The market model

Introduction

1. This appendix (i) provides an overview of the methodology we have adopted for our quantitative analysis of the costs and the benefits from the Test and (ii) sets out how we have used a market model to generate some of the inputs needed for our assessment.

2. It then (iii) describes the market model in more detail, (iv) discusses it, and presents how we have calibrated the model and the results it produces for (v) new stores and (vi) extensions.

Overview of the methodology for calculating the welfare implications of the Test

3. Estimating the costs and benefits arising from the Test involves comparing the outcome for consumers in many different scenarios. For example, suppose in one area the Test blocks a new store from being built by an incumbent. Various outcomes may result. A new large store could be built by a rival that is new to the area; a new store could be built by a rival already present (albeit with a smaller market share in that area); an existing rival store might be extended; or there may be no new store and no extension. Moreover, some of these outcomes could be subject to various possible delays. Estimating the costs and benefits to consumers involves comparing those scenarios where the Test makes them better off (for example, a rival rapidly builds a new large store instead) with those scenarios where the Test makes them worse off (for example, because neither a new store nor an extension are built).

4. In carrying out our analysis we have sought to base our estimates on evidence from our 2000–2006 database collated during the groceries market investigation wherever possible, including:

- the change in profit margin (and profit) of one store when a new store is opened by a rival close by. This change in profit depends on, and therefore can provide evidence about, the competitive response of stores to increased competition, and the willingness of consumers to switch their allegiance between stores in response to these competitive efforts;
- the profit margins of stores. This depends on, and therefore provides information about, the extent to which higher spending on quality is successful at attracting new consumers from all sources;
- data on average store profits and revenues which provide information on the level of consumer demand; and
- information about actual store and local area characteristics which informs the choice of scenarios we consider.

5. While we have extensive evidence on which we can rely in making our estimates, there are some important limitations. First, the data provides only indirect evidence about benefits to consumers. Second, the data covers only some of the scenarios that we need to consider.

6. We have conducted a standard cost benefit analysis based on the type of counterfactual analysis commonly used in competition investigations. Cost benefit analysis is the standard method used to evaluate whether public policy interventions are worthwhile, and we rely on the following principles of this approach:[1]

[1]See for example J. Dreze and Stern N. (1987): 'The theory of cost-benefit analysis', in AJ Auerbach and M Feldstein (ed), *Handbook of Public Economics*, edition 1, vol 2, chap 14, pp909–989.

- Those quantifiable costs and benefits that we have included are expressed in terms of money equivalents, so that they can be compared with each other. In particular, consumer benefits are expressed in terms of how much consumers would be willing to pay for the scenario in question.
- Consumers' willingness to pay is estimated as the area under a consumer demand curve, which links price to quantity bought. Since consumer demand curves are rarely observed directly, they are inferred using data to calibrate or estimate a demand curve statistically.
- To create a single measure of the impact, which includes costs and benefits that accrue at different times, the effects of the later outcomes are discounted to an NPV.

7. The standard approach in counterfactual analysis that we have used is to *(a)* build a model of how firms and consumers behave, *(b)* use observed data to calibrate the model so that it correctly predicts outcomes in those scenarios that have been observed, and then *(c)* use the calibrated model to simulate the outcome in those scenarios of interest that have not been seen.

The contribution of the market model

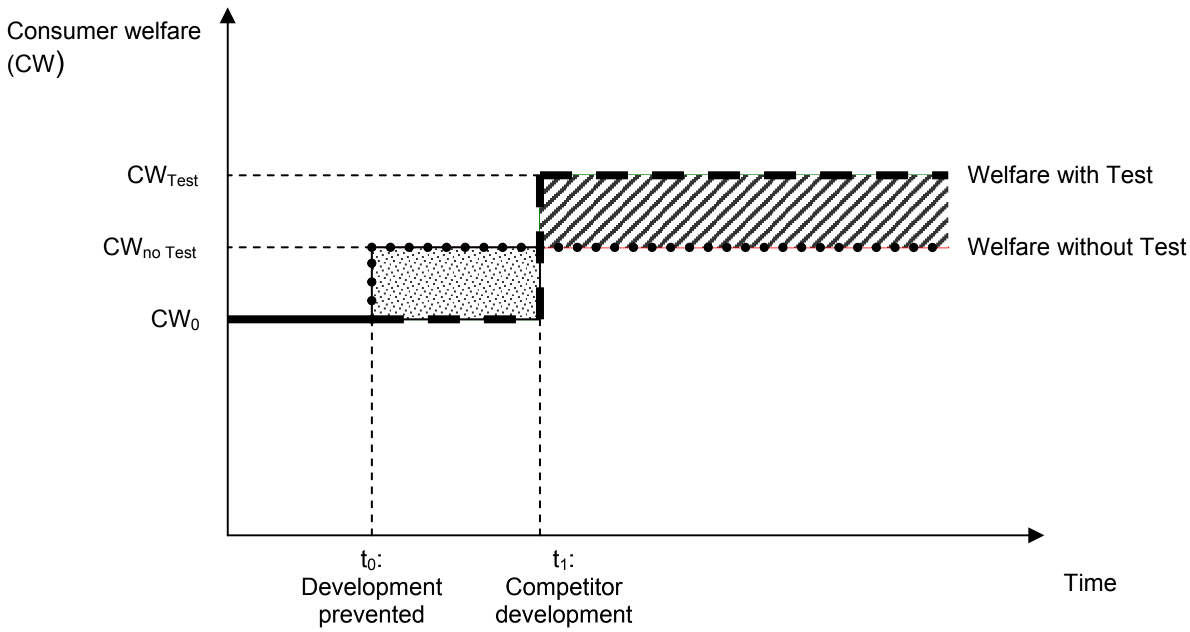
8. The market model described in this appendix does not provide a complete assessment of the costs and benefits from the Test. The market model considers the (annual) welfare effects of different market outcomes in the range of scenarios where the Test has an impact, but takes no account of the time period over which these welfare effects occur. The length of time during which the Test delivers benefits or costs is addressed in our NPV model (see Appendix B).

9. Moreover, our quantitative analysis only captures consumer welfare changes stemming from changes in the structure of local competition. There are several other benefits arising from the Test (see paragraph 5.2 of the provisional decision).

10. Figure 1 illustrates the welfare consequences from the Test in one hypothetical location. It is described in paragraphs 5.5 to 5.9 of the provisional decision.

FIGURE 1

Welfare consequences from the Test



Source: CC analysis.

11. The market model derives values for all three consumer welfare levels, ie for CW_0, $CW_{no\ Test}$ and CW_{Test}. The main outputs of the model are thus:

- the gain in annual consumer welfare when the development is carried out by a competitor instead of the incumbent, ie (CW_{Test} – CW_0); and
- the gain in annual consumer welfare from an incumbent's development, ie ($CW_{no\ Test}$ – CW_0).

Model description

12. Our model of competition between grocery stores in local areas has the following structure:

- each of n stores offers a single product (which could be interpreted as a product bundle). Retailers choose a quality variable which determines how attractive the bundle is to consumers;
- consumer demand is linear in the quality variables of all stores; and
- stores compete by simultaneously setting the quality variable such as to maximize profits.

13. We assume a local area with $k = 0, 1, \ldots, n$ stores all of which offer a single product (or product bundle). We assume that stores $i = 1, \ldots, n$ are large stores while store 0 subsumes all convenience and mid-sized stores in the local area. Our model focuses on large stores only and treats the characteristics and the behaviour of convenience and mid-sized stores as fixed.

14. To derive demand, we assume the existence of a representative consumer with a quadratic utility function. When the consumer buys q_k units of the product (or product bundle) at store 0 or stores $i = 1, \ldots, n$ the utility is given by

$$u(q_0, q_1, \ldots, q_n) = \sum_{i=1}^{n} \alpha_i q_i + \sum_{i=1}^{n} g_i q_i - \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} q_i q_j + q_0 .$$

q_0 denotes the quantity of an outside good which is purchased at, for example, convenience or mid-sized stores but which could also capture purchases on goods other than groceries. The values q_1 to q_n represent the consumption of products bought at large stores. $\alpha_i > 0$ and $\beta_{ii} > \beta_{ij} > 0$ are demand parameters. We assume $\beta_{ij} = \beta_{ji}$, ie stores exert a symmetric constraint on each other (see paragraphs 37 and 38). g_i denotes the quality of the product bundle at store i which is a competitive variable chosen by the stores (see paragraph 21).

15. Given prices r_i the consumer maximizes utility subject to the budget constraint

$$q_0 + \sum_{i=1}^{n} r_i q_i \leq M .$$

Note that we have normalized r_0 to one. From the solution to the utility maximization problem we derive the following linear inverse demand functions:[2]

$$r_i - g_i := p_i = \alpha_i - \beta_{ii} q_i - \sum_{j \neq i} \beta_{ij} q_j \text{ , } i = 1, \ldots, n.$$

16. Inverting the inverse demand system we obtain the following linear demand functions:[3]

$$q_i = a_i - b_{ii} p_i + \sum_{j \neq i} b_{ij} p_j .$$

Under our assumption that $\beta_{ii} > \beta_{ij} > 0$ the goods are substitutes, i.e. we have $b_{ii} > 0$ and $b_{ij} > 0$. Demand for good *i* therefore falls when p_i goes up, ie when either the price of good *i* increases or if the quality of good *i* goes down.

17. Each store $i = 1, \ldots, n$ sets a competitive variable g_i which measures the quality of a store's offering such as service level or the freshness of products. This variable is normalized such that it is measured in the per unit expenditure for quality. Each store therefore incurs costs from quality given by $g_i \cdot q_i$. For example, if store 2 sets $g_2 = 5$, expenditure on quality at store 2 amounts to five times the quantity sold. In the context of this model, we further assume that prices r_i are given.[4] The p_i can therefore be interpreted as a store's per unit revenue in excess (or net of) quality expenditure. Each store's revenue net of quality expenditure is therefore given by $p_i \cdot q_i$.

[2] We assume that *M* is sufficiently high for the demand of the outside good to be positive. As long as this holds true, consumer surplus is a valid measure of consumer welfare.
[3] Quadratic utility and linear demand functions for groceries are also used, for example, by PW Dobson and M Waterson, 'Chain Store Pricing across local markets', *Journal of Economics and Management Strategy*, 2005 (1), pp93–119.
[4] As set out in our Report, prices are currently generally set uniformly across the country.

18. Besides the quality costs we assume that each store incurs costs that depend on the level of sales. Our choice of this cost function seeks to capture the relevant supply-side characteristics while seeking compatibility with data and results collated during the groceries market investigation. We also took into account submissions from the parties.

19. We use two different cost functions for different scenarios:

- When we model the impact of new stores, a linear cost function which gives rise to constant marginal cost.
- When we model the impact of extensions, a quadratic cost function which gives rise to linearly increasing marginal cost.

20. We use a linear cost function of the form $C_i(q_i) = c_i \cdot q_i$, when examining new stores since a linear cost function underlies our margin concentration analysis. Since the margin concentration analysis examines the consequences of new store entry, it is well suited to calibrate our model when applied to the development of new stores.[5]

21. We use a quadratic cost function for our modelling of extensions in an attempt to capture capacity constraints of stores. Taking into account capacity constraints when modelling extensions is important for two reasons:

- The role of extensions is, at least in part, to relax a capacity constraint. A quadratic cost function is therefore a straightforward way to model extensions.
- Capacity constraints capture what Tesco described as ‘unmet demand’. This could emerge if capacity constraints prevent stores from fully satisfying the demand in a local area. It is common to model capacity constraints via an

[5]See below for how we calibrate the model.

increasing marginal cost curve reflecting the fact that it becomes increasingly costly for a store to attract or accommodate additional demand.[6]

22. We note that our margin concentration analysis assumes a linear cost function. However, our margin concentration analysis only considers local areas where entry occurred and not those where extensions were developed. We cannot therefore calibrate our modelling of extensions with the same precision as our modelling of new stores.

23. We chose a quadratic cost function of the form $C_i(q_i) = \frac{\overline{c}_i}{2}\left(\frac{q_i}{\overline{q}_i}\right) \cdot q_i$ which gives rise to increasing marginal cost $MC_i(q_i, \overline{q}_i) = \overline{c}_i\left(\frac{q_i}{\overline{q}_i}\right)$ when examining extensions.[7] $\overline{q}_i$ is a measure of the capacity (or size) of store *i*, q_i denotes demand and $\overline{c}_i$ is a cost parameter. Marginal costs increase with the level of demand and with the size of demand relative to capacity. In particular:

- marginal cost equals $\overline{c}_i$ when demand q_i exactly equals capacity $\overline{q}_i$. Hence, $\overline{c}_i$ denotes the level of marginal cost when the store is neither too big nor too small for its demand; and
- marginal cost is higher than $\overline{c}_i$ when demand q_i exceeds capacity $\overline{q}_i$. For example, if demand exceeds capacity by 50 per cent, marginal cost will be 50 per cent higher than $\overline{c}_i$.

[6]While it is a standard assumption to use an increasing marginal cost curve to model capacity constraints (see, for example, J Tirole, *The Theory of Industrial Organization*, p215) the particular functional form we use is not standard. Most of the literature assumes kinked or discontinuous marginal cost curves (see, for example, Maggi, AER 1996). We view our marginal cost curve as a simple approximation of those more complex functional forms. We do not think that our choice biases our results in a particular direction.

[7]A very similar cost function is used by MK Perry and RH Porter (1985): 'Oligopoly and the Incentive for Horizontal Merger', *American Economic Review*, vol 75(1), pp219–227.

24. As regards the *mode of competition* we assume that all stores compete by setting quality expenditure g_i simultaneously and non-cooperatively.

25. Under our assumptions, the profit of store i is given by

$$\pi_i = p_i \cdot q_i(p_1,\ldots,p_i,\ldots,p_n) - C_i(q_i).$$

26. We allow multiple stores to be owned by the same retailer. Whenever that is the case, we assume that the retailer maximizes the sum of profits at all of its stores. We note that, although prices are set nationally, quality (and therefore the value of the p_i) can vary across stores which are under common ownership.

27. The key assumptions of the model and the corresponding parameters are summarized in Table 1.

TABLE 1 **Model synopsis**

Model assumptions	*Parameters*
Linear Demand	a_i, b_{ii}, b_{ij}
Marginal Cost parameter, capacity	c_i, $\overline{q}_i$
Mode of competition: Simultaneous choice of p	Variable number of stores n and fascias
Under joint ownership of multiple stores p_i can vary across stores	

Source: CC analysis.

Discussion of the model

28. Our model is a reduced form approach. Important store characteristics such as location are not modelled explicitly but are implicitly captured by parameters of the utility function and the corresponding demand function parameters. We set out below the necessary parameter adjustments to model changes in the location of stores.

29. We distinguish between two aspects of store location:

- Accessibility: the location of a store determines how conveniently consumers can reach the store. A better location saves consumer travel costs and should therefore, for other given store characteristics, increase demand. We can reflect this by either scaling demand up or by increasing the representative consumer's willingness to pay by raising the utility function parameter α.

- Distance to other stores: stores closer to each other should be closer substitutes for consumers. This implies that, in response to a quality degradation, more consumers will leave the store and switch to a competitor situated nearby. We can therefore capture a lower distance between stores by higher values of the own and the cross-quality demand parameters (the b_{ii} and the b_{ij}).

30. Our approach of modelling convenience and mid-sized stores as an 'outside good' has two important implications:

- we do not consider any competitive interaction between large and convenience or mid-sized stores; and
- consumer surplus is measured as consumers' willingness to pay for the ability to shop at a large store instead of convenience or mid-sized stores.[8]

31. We do not consider the competitive interaction between large stores and smaller stores (mid-sized and convenience stores).[9] As the Test changes the market structure and improves the competitive offering of large stores we would expect that other smaller stores would react by improving their offering as well. By leaving this effect out we tend to underestimate both the consumer welfare detriment from fewer stores and the consumer welfare gain from more fascias. This affects both the costs and the benefits of the Test.

32. We experimented with a model that explicitly incorporated competition between large and convenience or mid-sized stores in order to address this issue. This model led to

[8]In order to measure the changes in consumer welfare brought about by the Test correctly, convenience and mid-sized stores must be taken into account in the cost benefit analysis.
[9]This issue was discussed extensively in the Report.

smaller values for the costs relative to the benefits. Hence, we consider our approach to be a conservative one.

33. Another important issue concerns the measurement of consumer surplus. In general, we seek to provide a framework for the additional consumer surplus resulting from a change in market and ownership structure. We therefore have to take into account the consumer surplus that consumers previously derived from shopping both at existing large stores as well as at convenience and mid-sized stores.

34. The consumer surplus from existing large stores is calculated within our scenarios. The consumer surplus derived from convenience and mid-sized stores is captured by measuring consumer surplus in terms of the excess benefits consumers derive from shopping at the large stores rather than convenience and mid-sized stores. For example, in our model a consumer surplus value of 20 means that the opportunity to shop at large stores gives consumers a gain in consumer surplus worth £20 as compared with a situation where they had to shop at convenience or mid-sized stores.[10]

35. We model quality investment as a variable rather than as a fixed-cost investment. Sainsbury's suggested that we should incorporate fixed-cost quality investment in our model as well.

36. We agree that some forms of quality investment are best modelled as fixed costs but decided to confine our analysis to the variable components of quality investment for two reasons:

[10]To understand this it is useful to recall that our quality parameter p can alternatively be interpreted as a price. The normalization $p_0 = 1$ implies that utility is measured in monetary terms. As an example, assume that a consumer spends £30 in a large store and receives a utility of 50 from that. If that consumer spent the same amount of money in a convenience or mid-sized store he would obtain a utility of 30. Note that (i) the consumer receives additional utility of 20 from shopping at a large store and (ii) that the consumer surplus derived from the large store's offering is 20 as well. Since utility is measured in monetary terms the consumers obtains an additional benefit worth £20 from shopping at a large store.

- first, we draw on the margin concentration analysis which considered the variable component of quality investment and use this analysis to calibrate our model; and
- second, we believe that also taking competition in fixed-cost quality investment into account would be likely to yield higher benefits from the Test. We therefore think that our model is conservative in that it biases the benefits from the Test downwards.

37. Some parties also said that we should consider scenarios where stores imposed asymmetric competitive constraints on each other, for example that store 1 imposes a stronger competitive constraint on store 2 than store 2 does on store 1. Such an assumption would tend to lead to lower prices for store 2 compared with store 1.

38. We did not consider asymmetric competitive constraints in our model for two reasons:

- first, the results from our margin concentration analysis do not provide any reliable guidance about the extent of asymmetric competitive constraints; and
- second, we do not think that the assumption of symmetric competitive constraints biases our results in any particular direction.

39. Our model does not incorporate consumer welfare gains from larger inter-store variety since we assume that the degree of differentiation between stores does not depend on whether the stores are owned by the same retailer or not. Neither does the model directly take into account consumer welfare gains from greater intra store variety in larger stores since consumer preference for larger stores is a function of increased expenditure on quality by those larger stores. We believe that the benefits from greater inter store variety outweigh those from greater intra-store variety and therefore believe that our model will underestimate the overall benefits from the Test.

The welfare impact of the Test when applied to new stores

Principles for the calibration of the model—new stores

40. In this section we set out how we calibrate the model with constant marginal cost. Our calibration strategy consists of two steps:

- first, we choose parameters such that our model yields results consistent with (i) data and results from the margin concentration analysis and (ii) a SSNIP test. Both the data and the outcome of a SSNIP test are independent of the size of demand in the local area; the first step therefore identifies the values of the parameters (and also the size of the annual costs and benefits from the Test) relative to each other but not their absolute size; and
- second, we choose a level of demand such that our model closely approximates to the average profit of large stores to determine the absolute size of our parameters and the annual costs and benefits from the Test.

41. First, we address which parameters need to be calibrated. Since our results only depend on the difference between the demand intercepts (ie a_i) and the marginal cost, we can fix the level of the a_i and just vary the marginal cost parameter. Hence, we calibrate three sets of parameters, namely the b_{ii}, the b_{ij}, and the c_i. We mainly focus on symmetric stores,[11] ie local areas where the b_{ii}, the b_{ij}, and the c_i are the same for all stores. There are hence three free parameters which must be jointly determined.

42. In order to be a relevant market, a monopolization of all stores in a local area must lead to a sufficiently large degradation in their offer. We said in the Report that a 5 per cent threshold for the SSNIP test might be too large since groceries retailing is a business with low profit margins and consumers' expenditure on groceries is large.

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[11] However, to investigate the welfare consequences when the Test encourages a locally weak incumbent to develop, we also consider different marginal cost parameters. See below for our approach in this case.

We therefore first consider outcomes for the SSNIP test between around 1 per cent and 5 per cent.

43. Second, we use data and quantitative results that were collated during the groceries market investigation. In particular, we use the following information:

- One retailer suggested using 15 per cent as the average variable profit margin of large stores. This number is broadly consistent with our data.
- The effect of a competitor fascia entry on a large incumbent store's profit margin was estimated to be 3.79 per cent in our margin concentration analysis.[12]

44. We consider both of these values to be conservative because they are averages over all local areas. In highly-concentrated areas we would expect higher profit margins. Moreover, in our margin concentration analysis we found that entry had a stronger impact on profit margins when the area was highly concentrated. We therefore use both values as lower bounds, calibrating our model such that the profit margin of stores before a new development takes place is at least 15 per cent and the change in profit margin upon entry by a competitor fascia is at least 3.79 per cent.

45. Upper bounds on parameters are obtained as follows:

- We use 25 per cent as the upper bound on profit margins, which we believe is a sensible assumption on the basis of the data that we have.
- We know from our margin concentration analysis that the impact of entry by a new competitor fascia store on incumbent profit margins almost quadruples when the analysis is restricted to large stores, instead of considering all stores larger than 280 sq metres.[13] If we assume that in highly-concentrated areas the competitive impact of large stores relative to all stores (larger than 280 sq metres) is also four

[12]One retailer submitted that 3.79 per cent was an overestimate for the profit margin reduction upon entry of a new fascia. We disagree for the reasons set out in the next paragraph and in paragraphs 11–14 of Appendix C.
[13]For all stores larger than 280 sq metres, the profit margin decreases by 0.96 per cent upon entry, while the effect is 3.79 per cent when only considering large stores.

times as big, we can estimate the reduction in profit margin upon a large competitor fascia store entry in a monopoly area as 17.2 per cent;[14] similarly, in a duopoly area the profit margin reduction can be estimated to be 14.4 per cent.

46. In order to calculate the outcome of a SSNIP test, we derive the percentage decline in average spending on quality when all stores in a local area move from separate to common ownership.

47. We calculate the profit margin and the change in profit margin as follows:

- first, we consider the profit margin incumbents earn before a new development is undertaken. The profit margin is calculated as $(p^*_i – c_i)/p^*_i$ where p^*_i denotes the equilibrium value of p_i; and
- second, we calculate the percentage change in the incumbent profit margin resulting from a new store by a new entrant, ie the change in incumbent profit margins resulting from both a new store and a new fascia.

48. Table 2 gives an overview of how the parameters affect the cost benefit ratio and the target values we use for the calibration, ie the outcome of a SSNIP test, the average variable profit margin and the change in the profit margin upon a competitor fascia entering. For example, the '-' in the first column of the first row means that a SSNIP test yields a lower value if we consider higher values of the b_{ii}. The '0' in the last row of the fourth column means that the choice of the marginal cost has no impact on the cost benefit ratio.

[14]The reduction in the profit margin for all stores above 280 sq metres when entry occurs in a monopoly area is estimated to be 4.3 per cent; the equivalent figure for a duopoly area is 3.6 per cent.

TABLE 2 **Relationship between parameters and target values for calibration**

Parameters	b_{ii}	b_{ij}	c_i
SSNIP	-	+	-
Variable profit margin	-	+	-
Change in variable profit margin	-	+	+
Cost benefit ratio	+	-	0

Source: CC analysis.

49. While the first step in our calibration fixes the parameter values and the size of the annual costs and benefits from the Test relative to each other, we need to calibrate the market size to identify their absolute values. The market size is varied by changing all demand parameters by a common factor, ie by multiplying all the a_i, b_{ii} and b_{ij} with the same (positive) number. This changes the market size but leaves demand characteristics such as, for example, elasticities constant. It also leaves the size of the annual costs and benefits relative to each other unaffected.

50. We choose the size of the market such that our model predicts a store profit of £6.758 million which is consistent with data on average large store AMST profit levels collated during the groceries market investigation.[15] We calibrate the model to yield this level of store profit in a local area with two symmetric stores and two fascias.

Results—new stores

51. We conduct the assessment of the impact of the Test for three market scenarios:

- first, we consider a local area with a single large store where a second store can be built either by the incumbent or a new entrant (the single-store market scenario);
- second, we investigate a local area with two independently owned stores of equal size where a third store could be developed either by an incumbent or a new entrant (the two-store market scenario); and

[15]See paragraph 15 of Appendix 4.4 of the Report.

- third, we consider a local area with two stores where one store is large (and is owned by a ‘strong’ fascia) and the other is small (and is owned by a ‘weak’ fascia) and where a third store could be developed by either of the two incumbents (the weak-incumbent scenario).

52. In all cases our measure of consumer welfare is consumer surplus.[16] The annual benefits and costs of the Test are derived as follows:

- We obtain the annual benefits from the Test by comparing (i) consumer welfare in an area where an additional store has been built by a new entrant or (in the third scenario) the weak incumbent with (ii) consumer welfare in an area where this additional store has been developed by an incumbent retailer or (in the third scenario) the strong incumbent.
- We obtain the annual costs of the Test by comparing (i) consumer welfare in an area where an incumbent fascia or (in the third scenario) the strong incumbent builds an additional store with (ii) an area where no additional store is built.

53. The annual welfare consequences of an additional store are related to the following two factors:

- first, with an additional store (independent of fascia), consumers will make a larger part of their grocery purchases at large stores (the market expansion effect). An additional store may make it more convenient for some customers to travel to a large store. The resulting consumer welfare change is the prime determinant of the cost of the Test; and
- second, where the additional store is developed by a new entrant or the weak incumbent, more competition will emerge in the local area (the competition effect). The gain in consumer welfare caused by the additional competition is the main determinant of the benefit of the Test.

[16]This is valid in this context as we have specified a quasilinear utility function.

54. We make the following assumptions:

- in the single store scenario, we assume that the entrant store is identical to the incumbent store;
- in the two-store scenario, we assume that the incumbent stores are identical to each other and the entrant store is identical to the incumbent stores;
- in the weak-incumbent scenario, we assume that the weak incumbent operates a store with 20 per cent higher marginal costs than the store from the strong fascia. This yields a market share between 60 and 70 per cent for the strong incumbent before the third store is developed; and
- in the weak-incumbent scenario we further assume that the marginal cost of the new store is independent of the fascia which builds the store.

55. Table 3 sets out results for the annual benefits and costs from the Test and for the three target values for calibration implied by different parameter assumptions. We consider two calibrations:

- In the baseline calibration our parameters are chosen such that the model yields (i) a value for store profit margins and changes in store profit margins upon a competitor fascia entry equal to our estimates and data; and (ii) a low value for the SSNIP test. Since our data points give us lower bounds we consider this to be a conservative calibration.
- In calibration 2 we increase the relative size of the cross-quality parameter such that our model yields higher values for the profit margins, the changes in profit margins upon a competitor fascia entry, and the SSNIP test. In particular, the reduction in the cross-quality parameter is such that we move to the upper bound

of profit margins which we consider reasonable.[17] All target values are still within the range supported by our data.

56. In the baseline calibration the market size is chosen such that the annual store profit in the two-store scenario (that is, in a symmetric duopoly) is £6.758 million. In calibration 2 we adjust the market size such that the store revenue in the two-store scenario is the same as in the baseline calibration (while store profit is now higher since the predicted profit margin is higher).

TABLE 3 **Calibration results for new stores**

	Gross benefit if built by incumbent in £'000 (delay cost)	*Gross benefit if built by a competitor that increases competition in £'000*	*Difference (net benefits due to competition)*	*SSNIP %*	*Margin %*	*Change in margin %*
Baseline calibration						
Single-store scenario	3,096	3,716	620	0.68	14.99	3.83
Two-store scenario	3,160	3,707	547	1.30	14.40	3.69
Weak-incumbent scenario	3,147	3,481	334	0.70	14.71	2.19
Calibration 2						
Single-store scenario	4,400	6,757	2,357	2.65	24.95	7.97
Two-store scenario	4,810	6,597	1,787	4.91	22.83	7.83
Weak-incumbent scenario	4,760	5,395	635	3.12	23.39	2.75

Source: CC analysis.

57. We note that, in terms of the annual benefits from the Test:

- The benefits are largest in the single-store scenario since an additional competitor in a monopoly area brings the largest increase in competition.
- The benefits are smallest in the weak-incumbent scenario since the incremental effect on competition from a new store of a retailer which already owns one store in a local area will be lower.

[17]We found no specification of parameters for which we moved to a value close to the upper bound for the change in profit margins without obtaining unreasonable results for at least one other calibration target value.

- The benefits are larger in calibration 2 which uses higher cross-quality parameters which imply a higher degree of competition between stores resulting in larger benefits.

58. In relation to the annual costs of the Test:

- The annual costs are higher in the two-store and the weak-incumbent scenario. This is due to the fact that in these two scenarios a second store by the (strong) incumbent has a procompetitive effect (ie leads to an increase in quality), while an additional incumbent store has no impact on quality in the single-store scenario.
- The costs increase in calibration 2 since a higher level of the cross-quality parameter lowers the market elasticity. This implies that consumers are less willing to switch from large to small and convenience stores, ie they view convenience stores as a less attractive alternative in calibration 2. This increases the market expansion effect and therefore the costs that result from depriving consumers from an additional large store.

59. However, the annual benefits from the Test relative to the annual cost are much higher in calibration 2 when the degree of competitive interaction between stores is increased.

The welfare impact of the Test when applied to extensions

60. By preventing an incumbent retailer from strengthening its market power through the extension of a store the Test creates a consumer benefit as long as:

- a new entrant or a retailer already in the area with a weaker market position would open a new store instead; or
- a retailer already in the area with a weaker market position would extend one of its stores instead.

In both of these cases the Test will lead to a more competitive market structure which in turn will result in a better competitive offering to consumers. Moreover, where a new store is developed consumers might also benefit from lower travel costs.

61. However, if weaker incumbent retailers or (in the case of the development of a new store) new entrants do not step in, consumers may well suffer a welfare detriment since the Test would prevent an increase in sales area.

62. Following the approach we have already taken when considering new developments, we estimate the change in consumer welfare resulting from possible changes in market structure brought about by the Test.

63. In order to derive the costs of the Test which arise from blocking an extension we compare consumer welfare after a strong incumbent has extended its store with consumer welfare without that extension and without any other extension or entry.

64. In order to derive the benefits of the Test we distinguish between three cases. As a response to a blocked extension by a strong incumbent it could be that:

- an entrant develops a new store;
- a weak incumbent develops a new store; or
- a weak incumbent extends an existing store.

65. In our framework for the assessment of the benefits of the Test we compare consumer welfare after a strong incumbent has built an extension with consumer welfare after a weak incumbent or new entrant has reacted by either building a new store or extending an existing one.

How to model extensions

66. The specification of our cost function allows us to model extensions in a straightforward way. The cost and corresponding marginal cost function has the following form:

$$C_i(q_i) = \frac{\bar{c}_i}{2}\left(\frac{q_i}{\bar{q}_i}\right) \cdot q_i \quad \Rightarrow \quad MC_i(q_i, \bar{q}_i) = \bar{c}_i\left(\frac{q_i}{\bar{q}_i}\right)$$

67. An extension is modelled as an increase in $\bar{q}_i$ which results in a decline of the extended store's marginal cost. Hence, the specification of the cost function reflects that the level of demand that a store can satisfy (its capacity) is determined by its size. If demand exceeds the capacity of a store, the store will eventually become congested. The cost function therefore suggests that congestion makes it increasingly costly for a store to attract or accommodate additional demand.

68. The level of marginal cost determines the competitive offering at a store. Higher marginal costs imply that it is more expensive to attract additional demand by raising quality. Since marginal costs increase in the level of congestion, a more congested store will therefore find it optimal to degrade quality.

Principles for the calibration of the model—extensions

69. The calibration of the model when applied to extensions follows the same two steps that we outlined above. We first calibrate our parameter values such that they are consistent with the data from the margin concentration analysis and a SSNIP test and then calibrate the market size which yields store profit levels observed in reality.

70. In the first step, however, we take into account the different cost function in our extensions model. The quadratic cost function implies that we do not have to calibrate the absolute level of the demand intercepts (ie all the a_i). This is true

because scaling all a_i up or down by a common factor neither affects the cost benefit ratio nor the values we use for the calibration.[18] Since we focus on symmetric stores, we have to calibrate three parameters, namely b_{ii}, b_{ij}, and $\bar{c}_i / \bar{q}_i$.

71. Following our analysis of new stores we use for calibration:

- a SSNIP test, ie there must be a sufficiently large reduction in per unit quality expenditure resulting from a monopolization of the local area;
- the profit margin of at least 15 per cent before an extension is build; and
- the change in the profit margin of at least 3.79 per cent in case of a new fascia store entry.

72. However, we note that the results from the margin concentration analysis might not be directly applicable to a local area where extensions occur and to our model for two reasons:

- first, the margin concentration analysis considered those areas where entry occurred, not extensions; and
- second, the margin concentration analysis presumes constant marginal cost to calculate the profit margin while in the model we use an increasing marginal cost function.

Nevertheless, we use these results as the best evidence available to us.

73. When we calibrate the market size in the second step we have to take into account that the level of demand also affects the marginal cost function. To keep the level of congestion constant when the market size is altered the capacity at each store has to be changed by the same factor as the demand parameters. We therefore multiply the demand parameters and the capacity for each store by a common factor when calibrating the market size.

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[18]However, the size of the a_i relative to each other does affect the cost benefit ratio.

Simulation results—extensions

Blocked extension is replaced by a competitor's new store

74. The annual costs and benefits we derive below are driven by the following factors:

- A blocked extension that is not immediately replaced by an alternative development causes a welfare loss since the extension reduces marginal cost which makes it profitable for stores to attract additional customers by improving quality. The absolute size of the annual delay costs depends both on the extent to which the lower marginal costs translate into higher quality as well as the size of the local area, ie how many customers would benefit from these quality improvements.
- The additional annual benefits from the Test depend again on the benefits consumers derive from increased competition in a local area arising from the entry of a new fascia (or a weak incumbent). The absolute size of these annual benefits depend both on the extent of quality improvements brought about by more competition as well as the size of demand in that local area.

75. We first consider a situation where, following an extension that is prevented by the Test, a rival develops a new store in the local area under consideration. In line with our approach for new stores, we consider three market scenarios:

- first, we consider a local area with a single large store where a new entrant can build a second large store after a substantial extension is prevented by the Test.
- second, we consider a local area with two independently owned stores of equal size where a new entrant could develop a large store after a substantial extension is prevented by the Test; and
- third, we consider a local area with two stores where one store is large (and is owned by a 'strong' fascia) and the other is small (and is owned by a 'weak' fascia) and where a third store could be developed by the weak incumbent after a substantial extension by the strong incumbent is prevented by the Test.

We also consider the welfare costs when a small extension by a monopolist prevented by the Test does not lead to any entry or expansion (and in the sensitivity analysis of our numerical assessment, we also consider the effect if larger extensions are prevented and no competitor entry or expansion occurs, see Appendix B).

76. We make the following assumptions:

- A substantial extension is 50 per cent of initial store size; a small extension is 25 per cent of initial store size. This assumption reflects data collated during the groceries market investigation.
- The new store is the same size as the incumbent stores in the first two scenarios, and the same size as the strong incumbent store in the third scenario.
- The small store from the weak incumbent in the third scenario has half the capacity ($\overline{q}_i$) of the strong incumbent's store.

77. We look at three different calibrations:

- Our baseline calibration again yields results closest to the estimates and the data on the margin and the change in margin upon a competitor's entry while still delivering low values for the SSNIP test.
- Calibration 2 increases the relative size of the cross-quality demand parameter such that the change in the profit margin upon a competitor's entry moves to the upper bound.
- Calibration 3 reduces the relative size of marginal cost (ie $\overline{c}_i \ / \ \overline{q}_i$) which moves the profit margin predicted by the model to its upper bound.

TABLE 4 **Blocked extension, new store replacement**

Baseline calibration	*Gross benefit if built by incumbent in £'000 (delay cost)*	*Gross benefit if built by a competitor that increases competition in £'000*	*Difference (net benefits due to competition)*	*SSNIP %*	*Margin %*	*Change in margin %*
Monopoly, small extensions—no replacement	362	-	-	0.78	15.63	5.33
Monopoly, substantial extension—replaced by new store new fascia	729	1,346	617	0.78	15.63	5.33
Duopoly, large extension—replaced by weak incumbent new store	801	1,453	652	1.03	14.79	3.43
Duopoly, large extension—replaced by new store new fascia	828	1,634	806	1.70	14.79	3.43
Calibration 2						
Monopoly, small extensions - no replacement	433	-	-	2.27	18.32	15.52
Monopoly, substantial extension—replaced by new store new fascia	860	2,068	1,208	2.27	18.32	15.52
Duopoly, large extension—replaced by weak incumbent new store	1,036	2,180	1,144	3.10	15.48	7.71
Duopoly, large extension—replaced by new store new fascia	1,073	2,519	1,446	4.87	15.48	7.71
Calibration 3						
Monopoly, Small Extensions - no replacement	700	-	-	1.80	25.00	4.76
Monopoly, substantial extension—replaced by new store new fascia	1,351	3,177	1,826	1.80	25.00	4.76
Duopoly, large extension—replaced by weak incumbent new store	1,476	3,273	1,797	2.36	23.81	3.08
Duopoly, large extension—replaced by new store new fascia	1,491	3,688	2,197	3.85	23.81	3.08

Source: CC analysis.

78. We first consider the level of annual benefits within each calibration and make two observations:

- The Test delivers higher annual benefits in a duopoly area (comparing the second with the third and the fourth row in each calibration). While an additional competitor adds most competition into a monopoly area the market size is larger in the duopoly area implying that more customers benefit from quality improvements.

- A new store from a new fascia brings in more competition than a new store from a weak incumbent (comparing the third with the fourth row).

79. Next, we consider the level of annual costs within each calibration:

- The costs are larger the larger the extension (comparing the first with the second row).
- The costs are higher in a duopoly area (comparing the second with the third and the fourth row). This results from the higher level of competition in a duopoly which forces the extended store to pass marginal cost reductions on to consumers to a larger extent.
- The costs are higher if the market share is more symmetric (comparing the third with the fourth row). A small store imposes less of a competitive constraint, which again reduces the extent to which an extended large store would pass on marginal cost reductions to consumers.

80. Comparing the absolute values of our results across the three calibrations we make two observations:

- The annual costs and benefits are again higher in calibration 2. As in our analysis of blocked new stores (see paragraph 62), higher benefits result from higher competition between stores implied by larger cross quality parameters. The higher delay costs are the consequence of a lower elasticity.
- The annual costs and benefits are highest in calibration 3. A lower level of marginal cost leads to higher quality levels resulting in higher sales at large stores. We therefore consider a larger market in calibration 3 leading to higher levels of consumer welfare.

81. Comparing the relative size of annual costs and benefits from calibrations 2 and 3 to the baseline calibration we note that:

- the annual costs are lower relative to the annual benefits in calibration 2 when we consider a higher degree of competition between stores; and
- the annual costs also decrease relative to the annual benefits in calibration 3. Lower marginal costs imply a less congested area which reduces the annual costs from the Test while there is still a benefit from more competition.

Blocked extension is replaced by a competitor's extension

82. In response to an extension prevented by the Test, a 'weak' incumbent could extend a store. We investigate the welfare consequences of a weak-incumbent extension replacing either a small or a substantial extension by a strong incumbent.

83. To compare the impact of extensions from strong and weak incumbents we make the following assumption. Since our data show that extensions at larger stores (i) add less GSA and (ii) are less intensively traded than extensions at small stores, a large store's extension removes congestion to a lesser extent than a small store's extension. We reflect this by assuming that the large store's extension is smaller. In particular, we assume that the large store's extension is 75 per cent of the size of the corresponding extension by the small store.

84. Otherwise, we make the same assumption and use the same parameter values as we did when considering a new store replacing a blocked extension. Since there is no new store entry in this model we cannot report a change in the profit margin.

TABLE 5 **Extension, extension replacement**

Baseline calibration	*Gross benefit if built by incumbent in £'000 (delay cost)*	*Gross benefit if built by a competitor that increases competition in £'000*	*Difference (net benefits due to competition)*	*SSNIP %*	*Margin %*
Duopoly, small extension—replaced by weak-incumbent extension	300	381	81	0.45	14.79
Duopoly, large extension—replaced by weak-incumbent extension	601	787	186	0.45	14.79
Calibration 2					
Duopoly, small extension—replaced by weak-incumbent extension	394	544	150	1.39	15.48
Duopoly, large Extension—replaced by weak-incumbent extension	782	1,097	315	1.39	15.48
Calibration 3					
Duopoly, small extension—replaced by weak-incumbent extension	580	860	280	1.12	23.81
Duopoly, large extension—replaced by weak-incumbent extension	1,129	1,693	564	1.12	23.81

Source: CC analysis

85. The annual costs and benefits within each calibration increase if larger extensions are considered. However, the relative size of annual benefits to costs stays almost constant. The absolute annual benefits and costs are higher in calibration 2 and 3 for the same reasons as outlined above.

Summary

86. In our NPV model we use results from the baseline calibration and calibration 2 to obtain the overall welfare consequences from the Test. To summarize, the following welfare levels from the market model feed into our NPV model.

TABLE 6 **Summary of annual costs and benefits**

	Baseline calibration			*Calibration 2 (high case)*		
	Gross benefit if built by incumbent in £'000 (delay cost)	*Gross benefit if built by a competitor that increases competition in £'000*	*Difference in £'000 (net benefits due to competition)*	*Gross benefit if built by incumbent in £'000 (delay cost)*	*Gross benefit if built by a competitor that increases competition in £'000*	*Difference in £'000 (net benefits due to competition)*
Single-store scenario: new build—monopoly store replaced by new fascia	3,096	3,716	620	4,400	6,757	2,357
Two-store scenario: new build—non-monopoly store replaced by new fascia	3,160	3,707	547	4,810	6,597	1,787
Weak-incumbent scenario: new build—non-monopoly store replaced by weaker incumbent	3,147	3,481	334	4,760	5,395	635
Extensions—monopoly store small extension—no replacement	362	N/A	N/A	433	N/A	N/A
Extensions—monopoly store substantial extension—replaced by new store new fascia	729	1,346	617	860	2,068	1,208
Extensions—non-monopoly store small extension—weak-incumbent extension replaces	300	381	81	394	544	150
Extensions—non-monopoly store large extension—replaced by weak-incumbent new store	801	1,453	652	1036	2,180	1,144
Extensions—non-monopoly store large extension—replaced by weak-incumbent extension	601	787	186	782	1,097	315
Extensions—non-monopoly store large extension—replaced by new store new fascia	828	1,634	806	1073	2,519	1,446

Source: CC analysis.

Net present value model

Introduction

1. In this appendix we describe how we used a net present value (NPV) model to combine our quantitative estimates of the welfare costs and benefits of the Test. The model calculates the sum of the benefits minus the costs, to give a net value in each year of the model. It discounts the net value in each year back to the present day, to reflect the fact that present benefits and costs are considered more significant than those occurring in the future. The sum of the discounted costs and benefits is the NPV.

2. The NPV model combines the results derived from our market model with a number of other estimates set out in paragraphs 5.37 to 5.65 of the provisional decision and Appendix A, data from our groceries market investigation and from publicly available data. It takes our annual assessment of the number of developments that would be deterred by the Test, set out in paragraphs 5.47 of the provisional decision and constructs an NPV model reflecting the costs and benefits that would occur as a result of the implementation of the Test over the life of the model. The aim is not to generate a single figure for the quantifiable elements of the costs and benefits, but rather to understand the NPV of the Test under a range of reasonable assumptions. We therefore looked at a base case, representing conservative but realistic assumptions, and considered how this changed using a wide range of sensitivities.

3. The NPV model does not take into account the qualitative aspects of the Test discussed in paragraphs 5.12 to 5.18 of the provisional decision.

Key inputs

4. We established estimates for the:

(a) number of developments affected by the Test;

(b) length of delay between when an incumbent development would have opened but for the Test and when we expect a competitor's development to open instead;

(c) benefits of entry and costs of delay;

(d) discount rate;

(e) administrative costs of the Test; and

(f) period of the model.

We discuss each of these in turn.

Number of developments affected by the Test

5. Our analysis indicates that 26 extensions and three new stores each year would have been prevented by the Test between 2000 and 2006 if the Test had been in operation at the time (see provisional decision paragraphs 5.46 and 5.47). There are several factors that might affect our estimate of the number of developments likely to be deterred by the Test in the future. However, for our base case model, we assumed that the number of developments affected remains constant over the life of the model. We conducted sensitivities which assumed decreases in the number of developments affected by the Test. These involved examining the effect of reducing the model length, reducing the number of developments affected, and assuming a decline over time of the impact of the Test.

6. We estimated the number of developments according to market structure, based on the market structures we had identified from our analysis of store developments between 2000 and mid-2006. For each market structure, an evaluation was made of the likely competitor reaction that would occur when an incumbent store was deterred by the Test. This allowed us to vary our assumptions on delays, benefits and costs, depending on the market structure and the likely competitor reaction. We looked separately at new stores and extensions.

New stores

7. The average size of the new-build stores that would have been prevented by the Test between 2000 and 2006 was some 3,300 sq metres net sales area (provisional decision Table 2). Given this size, we assumed that all the new-build stores deterred by the Test would be replaced by a competitor development.

Extensions

8. The average size of the extensions that would have been prevented by the Test is some 1,400 sq metres net sales area, although some extensions are much smaller. Where the store that would have been extended is the only fascia in the local area, we consider it less likely that a new development would be built by another retailer to replace a small extension deterred by the Test. Accordingly, our base case assumes that, in the single fascia case, an extension of less than 300 sq metres grocery sales area would not be replaced by a new entrant. Our analysis of the 2000–2006 data shows that extensions with around 300 sq metres of grocery sales area have net sales area of around 750 sq metres. We consider that if a store above this size was prevented it would attract a new entrant store of greater than 1,000 sq metres. Our base case assumes that a development larger that the 300 sq metres threshold could attract a new entrant store of greater than 1,000 sq metres net sales area. We conducted sensitivities which assumed changes to the 300 sq metres grocery sales area threshold.

9. Where there is more than one fascia in the local area, we assume that small extensions are most likely to be replaced by an extension to an existing weaker incumbent already present in the area. In our base case we assume that an extension of less than 300 sq metres grocery sales area would only be replaced by

an extension to a weaker incumbent.[1] Sensitivities that increased the 300 sq metres threshold were analysed.

Scenarios

10. We have assessed nine scenarios (three for new-build stores and six for extensions) that reflect how competitors would react when the original development is deterred by the Test. In many cases we have been able to estimate the number of times the scenario would be likely to occur based on our analysis of the 2000–2006 data. In some cases we have estimated the number of times the scenario would occur, but we also used sensitivities to examine the impact of changing these assumptions. The scenarios were:

New builds

(a) A new-build store that would have been built by the only fascia present in the isochrone is deterred by the Test and the store is replaced by a new entrant store.

- We estimate that one-third of deterred new-build stores would be single-fascia stores based on our analysis of the number of single-fascia stores that would have been deterred by the Test between 2000 and 2006. This amounts to one store a year.

(b) A new-build store that would have been built by the strong incumbent fascia, where more than one fascia is present, is deterred by the Test and replaced by a new entrant store.

- We estimate, based on the 2000–2006 data, that two-thirds of deterred new-build stores would be in areas with more than one fascia. We have assumed that half of these would be built by a new fascia and half by a smaller incumbent fascia. This amounts to one store a year.

[1] In this case our analysis indicates that this amounts to a total size of around 1,100 sq metres net sales area.

(c) A new-build store that would have been built by the strong incumbent fascia, where more than one fascia is present, is deterred by the Test and replaced by a store from a weaker incumbent.

- As in *(b)* above we estimate that two-thirds of deterred new-build stores would be in areas with more than one fascia. We have assumed that half of these would be built by a new fascia and half by a smaller incumbent fascia. This amounts to one store a year.

Extensions

(d) A small extension to a store operated by the only fascia present in an isochrone is less than 300 sq metres grocery sales area and is therefore too small to attract a replacement new entrant store (see paragraph 8).

- We estimate in our base case that, of the 26 extensions that would be deterred by the Test each year, 2.9 would fall into this category.

(e) A large extension to a store operated by the only fascia present in an isochrone is replaced by a new entrant store.

- Our base case assumption is that this includes all extensions of over 300 sq metres grocery sales area (the average size of which would be around 1,500 sq metres net sales area based on the 2000–2006 data). We estimate in our base case that, of the 26 extensions that would be deterred by the Test each year, 9.5 each year would fall into this category and produce a new entrant store. We modelled sensitivities that reflected the impact of assuming a larger threshold than the 300 sq metres for the size of extension that would be too small to attract a competitor store.

(f) A small extension to a store of a strong incumbent, where more than one fascia is present, is too weak to attract a new store and is replaced by an extension to a weaker incumbent store (see paragraph 8).

- We estimate in our base case that, of the 26 extensions that would be deterred by the Test each year, 0.7 each year would fall into this category. We modelled sensitivities that reflected the impact of assuming a larger threshold for stores that would not be built.

(g) A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by a new store of a weaker incumbent.

- Our base case assumption is that this includes all extensions over 300 sq metres grocery sales area. We estimate in our base case that, of the 26 extensions that would be deterred by the Test each year, 12.9 each year would be larger than 300 sq metres grocery sales area (with an average net sales area of some 1,500 sq metres).
- We have assumed in the base case that one-third of these are built as a new store by a smaller incumbent, one-third are built by an extension to a smaller incumbent store and one-third are built as new entrant stores. Accordingly, 4.3 stores each year would fall into each of these three categories.
- We modelled sensitivities that reflected the impact of assuming a larger threshold for extensions that would be too small to attract a new store, and changes in the proportions built by new entrants, smaller incumbents as extensions and smaller incumbents as new stores.

(h) A large extension to a store in an isochrone with more than one fascia is replaced by an extension to a smaller incumbent store (4.3 stores, see *(g)*).

(i) A large extension to a store in an isochrone with more than one fascia is replaced by a new entrant store (4.3 stores, see *(g)*).

11. A summary of the number of stores in the base case in each category is shown in Table 1.

TABLE 1 **Number of stores in each market structure and type of development**

	Category of development	*Number of stores each year*
(a)	A new-build store that would have been built by the only fascia present is replaced by new-entrant store	1
(b)	A new-build store that would have been built by the strong-incumbent fascia, where more than one fascia is present, is replaced by a new entrant store	1
(c)	A new-build store that would have been built by the strong-incumbent fascia, where more than one fascia is present, is replaced by a store from a weaker incumbent	1
(d)	A small extension to a store operated by the only fascia present is too small to attract a new entrant store and no additional floorspace is built	2.9
(e)	A large extension to a store operated by the only fascia present is replaced by a new entrant store	9.5
(f)	A small extension to a store of a strong incumbent, where more than one fascia is present, is too weak to attract a new store and is replaced by an extension to a weaker incumbent store	0.7
(g)	A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by a new store of a weaker incumbent	4.3
(h)	A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by an extension to a weaker incumbent store	4.3
(i)	A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by a new entrant store	4.3

Source: CC analysis.

Length of delay

12. In paragraphs 5.49 to 5.65 of the provisional decision we set out our analysis of the likely length of delay for a competitor to enter or expand in a local area if the strong incumbent's development was deterred by the Test. We identified different delay assumptions, depending on the type of development that was deterred and that was developed in its place:

(a) a new-build store is built instead of the strong incumbent's new-build store;

(b) a new-build store is built instead of the strong incumbent's extension; and

(c) an extension by a weaker incumbent is built instead of an extension by a strong incumbent.

13. In the base case, we assumed that in the longer term there would be no delay for a new competitor store to replace a strong incumbent's new store, or for a weaker incumbent's extension to replace a strong incumbent's extension, although we allowed a transition period of one year during which time there would be a delay of one year. We assumed that it would take longer for a new-build store to replace an extension to an existing store—four years for the first four years after implementation

of the Test, falling to one year thereafter once retailers are able to anticipate the impact of the Test.

14. The delays are summarized in Table 2.

TABLE 2 **Delay assumptions**

Category of development	*Short-term delay (years)*	*Long-term delay (years)*	*Transition period (years)*
New-build store replaced by another new-build store	1	0	1
Extension replaced by a smaller incumbent extension	1	0	1
Extension replaced by a new-build store	4	1	4

Source: CC analysis.

15. We also carried out a number of sensitivities to assess the impact of assuming greater delays before a competitor entered or expanded, or to take account of the possibility that a replacement extension may, or may not, in practice take place. In particular, we modelled the impact of there being a four-year delay to replace any extension prevented by the Test (whether through entry or extension), both for a transition period, and for the life of the model.

Benefits of entry and costs of delay

16. Appendix A details how we estimated:

- the gross benefit from the strong incumbent building a grocery retail development (this amounts to the cost of delayed entry);
- the gross benefit of another retailer providing the capacity instead and thereby increasing competition; and
- the net benefit due to competition; ie the difference between the two figures.

17. Separate figures were calculated in Appendix A for each of the scenarios described in paragraph 4. A conservative ‘baseline calibration’ was performed and a less conservative calibration (‘calibration 2’). These are detailed in Table 6 of Appendix A.

The NPV model calculates the effect of each scenario according to the average size of developments included in the scenario. Table 3 shows the cost and benefit assumptions taken from Table 6 of Appendix A expressed per sq metre of sales area.

TABLE 3 **Cost and benefit assumptions for each of the categories analysed per sq metre sales area**

		Baseline calibration			*Calibration 2*		
	£ per sq metre	*Gross benefit if built by strong incumbent (delay cost)*	*Gross benefit if built by a competitor that increases competition*	*Difference (net benefit due to competition)*	*Gross benefit if built by strong incumbent (delay cost)*	*Gross benefit if built by a competitor that increases competition*	*Difference (net benefit due to competition)*
(a)	A new-build store that would have been built by the only fascia present is replaced by a new-entrant store	1,019	1,223	204	1,448	2,224	776
(b)	A new-build store that would have been built by the strong-incumbent fascia, where more than one fascia is present, is replaced by a new-entrant store	1,040	1,220	180	1,583	2,172	588
(c)	A new-build store that would have been built by the strong-incumbent fascia, where more than one fascia is present, is replaced by a store from a weaker incumbent	1,036	1,146	110	1,567	1,776	209
(d)	A small extension to a store operated by the only fascia present is too small to attract a new entrant store and no additional floorspace is built	119	n/a	n/a	143	n/a	n/a
(e)	A large extension to a store operated by the only fascia present is replaced by a new-entrant store	240	443	203	283	681	398
(f)	A small extension to a store of a strong incumbent, where more than one fascia is present, is too weak to attract a new store and is replaced by an extension to a weaker incumbent store	99	125	27	130	179	49
(g)	A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by a new store of a weaker incumbent	264	478	215	341	718	377
(h)	A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by an extension to a weaker incumbent store	198	259	61	257	361	104
(i)	A large extension to a store of a strong incumbent, where more than one fascia is present, is replaced by a new-entrant store	272	538	265	353	829	476

Source: CC analysis.

Discount rate

18. We applied a discount rate to future costs and benefits in order to estimate their NPV. We used a discount rate of 3.5 per cent, in line with the figure specified by HM Treasury in its guidance on economic assessments (the Green Book) as the Social Time Preference Rate (STPR). We consider the STPR to be the appropriate discount rate to use for this exercise since it is defined as the value society attaches to present, as opposed to future, consumption. The STPR is used for discounting future benefits and costs, and is based on comparisons of utility across different points in time or different generations.[2]

Administrative costs

19. In the Report we estimated the administrative costs of the Test as £6–£8 million each year.[3] In the NPV model we used a mid-point of our estimate—£7 million each year.

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[2]The Green Book recommends that the STPR be used as the standard real discount rate.
The STPR has two components:

- The rate at which individuals discount future consumption over present consumption, on the assumption that no change in per capita consumption is expected, represented by ρ.
- An additional element, if per capita consumption is expected to grow over time, reflecting the fact that these circumstances imply future consumption will be plentiful relative to the current position and thus have lower marginal utility. This effect is represented by the product of the annual growth in per capita consumption (g) and the elasticity of marginal utility of consumption (μ) with respect to utility.

The STPR, represented by r, is the sum of these two components, ie $r = \rho + \mu.g$.

Estimates of ρ

This comprises two elements:

- catastrophe risk (L); and
- pure time preference (δ).

The first component, catastrophe risk, is the likelihood that there will be some event so devastating that all returns from policies, programmes or projects are eliminated, or at least radically and unpredictably altered. Examples are technological advancements that lead to premature obsolescence, or natural disasters, major wars etc. The scale of this risk is, by its nature, hard to quantify.

The second component, pure time preference, reflects individuals' preference for consumption now, rather than later, with an unchanging level of consumption per capita over time.

The evidence suggests that these two components indicate a value for ρ of around 1.5 per cent a year for the near future.

Estimates of μ

The available evidence suggests the elasticity of μ is around 1. This implies that a marginal increment in consumption to a generation that has twice the consumption of the current generation will reduce the utility by half.

Estimates of g

Maddison (2001) shows growth per capita in UK to be 2.1 per cent over the period 1950 to 1998. Surveying the evidence, the Treasury paper *Trend Growth: Recent Developments and Prospects* also suggests a figure of 2.1 per cent for output growth to be reasonable. The annual rate of g is therefore put at 2 per cent per year.

The calculated STPR

Taking g = 2 per cent, ρ = 1.5 per cent, μ = 1.0, the STPR to be used as the real discount rate is 0.015 +1.0*0.02 = **3.5 per cent.**

[3]Paragraph 11.382.

Period of the model

20. We assumed the lifetime of a store as 25 years. Our NPV model also operates over a 25-year period, in line with the assumption for the lifetime of a store. However, we recognize that it is difficult to project the likely impact of the Test over such a time-scale. We therefore also considered sensitivities which assessed each development over 25 years but only included those developments that were likely to take place over shorter timescales: 10, 15 or 20 years.[4]

Summary of the results

Base case

21. In the base case we used the assumptions detailed in paragraphs 5 to 20 above. In the base case the NPV, after including administration costs, is £1,880 million.

22. We conducted a sensitivities analysis to test the robustness of the Test to varying assumptions.

Probability that not all developments that failed the Test would result in new entry

23. The first sensitivity allowed for the possibility that not all developments deterred by the Test would result in new entry. We thought this more likely to occur for extensions rather than for new stores. When an extension does not result in a competitor development, the costs of the extension not being built in the local area would remain for that extension over the period of the model. We performed break-even calculations to estimate what the proportion of extensions that did not lead to a competitor development would have to be to give a zero NPV. We found that when the proportion of extensions that did not lead to a competitor development fell to 61 per cent the NPV for extensions was zero. The overall NPV (for extensions and

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[4]The model calculates the NPV of each store development in the start year of the development for each of the years covered by the model, then discounts the NPVs back to the start of the model.

new stores) was zero when the proportion of extensions that did not lead to a competitor development fell to 53 per cent.

24. In paragraph 5.60 of the provisional decision we compared retailers' planned extensions with (i) existing stores at mid-2006 and (ii) the retailer's lists of areas they would be interested in entering in order to assess the likelihood of competitors entering or extending in a highly-concentrated local area where an extension would have been blocked by the Test. We noted a large proportion of the extensions were in areas where either a competitor was already present (around 85 per cent of planned extensions) or were in areas where another retailer had expressed interest in entering the area (in around 10 per cent of the remaining 15 per cent). In our view, the results of this analysis suggest that, in a substantial majority of cases where the Test limited the strong incumbent's extension, a competitor would be likely to enter or expand. Therefore we consider that the level of entry will be well above the 61 per cent level that the probability calculation shows would make the Test unprofitable for extensions alone.[5]

25. The impact of reducing the probability of entry is shown in Table 4.

TABLE 4 **Impact of probability of entry on NPV**

NPV £ million	*New build*	*Extensions*	*Total**
Base case: probability of entry for extensions 100%	434	1,562	1,880
Probability of entry for extensions 90%	434	1,163	1,480
Probability of entry for extensions 80%	434	764	1,081
Probability of entry for extensions 70%	434	364	681
Probability of entry for extensions 60%	434	–35	282
Probability of entry for extensions 50%	434	–434	–117
Probability of entry for extensions 61%	434	0	317
Probability of entry for extensions 53%	434	–317	0

Source: CC analysis.

*Note that all of the total NPVs in the tables include admin costs so the figures are not additive across the row.

[5]We also note that we have already conservatively assumed that small extensions in single fascia areas will not be replaced and will result in a continuing welfare cost over the life of the model.

The effect of using different cost-benefit assumptions

26. The second sensitivity looked at the effect of using the less conservative calibration 2 assumptions detailed in Table 3 and Appendix A. If the calibration 2 figures are used instead the NPV increases significantly, as shown in Table 5. As we described in paragraph 17 we have conservatively used the baseline calibration assumptions in our evaluation of the remaining costs and benefits of the Test.

TABLE 5 **Impact of using different calibration assumptions**

NPV £ million	*New build*	*Extensions*	*Total*
Base case: uses baseline calibration assumptions	434	1,562	1,880
Calibration 2 assumptions	1,367	3,002	4,252

Source: CC analysis.

Reduction in the number of developments affected by the Test

27. We looked at sensitivities that reflected reductions in the number of developments affected by the Test. The first concerned a reduction in the number of stores affected by the Test. We have no reason to believe that the number of developments should be reduced and we note the later assessment performed by Tesco on developments from 2006 to 2008 produced similar results for the number of developments that would have been affected by the Test (see Appendix C). Table 6 shows that the NPV remains strongly positive when the number of stores is reduced significantly.

TABLE 6 **Reduced number of stores affected by the Test**

NPV £ million	*New build*	*Extensions*	*Total*
Base case: Number of new-build stores is 3, number of extensions is 26	434	1,562	1,880
Reduction by 10%	391	1,406	1,680
Reduction by 20%	348	1,250	1,480
Reduction by 30%	304	1,094	1,280
Reduction by 40%	261	937	1,081
Reduction by 50%	217	781	881

Source: CC analysis.

28. The second sensitivity looked at the impact of assuming an annual decline in the impact of the Test. The NPV remains strongly positive to large annual reductions in the impact of the Test, even when large reductions of 5 per cent a year are assumed.

TABLE 7 **Impact of assuming an annual decline in the impact of the Test**

NPV £ million	*New build*	*Extensions*	*Total*
Base case:	434	1,562	1,880
Annual reduction of 1%	388	1,392	1,663
Annual reduction of 2%	348	1,244	1,475
Annual reduction of 3%	313	1,117	1,313
Annual reduction of 4%	283	1,005	1,171
Annual reduction of 5%	257	909	1,048

Source: CC analysis.

The effect of delay

29. We also looked at sensitivities that reflected the effect of the market taking longer to adjust to the introduction of the Test. We tested the impact of assuming that all extensions deterred by the Test have an initial four-year delay, reducing to one year after four years. To model the most extreme cases we also assumed that there was a permanent four-year delay for all extensions. Finally we assessed the impact of a zero delay after the transition period for all extensions. The impact of these assumptions is shown in Table 8. Increased delay reduces the NPV but in all cases the NPV is still strongly positive.

TABLE 8 **Impact of assuming longer delay**

NPV £ million	*New build*	*Extensions*	*Total*
Base case: for new build assumes 1 year delay falling to zero after 1 year; single-fascia store small extension N/A; new store replacements for deterred extensions 4-year delay falling to 1 year after 4 years, extension replacements for deterred extensions 1-year delay falling to zero after 1 year	434	1,562	1,880
Low case 1: all extensions deterred by the Test have a 4-year delay falling to 1 year after 4 years	434	1,452	1,769
Low case 2: all extensions subject to 4-year delay throughout	434	850	1,167
High case: zero delay after transition period	434	1,701	2,018

Source: CC analysis.

Adjusting the thresholds for large extensions

30. In paragraph 8 we explained that we assumed that small extensions to stores in local areas with only one fascia would not be replaced, and small extensions in local areas with more than one fascia would only be replaced by a small extension to a small competitor store. Our base case uses a threshold of 300 sq metres grocery sales area to define small extensions that fall into these two categories. Table 9 shows the

impact of increasing the threshold. Increasing the threshold to 500 sq metres and 700 sq metres still results in strong positive valuations for the Test.

TABLE 9 **Impact of changing the small store extension threshold**

NPV £ million	*New build*	*Extensions*	*Total*
Base case: threshold of 300 m2 GSA, (766m2 NSA) for single-fascia store extensions that do not get built, 300m2 GSA (1,098 NSA) for extensions in local areas with more than one fascia where a small incumbent extension replaces the extension	434	1,562	1,880
Threshold increased to 500 m2 GSA, (901m2 NSA) for single-fascia store extensions that do not get built, 500m2 GSA (1,055 NSA) for extensions in local areas with more than one fascia where a small incumbent extension replaces the extension	434	1,142	1,459
Threshold increased to 700 m2 GSA, (1,121m2 NSA) for single-fascia store extensions that do not get built, 700m2 GSA (1,535 NSA) for extensions in local areas with more than one fascia where a small incumbent extension replaces the extension	434	821	1,138

Source: CC analysis.

Shorter time period for the model

31. The final sensitivity concerns the impact of shortening the timeframe of the model. Table 10 shows the impact of reducing the time period. Using a shorter time period helps to account for if the nature of the market, and particularly the way that grocery retailers developed stores, was to change significantly in future,[6] although there is no suggestion that this may be the case. The NPV is robust to reducing the time period significantly.

TABLE 10 **Impact of reducing the time period**

NPV £ million	*New build*	*Extensions*	*Total*
Base case: 25 years	434	1,562	1,880
20 years	373	1,340	1,612
15 years	300	1,075	1,293
10 years	214	761	915

Source: CC analysis.

Downside scenario

32. The impact of combining a number of sensitivities to reflect a substantial downside scenario was also examined. The following combined sensitivity was calculated:

- a 2 per cent decline a year in the impact of the Test;

[6]For example if the retailers developed larger stores, but substantially fewer stores overall.

- probability of entry for extensions 90 per cent (note stores under 300 sq metres grocery sales area are still assumed not to result in competitor entry in single-fascia areas);
- all extensions are delayed for four years, falling to one year after four years; and
- timeframe for the model of 15 years.

33. The NPV for this scenario remains positive at £789 million as shown in Table 11.

TABLE 11 **Compound scenario**

NPV £ million	*New build*	*Extensions*	*Total*
Compound scenario. 2% decline a year in the impact of the Test; Probability of entry for extensions 90%; All extensions delayed for 4 years, falling to 1 year after 4 years; and timeframe for the model of 15 years	259	612	789

Source: CC analysis.

Discussion of Tesco's proposed approach

1. Tesco proposed an alternative approach to assess the costs and benefits from the Test. This appendix sets out our current thinking about Tesco's approach, indicates our reservations with that approach, and shows that if we adjust the approach to account for our reservations it yields results which are broadly similar to our preferred approach.[1]

Tesco's approach

2. To assess the annual net benefits from a replacement development from a new entrant or weak competitor (the annual net benefits from the Test), Tesco suggested using the reduction in profits at all incumbent stores resulting from an additional fascia competing in the local market as a proxy. Tesco assumed that this reduction in profit margins was 1.9 per cent.

3. To assess the annual delay costs from a blocked incumbent development, Tesco first estimated gross profits at the blocked store. Second, it related foregone consumer welfare to gross profits by assuming a log linear demand curve and a profit margin of 15 per cent. Under these assumptions the delay costs from a blocked store amount to 116 per cent of gross profits.

4. In addition to calculating the costs and benefits of the Test, Tesco has predicted the effect of the Test on retail developments and derived an NPV for the Test. Tesco used a discount rate of 3.5 per cent and used its knowledge of the market to make assumptions about:
   - the number of developments that would be blocked by the Test;

[1] In this appendix we refer throughout to Tesco's submission of 26 June 2009, available on the CC website.

- the likelihood of blocked developments being replaced; and
- the time it would take to replace a blocked development.

5. Tesco calculated the number of developments that would be blocked by the Test based on mid-2006 to end 2008 data. From this data, Tesco estimated that there would be 26 blocked developments each year as a result of the Test, of which 4.4 would be new-build stores or off-site replacements and 21.6 would be extensions or on site rebuilds.

6. Tesco also calculated the likelihood of developments being replaced by a competitor development. Tesco applied what it described as a detailed, iterative and expert-led process to evaluate this based on the characteristics of the site, its knowledge of the interests and behaviour of other retailers in the area and the characteristics of the local area including the views of the LPA on grocery development. Tesco concluded that 8 per cent of the 26 developments would be replaced in a timely manner, a further 5 per cent would be replaced but with a delay and in 87 per cent of cases there was no obvious prospect of replacement entry.

7. Tesco also calculated the likely delay for a competitor to enter. Using a similar approach to that described by the CC in paragraphs 5.49 to 5.65 of the provisional decision, Tesco calculated three delay periods for a new retailer to assemble a site and gain planning permission which totalled four years plus an unquantified time required to search for a site.

Our views on Tesco's approach

8. We think that Tesco's approach is useful and captures parts of the costs and benefits of the Test that we consider relevant. We have some important concerns, however, about certain aspects of its methodology and assumptions.

Assessment of benefits

9. In general, there are two sources of consumer benefits from more competition:

- A benefit to existing customers through an improved offering (higher quality in our market model).
- A benefit stemming from an increase in demand at all large stores through an improved offering.

10. Tesco's approach takes into account the first source of consumer benefits but not the second. There is therefore, in our view, a downward bias in Tesco's approach that depends on how many customers switch from convenience and mid-sized stores to large ones as a response to an improvement in quality.

11. Second, Tesco suggests using 1.9 per cent as the relevant reduction in the profit margin upon a new fascia entry. We note that this number is based on average estimates for all markets from our margin concentration analysis instead of an estimate based on highly-concentrated areas only. In Appendix A we set out our reasons for thinking that the effect of a new competitor in highly-concentrated areas can be up to four times as large as its impact in an average market. We think that the estimates for average markets need to be adjusted upwards to reflect that the analysis here is solely concerned with highly-concentrated areas.

12. Moreover, we do not agree with Tesco's derivation of the 1.9 per cent from our margin concentration analysis. Tesco argued that the reduction in profit margin which was relevant for the assessment of the benefits of the Test should only incorporate the impact of a new fascia in a local area without at the same time capturing the impact of an additional store, and that 3.79 per cent reflected both the effect of an additional store and an additional fascia in the market. We agree. However, Tesco claimed that models 1 and 2 in Table 1 of Supplement 1 to Appendix 4.4 suggest that

the effect of a new fascia in isolation (ie keeping the number of stores constant) was just 1.9 per cent, ie half the size of 3.79 per cent.

13. The models mentioned above examine the impact of the number of competitor fascias (model 1) and the number of competitor stores (model 2) on a centre store's profit margin. The results imply that the impact of a single new *fascia* store on the centre store profit margin is twice as high as the impact of a single new *competitor* store. From these results, Tesco concluded that the impact of adding a new store was roughly equal to the impact of having an additional fascia (while keeping the number of stores constant) in the local area.[2]

14. We disagree. The definition of competitor stores in the regressions above includes both those stores that are owned by a competitor fascia and those that are owned by the centre store fascia. The estimate of the impact of a competitor store in model 2 therefore captures both the effect of a new fascia and a new store on incumbent profit margins. Any estimate that would isolate the impact of a new store by holding the number of fascias constant would therefore be much lower. This implies that while the average impact from an additional fascia might be lower than 3.79 per cent, it would be considerably higher than 1.9 per cent.

15. In addition, the Test leads to a benefit to consumers at all stores in a local area, ie there will be a benefit both to consumers who continue to shop at the incumbent store or stores as well as to consumers who shop at a new store. It is not clear whether benefits to consumers at new stores are taken into account in Tesco's approach.

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[2]We assume that Tesco's reasoning is as follows: the estimate from model 2 measures the effect of a new store, while the difference between the estimate of model 1 and model 2 measures the impact of a new fascia holding the number of stores constant. Since the estimate from model 1 is twice as high as the estimate from model 2, it follows that the difference between the estimates from model 1 and 2 is about the same size as the estimate from model 2.

Assessment of costs

16. Tesco used a log linear demand function. The use of a log linear demand function has some implications which in our view are inconsistent with results established during the groceries market investigation. In particular, a log linear demand function implies that the competitive offering of each store is independent from the competitive offering of its competitors.[3] Put differently, under log linear demand stores do not compete with each other. This contradicts findings in the groceries market investigation which showed that large stores impose a competitive constraint on each other.

17. Second, a log linear demand function predicts that some consumers would benefit excessively from a new store. In general, consumer surplus is the difference between what customers are willing to pay for a product and what they actually have to pay for it. A log linear demand function overstates consumer surplus in this context since it presumes that customers are willing to pay an infinite amount for the first units of the product under consideration. Put in our context, log linear demand predicts that some customers derive a very large (possibly infinite) benefit from having the opportunity to shop at a new large store.[4]

18. Moreover, we think that Tesco's approach overestimates the costs arising from the Test by counting the consumer surplus attributable to all the sales at the blocked store as consumer detriment. This overestimates the market expansion effect since a new store will attract some demand from existing large stores.

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[3]Log linear demand functions are therefore generally not considered to be well suited to model strategic interaction between firms. See J. Tirole, *The Theory of Industrial Organization*, p288.

[4]We are aware that views may differ on the most appropriate functional form to use and in particular that during the Somerfield/ Morrisons merger inquiry a particular view was taken on the appropriate assumptions in that case. However, in relation to the analysis of the issues at hand we believe the assumption of a linear demand to be justified for the reasons we have given. This reflects our current understanding of the nature of competition in this sector as well as established practice in modelling of similar scenarios.

Number of developments that would be deterred by the Test

19. Tesco's estimates are not substantially different to our estimates of 26 extensions and three new-build stores that would be deterred by the Test.

Likelihood of deterred developments being replaced

20. We have not considered Tesco's assumptions about the likelihood of replacement, since we did not consider it practicable to assess possible developments on a site-by-site basis, for the reasons given in paragraph 3.3 of the provisional decision. Such assessment would overly rely on individual judgements and any consideration of current circumstances may not reliably represent situations that might arise once the Test is in force.

21. However, in conducting our numerical analysis, we used various assumptions regarding the likelihood of entry, and conducted a sensitivity analysis to see the effect of varying those assumptions (see Appendix B).

Time it would take to replace a deterred development

22. The four years (plus search time) is not dissimilar to our four-year estimate of the time required to assemble a site and gain planning permission. We used retailer estimates of the total development time, however, which allows for the fact that some of the process may not be sequential.

23. However, Tesco assumed that this period would always apply, while our view is that once the Test is in place, incumbents will not have an inherent advantage in every case, with the result that the Test will not cause a delay once there is sufficient demand in a local area to justify a new store or expansion. In the case of an extension where there is just a single fascia in the local area, we allow for a persistent delay before a competitor enters with a new store.

Incorporating our concerns within Tesco's approach

24. We have, where possible, adapted Tesco's approach to reflect some assumptions that we consider to be more appropriate, whilst maintaining the simplicity of its approach. This section demonstrates that if we do so, Tesco's approach yields similar results to ours.

25. For illustrative purposes, we consider a monopoly store in a highly-concentrated local area where the incumbent could not develop a second store. We assume that:

- all stores have sales of £10 million a year;
- stores have a gross profit margin of 15 per cent (as suggested by Tesco);
- a discount rate of 3.5 per cent applies;
- there is a one-year delay before the competitor store is developed; and
- stores operate for 25 years.

26. Tesco's approach would lead to the following results:

- By applying a change in gross profit margins of 2 per cent to a single store,[5] the predicted annual net benefit would be £30,000.
- The annual delay costs are calculated as 116 per cent of gross profits or £1.74 million.

27. If we were to use Tesco's assumptions from paragraph 26 the NPV of the Test for each delayed store would be negative and the Test would lower the NPV of consumer welfare by around –£1.25 million.[6] Put differently, for the Test to have a positive impact on consumer welfare, the benefits from increased competition would have had to exceed £106,000 a year.

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[5]As mentioned above it is not clear to us whether Tesco's model accounts for the benefits of consumers at the new store as well. Our interpretation here is that those consumers are not included.

[6]This assumes a cashflow in the first year of –£1.7 million followed by positive cashflows of £30,000 for 25 years.

28. To derive the annual benefits from the Test, however, we consider it appropriate to assume that (i) the reduction of profit margins is higher in highly-concentrated areas and that (ii) competition attracts additional consumers to large stores. Under these assumptions we believe that a 7 per cent reduction in profit margins at each store would still be an underestimate. Applying a 7 per cent margin reduction at both stores we obtain an annual net benefit of £210,000. Hence, even if we thought that Tesco's calculation of delay costs were correct (which as discussed above we do not) the benefits from the Test would be twice as large as those necessary to yield a positive overall consumer welfare impact of the Test.

29. To derive the annual costs from the Test, we consider it more appropriate (i) to use a linear demand function and (ii) to take into account that a new large store will attract consumers from other large stores. Under these assumptions consumer surplus derived from a new store is below 50 per cent of the store's gross profits, ie below £750,000. Given even these costs, the Test would increase consumer welfare as soon as the benefits from increased competition exceeded £45,700 in our scenario.

30. Hence, by partly correcting for the overestimation of costs and the underestimation of benefits, we find that the benefits are between four and five times as large as those benefits necessary to yield a positive impact on consumer welfare.

Provisional conclusion

31. Our calculation of the NPV of the Test is substantially different from Tesco's. Our base case valuation for the Test is £1.9 billion over the 25-year life of the model. This compares with Tesco's valuation of –£321 million a year. This is due to the substantial differences in our assumptions for the probability of entry and other economic concerns over the Tesco approach. We considered that the Test would produce a net

benefit if up to 40 per cent of extensions prevented by the Test were not replaced (a figure that does not take into account the possible effect of the LPA override).

32. Tesco's approach yields results broadly in line with ours when our concerns are taken into account. However, the Tesco model does not capture all our concerns. For example, it does not take account of the benefit to consumers who respond to quality improvements by switching from smaller stores to large ones, or the market expansion effect resulting from a new store. Nor does it capture different market structures and different developments.

33. On the basis of the information currently available to us, we therefore think that our market model (set out in detail in Appendix A), while in part based on similar principles, arrives at more realistic estimates of the welfare consequences from the Test.