000 and below 2,000 sq metres within 10 minutes	Population and population density in a 10-minute isochrone around competitor stores above 2,000 within 10 minutes

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses. Variable Sainsbury's local dropped as there are no observations.

TABLE 6 **Variable profit of AMTS stores above 280 sq metres: impact of number of fascias, number of stores, sales area of stores, share in sales area and non-linear effects, with staff per net sales area (instrumented for)—10 minutes' drive-time**

	(1) *Ln(yrl. margin)*	*(2)* *Ln(yrl. margin)*	*(3)* *Ln(yrl. margin)*	*(4)* *Ln(yrl. margin)*
Constant (includes effect of Asda and of Cities and Services)	–2.4145***	–2.4968***	–2.4681***	–2.3491***
	(–32.28)	(–31.32)	(–32.11)	(–30.54)
Tesco Extra	0.2041**	0.1518	0.1996**	0.1535
	(2.37)	(1.62)	(2.29)	(1.63)
Tesco Metro	0.1551**	0.1161*	0.1517**	0.1290*
	(2.48)	(1.72)	(2.42)	(1.94)
Morrisons	0.1949***	0.1437*	0.1863**	0.1548*
	(2.60)	(1.75)	(2.44)	(1.91)
Sainsbury's	0.0637	0.0267	0.0592	0.0380
	(1.08)	(0.42)	(0.99)	(0.60)
Sainsbury's Local	0.3622***	0.3314***	0.3493***	0.3545***
	(6.03)	(4.86)	(5.71)	(5.20)
Tesco Superstore	0.2286***	0.1795**	0.2261***	0.1835**
	(2.75)	(2.00)	(2.70)	(2.04)
London suburbs	–0.0623***	–0.0626***	–0.0693***	–0.0567**
	(–2.76)	(–2.78)	(–3.18)	(–2.44)
London centre	0.0024	–0.0097	–0.0058	–0.0080
	(0.13)	(–0.50)	(–0.31)	(–0.40)
London cosmopolitan	–0.1245***	–0.1177***	–0.1286***	–0.1131***
	(–3.13)	(–2.97)	(–3.38)	(–2.92)
Prospering UK	0.0005	–0.0017	–0.0006	0.0049
	(0.04)	(–0.14)	(–0.05)	(0.40)
Coastal and countryside	0.0361**	0.0342**	0.0388***	0.0350**
	(2.48)	(2.16)	(2.68)	(2.23)
Mining and manufacturing	–0.0110	–0.0077	–0.0129	–0.0062
	(–0.72)	(–0.50)	(–0.86)	(–0.39)
Northern Ireland countryside	–0.0590	–0.0377	–0.0448	–0.0802
	(–0.82)	(–0.53)	(–0.62)	(–1.04)
Mean income of people living within 10 mins (£'000)	0.0051**	0.0049**	0.0059***	0.0042*
	(2.42)	(2.24)	(2.92)	(1.76)
Store size ('000 sq metres)	0.0472**	0.0543***	0.0455**	0.0486**
	(2.56)	(2.74)	(2.47)	(2.53)
Petrol forecourt	–0.1007***	–0.1105***	–0.0987***	–0.1070***
	(–4.78)	(–4.87)	(–4.72)	(–4.76)
Toilets	0.0475***	0.0537***	0.0513***	0.0441**
	(2.71)	(3.07)	(2.95)	(2.51)
ATM	0.0559***	0.0469**	0.0540***	0.0533***
	(3.09)	(2.50)	(2.99)	(2.83)
Staff per sq metre net sales area	1.8086	2.6258*	1.8517	2.4989*
	(1.31)	(1.75)	(1.33)	(1.67)
Number of competing fascias over 280 sq metres within 10 mins	–0.0125***			
	(–4.16)			
Number of competitor stores within 10 mins		–0.0048***		
		(–3.90)		
Combined net sales area ('000) of competitors within 10 mins			–0.0034***	
			(–3.98)	
Share of competitors' net sales area in total net sales area within 10 mins				–0.2177***
				(–4.09)
Observations	1,434	1,434	1,434	1,434
idstat	15.247	13.664	14.819	13.888
idp	0.002	0.003	0.002	0.003
j	2.358	4.185	4.804	2.748
jp	0.308	0.123	0.091	0.253
Instruments	Population and population density in a 10-minute isochrone around competitor stores above 280 sq metres within 10 minutes plus additional instruments for 'Staff per NSA': Population within 10 minutes of centre store; Wages retail and repair in 2006 (from ONS; regional level)	As in (1)	As in (1)	As in (1)

Source: CC analysis.

* p <0.10; ** p <0.05; *** p <0.01.
Note: t statistics in parentheses.

PART B. Summary statistics

TABLE 7 **Summary statistics of AMST centre stores in sample**

Variable (1,435 observations)	*Mean*	*Std dev*	*Min*	*Max*
Yearly margin (yearly revenue – yearly direct costs)/yearly revenue (%)	[✂]	[✂]	[✂]	[✂]
Store size (net sales area in '000 sq metres)	2.90	1.32	0.29	5.99
Petrol forecourt	0.54	0.50	0	1
Toilets	0.84	0.37	0	1
ATM	0.89	0.31	0	1

Source: CC analysis.

TABLE 8 **Local cost and demand conditions**

Variable (1,435 observations)	*Mean*	*Std dev*	*Min*	*Max*
Mean income of people living within 10 mins (£'000)	32.15	4.66	22.92	47.45
Regional wages in sector 'Retail and Repair', 2006	252.70	36.21	215.60	330.80

Supergroups	*Frequency*	*%*
Prospering UK	494	34.43
Cities and Services	298	20.77
Mining and Manufacturing	284	19.79
London Centre	132	9.20
Coastal and Countryside	120	8.36
London Suburbs	65	4.53
London Cosmopolitan	33	2.30
Northern Ireland Countryside	9	0.63
Total	1,435	100

Source: CC analysis.

TABLE 9 **Summary statistics for competitors from all fascias**

Variables (1,435 observations)	*Summary statistics*			
	Mean	*SD*	*Min*	*Max*
Number of competing fascias over 280 sq metres within 10 mins	4.89	2.44	0	11.00
Number of competitor stores within 10 mins	6.86	4.88	0	33.08
Combined net sales area ('000) of competitors within 10 mins	8.86	7.08	0	62.46
Share of comp net sales area in total net sales area within 10 mins (%)	62	20	0	98
Size of 3 nearest competitors over 280 sq metres relative to own size	1.73	1.95	0.21	26.11
Drive-time to 3 nearest competitors over 280 sq metres	6.95	4.95	0.38	25.00

Source: CC analysis.

TABLE 10 **Summary statistics for AMST competitors**

Variables (1,435 observations)	*Summary statistics*			
	Mean	*SD*	*Min*	*Max*
Number of AMST competing fascias within 10 mins	1.20	0.89	0	3

Source: CC analysis.

TABLE 11 **Summary statistics for large competitors**

Variables (reduced sample)	*Summary statistics*			
	Mean	*SD*	*Min*	*Max*
Number of above 1,400 sq metres competing fascias within 10 mins (1,183 obs)	1.24	1.03	0	5
Number of above 2,000 sq metres competing fascias within 10 mins (1,042 obs)	0.97	0.89	0	4

Source: CC analysis.

PART C. Description of the dataset

1. The following list describes which stores are dropped from the full sample of stores which we received from the parties Asda, Morrisons, Sainsbury's and Tesco for the sample of centre stores:

   - Concentrate on period May 2005 to May 2006:
     - — Drop stores which opened after May 2006.
     - — Drop stores which opened half a year before May 2005.
     - — Drop stores that have missing margin observations (either due to costs or revenues) during May 2005 and May 2006.
   - Use only stores between 280 and 6,000 sq metres. For stores below this size group data is scarce. Stores above 6,000 sq metres probably receive a large share of their revenues from non-grocery items.
   - Drop outliers which are stores with extremely high or low profit margins.
   - Drop stores with missing information on store characteristics.

2. *Competitor stores* are all those stores in the full sample (not the cleaned one) which have a net sales area above 280 sq metres:

   - From drive-time information between stores, which was made available by CACI, we compute the relevant competitors in the isochrones around the centre stores and their nearest neighbours.
   - For the fascia variables we count Aldi, Asda, Co-op, Iceland, Lidl, Morrisons, M&S, Netto, Sainsbury's, Somerfield, Spar, Tesco and Waitrose separately. All other fascias are aggregated into a competing fascia called 'Other'.
   - For stores for which there is no third, second or first closest competitor within 20 minutes, we put the corresponding value of drive-time to this competitor to 25 minutes. The floor space of this 'hypothetical' competitor is then set to the average floor space over all stores.

3. Data from CACI also allows us to compute the mean income of the people living 10 minutes' drive-time from the centre store and the population and population density around the competitor stores.

4. Regional wages for the sector 'Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods' (shorthand: 'Retail and Repair') are taken from the 2006 Annual Survey of Hours and Earnings.

5. The next section details the revenue and cost measures provided by the companies. [✂] For Morrisons, we use, instead of the reported direct cost, the sum of staff costs and costs of sales.

PART D. Measures of revenue and direct cost for the margin calculation for each of the four retailers

1. In this section we describe the revenue and direct cost components of the margin calculations. For each fascia a store variable profit margin was computed as follows: Margin = (Total Yearly Revenue – Total Yearly Direct Costs) / Total Yearly Revenue. Generally, direct costs included the cost of good sold and staff costs. For each fascia we present below the different accounting data that was sent to the CC.

2. Tesco store revenue is inclusive of VAT and net of any refunds. Direct costs include [✂].

3. Asda has provided revenue data net of VAT. Asda store costs include cost of goods sold, shrinkage, wages, salaries, consumables net of supplier income and net of small income streams such as concessions, post office income, commission etc.

4. Sainsbury's direct store costs include VAT, cost of goods sold, stock loss, staff discounts, loyalty costs, store labour, store controlled costs (utilities, carrier bags, wrapping materials, general equipment, refuse removal, trolleys, till losses, uniform and catering).

5. Morrisons revenues include VAT. Its store costs include property expenses, security costs, cleaning, casual labour, overalls, petty cash, gardening, refuse, packaging and sundry items. We have separately collected from Morrison's store labour costs and costs of sales and use this to calculate store gross margin.