

An assessment of geographic market definition in the UK groceries market

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1. My name is Jerry A. Hausman. I am the MacDonalld Professor of Economics at the Massachusetts Institute of Technology (MIT) in Cambridge, MA. I have been a faculty member at MIT for 34 years. I received an A.B. degree from Brown University and a B.Phil. and D. Phil. (Ph.D.) in Economics from Oxford University where I was a Marshall Scholar. My academic and research specialties are econometrics, the use of statistical models and techniques on economic data, and microeconomics, the study of consumer behavior and the behavior of firms.
2. In December 1985, I received the John Bates Clark Award of the American Economic Association for the most “significant contributions to economics” by an economist under forty years of age. I have received numerous other academic and economic society awards, including the Frisch Medal for the best applied paper in Econometrica, the leading international econometrics journal, over a 5 year period. My curriculum vitae, including a listing of my articles and presentations in the last ten years, is attached as Exhibit A.
3. I have conducted significant academic research regarding the economics of the retail food industry in the U.S. In the 1990s I did research and published academic papers on a number of products including retailing of cereal, beer, and tissue. I also developed a “merger simulation model” for differentiated products that has been widely adopted, and I applied the model to analyzing mergers for products sold in supermarkets in a number of countries including the UK, the US, France, and Australia. More recently I have completed academic research on the effect of Wal-Mart on the retail food industry in the U.S.: “CPI Bias from Supercenters: Does the BLS Know that Wal-Mart Exists?”, forthcoming in E. Diewart and C. Hulten eds. and “Consumer

Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart,” forthcoming Journal of Applied Econometrics.

4. Counsel for Tesco has asked me to review the recent submission by the CC in which the CC concludes that geographic markets for retail food outlets in the UK are local, and in particular to consider:
 - i). the economic analysis employed by the CC to support its geographic market definition finding;
 - ii). the analysis employed by the CC to dismiss Tesco’s SSNIP model for geographic market definition;
 - iii). the CC’s econometric margin-concentration analysis.

5. While I have some significant concerns over the econometric model specifications and techniques in the submission, I have been unable to investigate these concerns because of lack of access to the data used by the CC. Indeed, I have been unable to interpret much of the CC’s econometrics because of deletion of company names. I would be prepared to sign a confidentiality agreement to access the data and econometric results. For now, I will accept much of the CC’s econometric analysis and interpret the results as presented.

6. Counsel for Tesco has also asked me to consider the analysis employed by RBB Economics to dismiss Tesco’s SSNIP model for geographic market definition.
 - A. The importance of Marginal Customers

7. The CC concludes that the geographic scope of relevant markets is local, within a 10 or 15 minute drive-time of a given store. This conclusion appears to conflict with the CC’s own evidence on customer behavior and with information from Tesco about the shopping patterns of customers around its stores (using data from its Clubcard shopper card).

8. According to the hypothetical monopolist (SSNIP) approach, product market or geographic market definition when price discrimination is not feasible involves identifying the smallest set of products for which a hypothetical monopolist could profitably raise price a significant amount (typically 5%) above the competitive level for a sustained period of time. Thus, under the hypothetical monopolist approach, a potential market definition is too narrow if, in the face of a 5% price increase, the number of customers who switch to suppliers outside the "geographic market" is sufficiently large to make the price increase unprofitable. Economists refer to the customers who switch to purchases outside the geographic market at the increased price as "marginal" customers. For small price increases they switch from the products inside the putative geographic "market" to products outside the market. However, not all customers are marginal customers. Indeed, in the typical case most customers would continue to purchase the product inside the market despite the higher price because their willingness to switch to the product outside the market to obtain a lower price is outweighed by increased transportation costs, the value of time, or other switching costs. Economists refer to this group of customers as "inframarginal." However, even though the large majority of customers may be inframarginal, only a relatively small proportion of customers are necessary to defeat a price increase.
9. To illustrate, suppose that the demand for a product is somewhat elastic, e.g., a 5% price increase will result in a 10% decrease in the quantity sold. For a 5% price increase, 10% of the original demand is from marginal customers who switch in response to the price increase. The other 90% of the original demand is from inframarginal customers who continue to purchase at the higher price. Even though the inframarginal customers outnumber the marginal customers nine to one, the number of marginal customers may be sufficiently large to make the 5% price increase unprofitable for the hypothetical monopolist. With each lost marginal customer the hypothetical monopolist loses the entire incremental profit of that sale, while for each retained inframarginal sale the hypothetical monopolist gains only 5% of the

original selling price. Thus, whether the price increase will be profitable depends on the product's incremental profitability (measured by the ratio of price to marginal cost) prior to the price increase. For example, if price is twice marginal cost, the incremental profit lost on the marginal 10% will exceed the incremental profit gained on the inframarginal 90%. This example illustrates the general principle that only a relatively small number of marginal customers is required to defeat a price increase.

10. I understand that there is some dispute about the level of margins that it is appropriate to use.
 - i). Tesco's commercial gross margin is about []%
 - ii). Tesco's SSNIP test model uses a margin of []%, which assumes that the hypothetical monopolist can save variable store costs when customers switch away.
11. The CC's margin-concentration econometrics use a margin of []% for Tesco, which assumes the hypothetical monopolist can save all store costs except property costs which are assumed fixed.
12. In my view the correct approach is to consider the change in variable costs that approximates the size of the price increase by the hypothetical monopolist. While my results are not especially sensitive to the particular gross margin I use, the Tesco gross margin of []% seems most appropriate to use. I also calculate results for the other gross margin calculations.¹
13. For a 5% SSNIP to be unprofitable, the following proportions of revenues would need to switch away from the hypothetical monopolist using a calculation to be explained in equation (4) below:²

¹ I do not have gross margins for other supermarket chains in the UK. However, I note that Tesco's customer base seems to be approximately the "average" for the UK.

² These calculations of the proportion of store revenues would be equivalent to the proportion of customers, only if all customers have the same size basket

Table 1: Required Proportion of Revenues to Defeat a Hypothetical 5% Price increase

<u>Margin Used</u>	<u>% Needed to Switch</u>
Tesco Commercial gross margin	[] %
Tesco’s estimated SSNIP margin	[] %
CC’s estimated store margin	[] %

Thus, the proportion of marginal volume that needs to switch to defeat a 5% price increase varies between [] % and [] %. Even if [] % of customers shop “close to home”, sufficient marginal customers may well exist to defeat a 5% price increase.

14. The CC has focused its attention not on the behavior of marginal customers but on average customers. The CC reports that customers on average travel no more than 10 minutes and has provided these averages only on a regional basis. I reproduce below the CC’s Table 6 from its Market Definition submission.

TABLE 6 Cumulative distribution of shopper drive-times*

All stores	<i>Cumulative % of shoppers</i>						
	<i>Drive-time (mins)</i>						
	<i>0–5</i>	<i>5–10</i>	<i>10–15</i>	<i>15–20</i>	<i>20–25</i>	<i>25–30</i>	<i>Over 30</i>
All regions	38	70	85	92	95	97	100
East Midlands	32	65	82	90	94	96	100
East of England	37	66	83	91	95	97	100
London	46	77	88	94	97	98	100
North East	37	70	85	93	96	97	100
North West	39	76	89	94	97	98	100
Scotland	40	70	83	90	94	96	100
South East	38	71	86	93	96	98	100
South West	39	67	82	91	95	97	100
Wales	33	64	79	88	93	96	100
West Midlands	37	70	87	94	97	98	100
Yorkshire and The Humber	36	68	83	92	96	98	100

Source: CC analysis of TNS SuperPanel data.

The CC claims that these data show that “the vast majority” of customers shop locally. This claim is true. But these data do not demonstrate that the market is 10 minutes or even 15 minutes.

15. In my view this evidence confuses the issue of average customer drive-times with marginal customer behavior. Using Tesco’s estimated SSNIP gross margin of []% only []% of customers need to switch away for a SSNIP to be unprofitable. Suppose that the hypothetical market was 10 minutes – i.e. the hypothetical monopolist owned all the stores within a 10 minute drive time. The CC’s Table 6 (above) would suggest that the hypothetical monopolist would serve a large number of customers from outside that 10 minute drive time. Although these customers live outside the boundary of the putative ‘market’, as customers of the hypothetical monopolist they could nonetheless undermine an attempt to increase prices by switching away. In fact, if we supposed that all and only these customers switched away, the data in Table 6 and Tesco’s estimated SSNIP gross margin would suggest that in no region would a hypothetical 5% price increase be profitable. As I discuss below, this outcome is likely to understate the amount of switching.
16. The CC’s analysis is aggregated to regional level. To properly understand the local market for each store it would be necessary to understand the drivetime pattern around each store. Tesco have provided me with data on the drivetime distributions around each of their stores combined with purchase volumes of shoppers. I have looked at stores above 15,000 sq. ft which I understand correspond to the CC’s previous definition of a one-stop shop.
17. I find that from this data, using the Tesco estimated SSNIP gross margin that for 78% of stores the market is wider than 10 minutes and for 35% of stores the market is wider than 15 minutes. Using the CC’s more conservative margin assumption I estimate that for 64% of stores the market must be wider than 10 minutes and for 21% the market must be wider than 15 minutes. Thus, I find a significant proportion of markets which are larger than the CC analysis claims to be the case.

18. Note that these findings are not a full application of the SSNIP test, since I have assumed that all the customers living within the 10 minute ‘market’ stay with the hypothetical monopolist. This assumption is quite conservative because it omits three further sources of customer switching. Firstly it does not consider the switching of those customers to stores located outside the 10 minute boundary. Secondly it does not consider switching of consumers away from large supermarkets to other non-large supermarket outlets within the market when prices increase. Finally, the approach also does not consider any reduction in purchases of food for home usage as a result of higher prices. A full application of the SSNIP test would take account of switching from customers both inside and outside the putative geographic market. Once account is taken of switching by customers within the market to other outlets or to other goods, the market size calculations would increase further. As I have demonstrated above, in many cases switching from those customers living outside the drive time boundary alone would be sufficient to defeat a price increase by the hypothetical monopolist. Taking account of both sources of switching would tend to suggest even wider markets.

B. Analysis of the RBB Economics Submission

19. RBB Economics has submitted a paper that considers geographic market definition. RBB recognizes that the hypothetical monopolist (SSNIP) approach is the correct approach. However, RBB claims that quantitative analysis should not be used with the hypothetical monopolist test in the current situation. I find this position to be extremely misguided. RBB attempts to state that a qualitative approach is superior to a quantitative approach. RBB fails to realize that the CC has already performed an econometric quantitative analysis which demonstrates that a 10 minute or 15 minute drive-time market is too narrow and demonstrates the error in the RBB approach. I return to this issue below.
20. The major criticism that RBB makes of the quantitative test that Tesco has submitted is that it ignores “price flexing.” (¶ 2.2, p. 8). RBB refers the

assumption of “no price flexing” as “the most serious flaw in the Tesco methodology.” (¶ 2.2.1, p. 9)

21. A question arises about how the SSNIP test should be applied. RBB describes a particular price discrimination strategy in which the store at the centre of a market raises price by 5% (RBB uses 5 stores, A, B, C, D, E along a line), while other stores owned by the hypothetical monopolist do not raise price at all. Suppose that stores B, C, and D all had the same volume. If the hypothetical monopolist only increases prices at store C by 5%, then prices in the market have increased by less than 5%, and indeed by less than $(5/3) = 1.67\%$ because of marginal customer substitution to stores B and D. This increase is not sufficient for a SSNIP.
22. When considering hypothetical geographical price discrimination, one needs to ensure that the result does not lead to a de minimus overall price increase. Professor Dennis Carlton, currently the chief economist at the US Department of Justice Antitrust Division has considered this problem of market definition recently. While Professor Carlton does not take a position on whether prices for each product (or here supermarket) should go up by 5%, he posits that the at a minimum the average price should increase by 5%:
- “In this thought experiment of using a hypothetical monopolist, there is not necessarily a unique set of products that determines the market, nor is there an unambiguous methodology of how to raise the price of each product in the market (should each go up by 5 percent or just on average rise by 5 percent?)”³
- Prof. Carlton makes a similar point in another recent paper: “If products are not homogeneous, should each product’s price rise by 5% or should some index rise by 5%?”⁴ Thus, the hypothetical monopolist test uses 5% (or

³ Dennis Carlton, “Market Definition: Use and Abuse,” U.S. DOJ mimeo, 2007, p. 16. For geographic market definition Prof. Carlton states: “I would handle this in the same way as product market definition is handled: by treating location as a product characteristic and asking the same type of questions as one does for inclusion of a product in the market.” Tesco appears to have taken this approach in their model to determine geographic markets.

⁴ Dennis Carlton, “Does Antitrust Need to be Modernized?”, US DOJ mimeo, EAG 07-3 January 2007.

sometimes 10%), because market definition is useful for determining where significant market power can be exercised. A significant increase above competitive prices rules out hypothetical price increases which are too small to be of concern.

23. Subject to the requirement of an average price increase of 5%, RBB might assume that the hypothetical monopolist increases prices at store C by 15% to get a 5% average price increase. But, because of marginal customer substitution to stores B and D where prices have not increased at all, the average will be less than 5%. Indeed, there may be no amount that the hypothetical monopolist could increase the price of C, holding the prices of B and D constant and achieve a profitable 5% overall price increase.
24. Another possibility exists that the price of C could be increased more while the price of B and D could be increased but by lesser amounts. However, when one realizes that above store C (to the north) is store E and below store C (to the south) is store F to which consumers could travel I find it difficult to see that RBB has demonstrated, even with unequal price increases, that a hypothetical monopolist could succeed.
25. In RBB's Brixton example (p. 13) it appears that 7 stores comprise their market. Yet if the single Tesco store increased prices by 5% the average price increase by the hypothetical monopolist is less than 0.71%, because of substitution. In my experience a market definition based on a less than 1% hypothetical price increase would not usually be a concern of competition authorities. As I explained above if the hypothetical price increase of the store in the center were 30% (to attempt to achieve an average 5% increase) the switching away from that store would increase because marginal customers would now be prepared to drive further. It is not clear that an achievable average 5% price increase in the Brixton example is feasible.
26. RBB's basic approach does not make economic sense as it will always lead to a narrow price discrimination geographic market. Consider the Brixton example in Figure 3. Under the assumption of limited product differentiation a hypothetical monopolist could always increase the price at a single store and

marginal customers would go to the nearest store where the hypothetical monopolist had not increased prices. Because the RBB approach does not take account of the need to achieve an average price increase, it only requires that prices increase to a small subset of customers. However, the implication of this approach is that any pair of adjacent stores could form a geographic market. With even limited product differentiation, a hypothetical monopolist of any two such stores could increase prices to some customers. Thus, using the RBB approach the two stores would form a geographic market.

27. As an example consider two supermarkets which are close to each other, say a Tesco and a JS (e.g. near Cromwell Road in London or along a high street elsewhere). Under RBB's approach the hypothetical monopolist increases price at the JS and all price sensitive customers decide to shop at the Tesco where prices have not increased. Thus, the two stores comprise a geographic market under the RBB approach.
28. However, this approach conflicts with the CC's econometric results (to the extent they are correct). For example in Annex A of the May 2007 report the CC uniformly finds an effect in column (1) of each of the tables of entry of a large competitor with 10 minutes drive-time. Yet under the RBB approach the CC should find no effect because the two stores very close to each other should constrain each other to the extent that entry of a new store outside the two store market should have no significant effect on prices (margins) within the market. The CC's results (and basic knowledge) demonstrate that the two stores near each other cannot comprise a relevant market given observed shopper data.

C. Analysis of Price Discrimination of a Hypothetical Monopolist Under Uncertainty

29. There is another consideration that needs to be analyzed in any real-world attempt to introduce profitable price discrimination. Neither the CC nor RBB takes into account that with imperfect targeting of consumers, it becomes much more difficult to profitably price discriminate. I analyze this situation in

my paper, "Market Definition Under Price Discrimination," with G. Leonard and C. Velturo, Antitrust Law Journal, Vol. 64, 1996.

30. An explanation of the difference between the situation with perfect or imperfect targeting of consumers helps clarify the economic point. When monopoly provision of telephone service existed in the US, geographic price discrimination often occurred. For example Stamford CT and White Plains NY are only about 12 miles apart yet in the 1980s had differential residential telephone monthly rates because the Connecticut and New York state utility commissions, who set local telephone rates, used different approaches in regulating the respective telephone companies, Southern New England Telephone company and New York Telephone company.⁵ But this geographic price discrimination worked because even a household in Ridgefield CT which is adjacent to the New York border had no choice in telephone provider. Thus "perfect targeting" existed for geographic price discrimination.
31. However, profitable price discrimination becomes much more difficult if targeting becomes imperfect. If the hypothetical monopolist attempts to increase price, it will lose customers who decide to switch to the lower price alternative that they had previously not purchased. The more imperfect the targeting the more difficult it becomes to price discriminate in a profitable manner. At least in the US the *Merger Guidelines* (1992) has the implicit assumption of "perfect targeting" in considering whether price discrimination markets exist. My paper which describe the correct approach with imperfect targeting was initially used in Federal Trade Commission (FTC) v. RR Donnelley which led to dismissal of the FTC's complaint.
32. Thus, I believe that it is crucial to take account of imperfect targeting because if a hypothetical monopolist supermarket operator in the UK attempted to increase prices by 5%-10% in a given geographic area, many consumers have the ability to travel outside of the geographic area to purchase their food supplies. The choice offered to consumers outside the area would typically be

⁵ New York state had significantly more intra-state toll call activity than Connecticut, a much smaller state.

identical to the choice within the price discrimination area so that the price increase would motivate many customers to shop in the non-discrimination area. In my example a consumer in Ridgefield CT could cross the border to New York to purchase groceries or similarly many consumers in Oxford (where I used to live) could drive to Woodstock to the north or Abingdon to the south to purchase groceries.

33. In what follows I set out in more detail the general conditions for proper consideration of price discrimination in market definition, and consider these in the context of the UK market for groceries.
34. The theory of price discrimination enters into market definition when the hypothetical monopolist would have the ability to distinguish inframarginal customers from marginal customers. If the hypothetical monopolist has the ability to identify the inframarginal customers, it will have the incentive to charge customers different prices depending on their willingness to pay for the product. In particular, the hypothetical monopolist could charge each customer a price above the competitive price, just below the customer's maximum willingness to pay for the product (a price just below where the customer would no longer buy the product). Thus, even though the hypothetical monopolist may not find it profitable to raise price 5% above the competitive level uniformly across all its customers, it may find it profitable to raise price 5% to a certain group (subset) of consumers.⁶ Under the hypothetical monopolist price discrimination approach to market definition, this latter group of customers constitutes a relevant market. Thus, if the hypothetical monopolist could profitably raise price to a subset of its customers, these customers constitute a separate relevant market. If, on the other hand, profitable price discrimination against the subset of customers is not feasible, the subset does not define a separate relevant market. Thus, in

⁶ The question becomes, while a hypothetical supermarket monopolist nationwide could likely increase prices by 5% since consumers would have to travel to Ireland or France to buy groceries, could a hypothetical monopolist in Oxford profitably increase price or would sufficient consumers travel outside the narrowly defined Oxford geographic market to defeat the price increase? By the term "supermarket monopolist" I am using the CC's product market definition and not discussing whether M&S and discounters should be included in the product market.

any particular circumstance the crucial question concerns whether a hypothetical monopolist could profitably price discriminate.

35. Price discrimination is feasible only under certain conditions. The two most important conditions are: first, that the hypothetical monopolist is able to identify the customers to whom price can be increased, and, second, that the product in question cannot be profitably arbitrated. The importance of the first condition is obvious--if the monopolist cannot identify customers who are willing to pay a price above the competitive level, price discrimination is not technically possible, let alone profitable. I will not discuss the second condition since significant resale of food is not likely.
36. Before price discrimination can be used to define markets in a particular merger application, it must be established that a hypothetical monopolist could successfully practice price discrimination. One obvious approach to establishing the feasibility of price discrimination is to demonstrate that price discrimination is currently being practiced by producers in the proposed market. Given that currently uniform national prices are being charged by all the major retailers and the CC has produced no evidence that the quality of service or level of promotions varies systematically by geographic area, I have significant doubts about the feasibility of price discrimination.⁷
37. The first condition, that customers can be identified and targeted, is often difficult to verify. Indeed, in the ALJ (1996) paper my misgivings concerning the use of price discrimination to define markets was based on the failure of this condition to be met in many situations. For example, while information from shopper cards may be able to identify a customer's home address and their typical level of spending, these data would not provide sufficient information to price discriminate effectively between marginal and non-marginal customers. To identify the correct customers for perfect targeting, one would need to know a large amount of information, for example the type of shopping trips which they were carrying out, their views of different

⁷ I am aware that the CC has claimed it finds different variable margins which would signify price discrimination. I define price discrimination as a difference between price and marginal cost, which is the definition used in the Tirole textbook and the Stigler textbooks. I return to this econometric evidence later.

formats and brand of retailer, their place of work (e.g. outside the price discrimination market), the number of cars available to go shopping with, the average weekly food shopping expenditure in all retailers, and the shopper's value of time. While retailers may know something about some of these characteristics at the aggregate level (e.g. from surveys) this information would not make individual targeting possible. If customers with certain characteristics have a higher willingness to pay for the product, due, for instance, to a high value of time to travel outside the geographic market, it would not be sufficient simply to know that those customers existed – the hypothetical monopolist would have to be able to limit the increase in price above the competitive level to those *specific* customers. While supermarkets might have some information because of supermarket shopper cards, the hypothetical monopolist would not have the important information described above which would be needed to do this perfect targeting. Moreover, since customers' behavior is likely to change over time, any information on their past decisions will not be an accurate predictor of their future decisions, further limiting the ability of a retailer to target any price increase. Since perfect targeting is therefore not a credible possibility in this market, I now consider what happens when consumers cannot be targeted with certainty.

38. The hypothetical monopolist will generally not be able to perfectly identify the inframarginal customers who have high willingness to pay. An assessment by a hypothetical monopolist of a customer's willingness to pay will involve substantial uncertainty. Like any guess, this guess can be wrong. A sufficient number of wrong guesses can make the attempt to price discriminate unprofitable. In many cases only a small percentage of wrong guesses is required before an attempt at price discrimination becomes unprofitable. Thus, while the hypothetical monopolist could attempt to increase prices overall in the geographic market and then give coupons to expected marginal customers, errors of both kinds will occur. Some customers who receive the coupons will be inframarginal customers, and, more importantly, some customers who do not receive the coupons will decide to shop outside the

geographic market. I initially consider this second type of error, ignoring the potentially significant costs of giving coupons only to customers identified as potentially marginal.

39. In the case where the hypothetical monopolist cannot perfectly identify the customers to target, the targeting must be correct in a large percentage of cases or the price discrimination attempt will fail to be profitable. Thus, it is insufficient to argue that some inframarginal customers exist (or even that inframarginal customers constitute a majority of purchasers) and that the hypothetical monopolist could raise price to them. This argument is based on the assumption that the hypothetical monopolist can perfectly identify the inframarginal customers. Without such an assumption one cannot decisively conclude that such a group of inframarginal customers indeed corresponds to a relevant market for antitrust analysis. Thus, the claim that the value of time varies across consumers or other switching costs exist is not sufficient to claim that a price discrimination market could exist, unless the hypothetical monopoly is able to perfectly identify and target the inframarginal customers.
40. Suppose that it has been claimed that a subset of customers, called the target group, constitutes a relevant market because it could be targeted by a hypothetical monopolist for a 5% price increase, so that the first source of error does not matter. The target group consists of customers, each of whom purchases spends e_i per week on groceries at the competitive price p_0 . Suppose that some uncertainty exists about whether the customers in the target group actually would pay a price 5% percent above p_0 without switching to supermarkets outside the relevant geographic market. In particular, while a fraction θ of the target group will accept the 5 percent price increase, the remaining $1 - \theta$ will switch to competing supermarkets not controlled by the hypothetical monopolist. The identities of the customers in the θ fraction are unknown to the monopolist.
41. Assuming that the marginal (average variable) cost of production is constant at level c , and ignoring fixed costs, the hypothetical monopolist's profits derived from the target group before attempting any price increase is:

$$\Pi_0 = (p_0 - c)x_0 \quad (1)$$

where I use p_0 as a price index for the typical food basket and the quantity index $x_0 = e/p_0$, which is mean expenditure divided by the price index.⁸ After the hypothetical monopolist increases price by 5 percent to the target group, only θ customers will remain. The rest will switch to supermarket in areas beyond the hypothetical monopolist's control. Thus, the monopolist's profits after the price increase will be

$$\Pi_1 = \{\theta * (1.05 p_0 - c)\}x_0 \quad (2)$$

42. The change in the hypothetical monopolist's profits before and after the price increase is

$$\Pi_1 - \Pi_0 = \{\theta * 0.05 p_0 - (1 - \theta)(p_0 - c)\}x_0 \quad (3)$$

This equation has the following interpretation. For the fraction of customers about whom the hypothetical monopolist has guessed "correctly" (θ), the monopolist gains a 5% price increase, where I am conservatively assuming that despite the 5% price increase consumer buy the same amount of groceries.⁹ However, for the fraction of customers about whom the hypothetical monopolist has guessed incorrectly ($1 - \theta$), the hypothetical monopolist loses the entire incremental profit (the margin of price over marginal cost) since these customers switch to supermarkets outside the area the hypothetical monopolist controls.

43. If the change in profits is positive, the price discrimination attempt is "successful," while if the change is negative, the price discrimination attempt

⁸ Matters are slightly more complicated here because consumers purchase a basket of groceries rather than a single product. Thus, I use a price index and quantity index to return the situation to essentially the single good situation.

⁹ Actually, consumers would probably buy less groceries so profits from the price increase would be less than I calculate. The most recent estimate I found for the own price elasticity of food at home for the UK in 2000 was approximately -0.35.

"fails." Thus, we can solve for the minimum level of θ for which the attempt would be successful:

$$\Pi_1 - \Pi_0 > 0 \quad \text{if } \theta > \frac{p_0 - c}{1.05p_0 - c} \quad (4)$$

Thus, the greater the amount by which the competitive price exceeds marginal costs in an industry, the more important it is for the monopolist to correctly identify the customers who will accept the price increase. Suppose that the competitive price-to-cost ratio is approximately [] (based on Tesco's estimated gross margin of []%) which I understand to be the approximate ratio in the UK supermarket industry.¹⁰ Then, the percentage of correct guesses, θ , must be greater than []% for the price discrimination attempt to be successful. In other words, if the hypothetical monopolist's guess is wrong for more than approximately []% of the customers targeted for the 5% price increase, profits will decline when price is raised by 5%.

44. In this case the proposed market definition based on price discrimination fails. For greater price-to-cost ratios, the losses associated with guessing incorrectly increase (in the form of a greater lost margin on each incorrect guess), with the result that the hypothetical monopolist must guess correctly with even greater frequency to make a price increase profitable. Table 1 provides a break-even analysis of the percentage of discriminatory attempts that must succeed given a specified range of pre-discriminatory price-to-marginal cost ratios.

¹⁰ This ratio is consistent with, but somewhat smaller, than the similar ratio in the U.S.

Table 1

Price to MC ratio	Break even % No price elasticity	Break even % Price elasticity included
1	0.00%	0.00%
1.1	64.52%	65.67%
1.2	76.92%	78.29%
1.25	80.00%	81.42%
1.3	82.19%	83.66%
1.4	85.11%	86.62%
1.5	86.96%	88.51%

For example, if the price-to-cost ratio is 1.1, the hypothetical monopolist must be correct on at least 64.5% while if the price to cost ratio is 1.5 the critical breakeven percentage increases to 87%. If the right hand column of Table 1 I have recalculated the critical breakeven percentage taking into account the price elasticity of food at home. As expected the percentage increase by a small amount, but I will disregard this increase since it is not important and I do not know the accepted elasticity.

45. The economic question then becomes whether the hypothetical monopolist can target consumers within a 10 or 15 minute drive-time market as the CC suggests or are there []% of consumers who live sufficiently close to the edge of the market or work outside the market and whom the hypothetical monopolist could not successfully identify with coupons to make the price discrimination profitable? The answer is an empirical matter but it seems likely that price discrimination could not be profitable in all 10 or 15 minute drive-time local markets in the UK. The calculation that I gave at the beginning of the paper demonstrates this result to hold: in a large majority of situations a sufficient proportion of customers drive more than 10 or 15 minutes to shop to defeat a hypothetical 5% price increase.
46. As an approximation for an illustrative calculation, I assume a 5 mile radius circular market with constant population density. I calculate that only those consumers living within approximately [] of the boundary need to shop outside the market to defeat a price increase. Of course, the hypothetical monopolist might be able to target some of these consumers with targeted

coupons so they would not be subject to the price increase but other consumers who live closer to the center will work outside the local market and will find it convenient to shop on the way home from work to save the 5% price increase. I think the correct conclusion is that with imperfect targeting, the hypothetical monopolist will likely find it extremely difficult to impose a 5% price increase profitably in a local 5 mile radius market.

D. Evidence on Geographic Market Definition in the CC Empirical Analysis

47. I consider the empirical analysis in the CC paper, “Working paper on market definition” (May 2007). The CC infers from the results in Table 8 (¶ 66) that “local market structure is important in determining store performance and that competition is local.” If I assume the correctness of the CC’s econometric analysis (to which I have not had access), I question the CC’s conclusion with respect to market definition. In a differentiated product setting, a common finding is that local competition exists in the sense that some goods are closer competitors to other goods, in the economic sense of higher cross price elasticities. Thus, in my 2002 paper of the tissue market I found that Kleenex and Proctor and Gamble tissue were closer competitors than the Scott brand, which was a lower price brand. Nevertheless, the Scott brand was in the market since it constrained the premium brands price behavior. Thus more “distant” goods in product space can constrain “nearby” goods. I do not think one can conclude that the CC’s finding in Table 8 necessarily imply a small geographic market.
48. In ¶ 10 of Annex A the CC considers various model specification comparing the situation where are no competitor fascia with 10 or 15 minutes’ drive-time and the variable profit when there is at least one competitor fascia within 20 minutes’ drive-time. This situation would seem to be a “natural experiment” where the hypothetical monopolist is observed as an actual

monopolist.¹¹ However, the results in the Tables appear to be internally inconsistent.

49. To the extent that I am interpreting the results correctly (which I may not be), consider Table 11 (an extreme example, but the finding holds generally for the other tables).¹² Columns (1)-(3) find that the maximum effect of large competitor fascia is -0.047. As I understand the CC approach the maximum number of such competitors is 5 so the difference between “monopoly” and “full competition” is approximately -0.235.¹³ Yet the estimate in column (4) of the “natural experiment” of a monopoly situation is estimated to be -0.566 or slightly over 2.4 times as large. Thus, I conclude that either I have misinterpreted the CC results or that the CC econometric analysis has serious problems.

50. These econometrics results also cause me to have grave concerns regarding the CC econometric methodology. Tesco, RBB, and the CC all seem to agree that prices are essentially national prices. Thus, the variable cost must change in response to competitive conditions to cause variable margins to change. As an economist I find it extremely difficult to accept that in Table 10 the company (name unknown to me) increases its variable costs by the equivalent of approximately a 25% change in margin when a large competitor locates within 10 minutes drive time. Even more difficult to accept is that when a large competitor locates within 15 minutes drive time, as in Table 11, the company increases its variable costs by the equivalent of approximately a 57% change in margin. From my experience study the supermarket industry in a number of countries, these changes in variable costs are difficult to believe. Instead, they cause me to have severe doubts about the econometric model specification and the econometric estimation.

51. Another way to consider the results is to assume that with competition the gross margin is approximately [l]. I now use the result of Table 11, column

¹¹ A response might be that potential entry constrains the actual monopolist. If so, the economic analysis would change considerably.

¹² Tables 2, 4, 5, 8, and 11 all display this problem

¹³ I understand that the average number of competing fascia within 10 minutes is approximately 2. If I used the average number of competing fascia, the comparison would be even more extreme.

(4) and compare the situation to a monopoly situation so the margin increases to [1]. This result implies the gross margin increases by over [1] or by 76%, which is too large to be believable.¹⁴ Since the CC has not investigated variable costs so that the margin analysis arises from a “black box” type model, I am especially perplexed by the results. I think a likely explanation is that a significant part of the difference is arising from volume effects that are not being captured by the model specification.

¹⁴ Alternatively, if I use the CC estimate of gross margin of [1], I find an increase to [1]. Thus, the percentage increase is again 76%, as expected.

Exhibit A: Curriculum Vitae

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EDUCATION:

OXFORD UNIVERSITY

D. Phil. 1973 (Ph.D)

B. Phil. 1972

BROWN UNIVERSITY

A.B. (Summa Cum Laude), 1968

THESIS: "A Theoretical and Empirical Study of Vintage Investment and Production in Great Britain,"
Oxford University, 1973.

FELLOWSHIPS, HONORS AND AWARDS:

Phi Beta Kappa

Marshall Scholar at Oxford, 1970-1972

Scholarship at Nuffield College, Oxford, 1971-1972

Fellow, Econometric Society, 1979.

Frisch Medal of the Econometric Society, 1980

Fisher-Schultz Lecture for the Econometric Society, 1982

John Bates Clark Award of the American Economic Association, 1985

Smith Lectures, Brigham Young University 1986

Jacob Marschak Lecture for the Econometric Society, 1988

Hooker Lectures, Macmaster University 1989

Fellow, National Academy of Social Insurance, 1990

American Academy of Arts and Sciences, 1991.

Fellow, Journal of Econometrics, 1998.

Shann Memorial Lecture for the Australian Economics Society, 2003

Cemmap International Fellow, University College London, 2004

Honorary Professor, Xiamen University, 2005

Biennial Medal of the Modelling and Simulation Society of Australia and New Zealand, 2005

Fellow, Modelling and Simulation Society of Australia and New Zealand, 2005

Condliffe Memorial Lecture, University of Canterbury, NZ, 2005

Invited Lecture, Far East Meetings of Econometric Society, Beijing 2006

Keynote Speaker, ACCC Conference, Australia, 2006

EMPLOYMENT:

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

1992- John and Jennie S. MacDonald Professor

1979- Professor, Department of Economics

1976-79 Associate Professor, Department of Economics

1973-76 Assistant Professor, Department of Economics

1972-73 Visiting Scholar, Department of Economics

VISITING APPOINTMENTS:

- 1986-87 Visiting Professor, Harvard Business School
1982-83 Visiting Professor, Harvard University Department of Economics
Visiting Positions: University of Washington, Australian National University, Ecole Normale Supérieure, Oxford University, University of Sydney, Wuhan University, Beijing University, University of Western Australia, University College London, Uppsala University, Xiamen University
- U.S. ARMY, ANCHORAGE, ALASKA
1968-70 Corps of Engineers

PROFESSIONAL ACTIVITIES:

- Associate Editor, Bell Journal of Economics, 1974-1983
Associate Editor, Rand Journal of Economics, 1984-1988
Associate Editor, Econometrica, 1978-1987
Reviewer, Mathematical Reviews, 1978-1980
American Editor, Review of Economic Studies, 1979-82
Associate Editor, Journal of Public Economics, 1982-1998
Associate Editor, Journal of Applied Econometrics, 1985-1993
Advisory Editor, Economics Research Network and Social Science Research , 1998-
Advisory Editor, Journal of Sports Economics, 1999-
Advisory Editor, Journal of Competition Law & Economics, 2004-
Advisory Editor, Journal of Applied Economics, 2005-
Member of MIT Center for Energy and Environmental Policy Research, 1973-1995
Research Associate, National Bureau of Economic Research, 1979-
Member, American Statistical Association Committee on Energy Statistics, 1981-1984
Special Witness (Master) for the Honorable John R. Bartels, U.S. District Court for the Eastern District of New York in Carter vs. Newsday, Inc., 1981-82
Member of Governor's Advisory Council (Massachusetts) for Revenue and Taxation, 1984-1992
Member, Committee on National Statistics, 1985-1990
Member, National Academy of Social Insurance, 1990-
Member, Committee to Revise U.S. Trade Statistics 1990-1992
Director, MIT Telecommunications Economics Research Program, 1988-
Board of Directors, Theseus Institute, France Telecom University, 1988-1995
Member, Conference on Income and Wealth, National Bureau of Economic Research, 1992-
Member, Committee on the Future of Boston, 1998
Member, GAO Expert Panel to advise USDA on Econometric Models of Cattle Prices, 2001-2
Advisor, China Ministry of Information on Telecommunications Regulation, 2002-2006
Member, FTC Panel on Merger Evaluation, 2005

PUBLICATIONS:

I. Econometrics

- "Minimum Mean Square Estimators and Robust Regression," Oxford Bulletin of Statistics, April 1974.
- "Minimum Distance and Maximum Likelihood Estimation of Structural Models in Econometrics," delivered at the European Econometric Congress, Grenoble: August 1974.
- "Full-Information Instrumental Variable Estimation of Simultaneous Equation Models," Annals of Economic and Social Measurement, October 1974.
- "Estimation and Inference in Nonlinear Structural Models," Annals of Economic and Social Measurement, with E. Berndt, R.E. Hall, and B.H. Hall, October 1974.
- "An Instrumental Variable Approach to Full-Information Estimators in Linear and Certain Nonlinear Econometric Models," Econometrica, 43, 1975.
- "Simultaneous Equations with Errors in Variables," Journal of Econometrics 5, 1977.
- "Social Experimentation, Truncated Distributions, and Efficient Estimation," with D. Wise, Econometrica, 45, 1977.
- "A Conditional Probit Model for Qualitative Choice," with D. Wise, Econometrica, 46, 1978.
- "Specification Tests in Econometrics," Econometrica, 46, 1978.
- "Non-Random Missing Data," with A.M. Spence, MIT Working Paper 200, May 1977.
- "Attrition Bias in Experimental and Panel Data: The Gary Income Maintenance Experiment," with D. Wise, Econometrica, 47, 1979.
- "Missing Data and Self Selection in Large Panels," with Z. Griliches and B.H. Hall Annales de l'INSEE, April 1978.
- "Stratification on Endogenous Variables and Estimation," with D. Wise, in The Analysis of Discrete Economic Data, ed. C. Manski and D. McFadden, MIT Press, 1981.
- "Les modèles probit de choix qualitatifs," ("Alternative Conditional Probit Specifications for qualitative Choice.") (English Version), September 1977; EPRI report on discrete choice models, Cahiers du Séminar d'Econometrie, 1980.
- "The Econometrics of Labor Supply on Convex Budget Sets," Economic Letters, 1979.
- "Panel Data and Unobservable Individual Effects," with W. Taylor, Econometrica 49, 1981.
- "Comparing Specification Tests and Classical Tests," with W. Taylor, August 1980, Economic Letters, 1981.
- "The Effect of Time on Economic Experiments," invited paper at Fifth World Econometrics Conference, August 1980; in Advances in Econometrics, ed. W. Hildebrand, Cambridge University Press, 1982.
- "Sample Design Considerations for the Vermont TOD Use Survey," with John Trimble, Journal of Public Use Data, 9, 1981.
- "Identification in Simultaneous Equations Systems with Covariance Restrictions: An Instrumental Variable Interpretation," with W. Taylor, Econometrica, 51, 1983.
- "Stochastic Problems in the Simulation of Labor Supply," in Tax Simulation Models, ed. M. Feldstein, University of Chicago Press, 1983.

- "The Design and Analysis of Social and Economic Experiments," invited paper for 43rd International Statistical Institute Meeting, 1981; Review of the ISI.
- "Specification and Estimation of Simultaneous Equation Models," in Handbook of Econometrics, ed. Z. Griliches and M. Intriligator, vol. 1, 1983.
- "Full-Information Estimators," in Kotz-Johnson, Encyclopedia of Statistical Science, vol. 3, 1983
- "Instrumental Variable Estimation," in Kotz-Johnson, Encyclopedia of Statistical Science, vol. 4, 1984
- "Specification Tests for the Multinomial Logit Model," with D. McFadden, Econometrica, 52, 1984.
- "Econometric Models for Count Data with an Application to the Patents R&D Relationship," with Z. Griliches and B. Hall, Econometrica, 52, 1984.
- "The Econometrics of Nonlinear Budget Sets," Fisher-Shultz lecture for the Econometric Society, Dublin: 1982; Econometrica, 53, 1985.
- "The J-Test as a Hausman Specification Test," with H. Pesaran, Economic Letters, 1983.
- "Seasonal Adjustment with Measurement Error Present," with M. Watson, Journal of the American Statistical Association, 1985.
- "Efficient Estimation and Identification of Simultaneous Equation Models with Covariance Restrictions," with W. Newey and W. Taylor, Econometrica, 55, 1987.
- "Technical Problems in Social Experimentation: Cost Versus Ease of Analysis," with D. Wise, in Social Experimentation, ed. J. Hausman and D. Wise, 1985.
- "Errors in Variables in Panel Data," with Z. Griliches, Journal of Econometrics, 1986.
- "Specifying and Testing Econometric Models for Rank-Ordered Data," with P. Ruud; Journal of Econometrics, 1987.
- "Semiparametric Identification and Estimation of Polynomial Errors in Variables Models," with W. Newey, J. Powell and H. Ichimura, Journal of Econometrics, 1991.
- "Flexible Parametric Estimation of Duration and Competing Risk Models," with A. Han, Journal of Applied Econometrics, 1990.
- "Consistent Estimation of Nonlinear Errors in Variables Models with Few Measurements," with W. Newey and J. Powell, 1987.
- "Optimal Revision and Seasonal Adjustment of Updated Data: Application to Housing Starts," with M. Watson, Journal of the American Statistical Association Proceedings, 1991.
- "Seasonal Adjustment of Trade Data," with R. Judson and M. Watson, ed. R. Baldwin, Behind the Numbers: U.S. Trade in the World Economy, 1992.
- "Nonlinear Errors in Variables: Estimation of Some Engel Curves," Jacob Marschak Lecture of the Econometric Society, Canberra 1988, Journal of Econometrics, 65, 1995.
- "Nonparametric Estimation of Exact Consumers Surplus and Deadweight Loss," with W. Newey, Econometrica, 63, 1995.
- "Misclassification of a Dependent Variable in Qualitative Response Models," with F. Scott-Morton and J. Abrevaya, Journal of Econometrics, 1998.

"Semiparametric Estimation in the Presence of Mismeasured Dependent Variables," with J. Abrevaya, Annales D'Economie et de Statistique, 55-56, 1999.

"A New Specification Test for the Validity of Instrumental Variables," with J. Hahn, Econometrica, 70, 2002.

"Microeconometrics", Journal of Econometrics, 2000.

"Instrumental Variables Estimation for Dynamic Panel Models with Fixed Effects", with J. Hahn and G. Kuersteiner, mimeo May 2001, Journal of Econometrics, 2006/.

"Mismeasured Variables in Econometric Analysis: Problems from the Right and Problems from the Left", Journal of Economic Perspectives, 2001.

"Estimation with Weak Instruments: Accuracy of Higher Order Bias and MSE Approximations", with J. Hahn and G. Kuersteiner, mimeo 2002, Econometrics Journal 2004.

"Notes on Bias in Estimators for Simultaneous Equation Models", with J. Hahn, Economic Letters, 2002

"Triangular Structural Model Specification and Estimation with Application to Causality", Journal of Econometrics, 2003

"Weak Instruments: Diagnosis and Cures in Empirical Econometrics", with J. Hahn, American Economic Review, 2003.

"Instrumental Variable Estimation with Valid and Invalid Instruments", with J. Hahn, August 2003, Annales d'Economie et de Statistique, 2006.

"Difference in Difference Meets Generalized Least Squares: Higher Order Properties of Hypotheses Tests", with G. Kuersteiner, forthcoming Journal of Econometrics

"Response Error in a Transformation Model: Estimation of Wage Equations," with Jason Abrevaya, Econometrics Journal 2004

"Asymptotic Properties of the Hahn-Hausman Test for Weak Instruments", with J. Stock and M. Yogo, Economic Letters, 2005.

"Many Weak Instruments and Microeconomic Practice," with C. Hansen and W. Newey, September 2004, revised July 2005, forthcoming Journal of Business and Economic Statistics.

"Instrumental Variable Estimation as a Projection: Inconsistency Results for LIML and a New Consistent Estimator," with T. Woutersen , August 2004

"A Semi-Parametric Duration Model with Heterogeneity that Does Not Need to be Estimated," with T. Woutersen, Econometric Society World Meetings, London, 2005, Nov 2004.

"Estimating the Derivative Function with Counterfactuals in Duration Models with Heterogeneity," with T. Woutersen, September 2005.

"Using a Laplace Approximation to Estimate the Random Coefficients Logit Model by Non-linear Least Squares", with M. Harding, December 2005, forthcoming International Economic Review.

"Duration Models," forthcoming in the New Palgrave, with T. Woutersen, March 2006.

"Hausman Tests," forthcoming in the International Encyclopedia of the Social Sciences, with H. White, June 2006.

"IV estimation with Heteroskedasticity and Many Instruments," with W. Newey and T. Woutersen, December 2006.

"Testing for Causal effects in a Generalized Regression Model with Endogenous Regressors," with J. Abrevaya and S. Khan, March 2007.

II. Public Finance and Regulation

"The Evaluation of Results from Truncated Samples," with D. Wise, Annals of Economic and Social Measurement, April 1976.

"Discontinuous Budget Constraints and Estimation: The Demand for Housing," with D. Wise, Review of Economic Studies, 1980.

"The Effect of Taxation on Labor Supply: Evaluating the Gary Negative Income Tax Experiment," with G. Burtless, Journal of Political Economy, 1978.

"AFDC Participation -- Permanent or Transitory?," in Papers from the European Econometrics Meetings, ed. E. Charatsis, North Holland: 1981.

"The Effect of Wages, Taxes, and Fixed Costs on Women's Labor Force Participation," Journal of Public Economics, October 1980.

"The Effect of Taxes on Labor Supply," in How Taxes Affect Economic Behavior, ed. H. Aaron and J. Pechman, Brookings: 1981.

"Income and Payroll Tax Policy and Labor Supply," in The Supply Side Effects of Economic Policy, ed. G. Burtless, St. Louis: 1981.

"Individual Retirement Decisions Under an Employer-Provided Pension Plan and Social Security," with G. Burtless, Journal of Public Economics, 1982.

"Individual Retirement and Savings Decisions," with P. Diamond, Journal of Public Economics, 1984.

"Retirement and Unemployment Behavior of Older Men," in H. Aaron and G. Burtless, Retirement and Economic Behavior, Brookings: 1984.

"Tax Policy and Unemployment Insurance Effects on Labor Supply," in Removing Obstacles to Economic Growth, ed. M. Wachter, 1984.

"Family Labor Supply with Taxes," with P. Ruud, American Economic Review, 1984.

"Social Security, Health Status and Retirement," with D. Wise, in Pensions, Labor, and Individual Choice, ed. D. Wise, 1985.

"The Effect of Taxes on Labor Supply," in Handbook on Public Economics, ed. A. Auerbach and M. Feldstein, 1985.

"Choice Under Uncertainty: The Decision to Apply for Disability Insurance," with J. Halpern, Journal of Public Economics, 1986.

"Household Behavior and the Tax Reform Act of 1986," with J. Poterba, Journal of Economic Perspectives, 1987, also published in French in Annales D'Economie et de Statistique, 1988.

"Involuntary Early Retirement and Consumption," with L. Paquette, ed. G. Burtless, Economics of Health and Aging, 1987.

- "Income Taxation and Social Insurance in China," in Sino-U.S. Scholars on Hot Issues in China's Economy, 1990.
- "On Contingent Valuation Measurement of Nonuse Values," with P. Diamond, in Contingent Valuation: A Critical Appraisal, ed. J. Hausman, 1993.
- "Does Contingent Valuation Measure Preferences? Experimental Evidence," with P. Diamond, G. Leonard, M. Denning, in Contingent Valuation: A Critical Appraisal, ed. J. Hausman, 1993.
- "Contingent Valuation: Is Some Number Better than No Number?" with P. Diamond, December 1993, Journal of Economic Perspectives, 8, 1994.
- "A Utility-Consistent Combined Discrete Choice and Count Data Model: Assessing Recreational Use Losses Due to Natural Resource Damage," with G. Leonard and D. McFadden, Journal of Public Economics, 56, 1995.
- "Contingent Valuation Measurement of Nonuse Values," with P. Diamond, ed. R.B. Stewart, Natural Resource Damages: A Legal, Economic, and Policy Analysis, 1995.
- "A Cost of Regulation: Delay in the Introduction of New Telecommunications Services," with T. Tardiff, 1995, ed. A. Dumort and J. Dryden, The Economics of the Information Society, 1997.
- "Valuation and the Effect of Regulation on New Services in Telecommunications," Brookings Papers on Economic Activity: Microeconomics, 1997.
- "Taxation By Telecommunications Regulation," Tax Policy and the Economy, 12, 1998.
- "Taxation by Telecommunications Regulation: The Economics of the E-Rate", AEI Press, 1998.
- "Economic Welfare and Telecommunications Welfare: The E-Rate Policy for Universal Service Subsidies," with H. Shelanski, Yale Journal on Regulation, 16, 1999.
- "Efficiency Effects on the U.S. Economy from Wireless Taxation", National Tax Journal, 2000.
- "Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers", with H. Singer and J.G. Sidak, Yale Journal on Regulation, 18, 2001.
- "Regulating the U.S. Railroads: The Effects of Sunk Costs and Asymmetric Risk," with S. Myers, Journal of Regulatory Economics, 2002.
- "Regulated Costs and Prices in Telecommunications," in G. Madden ed. International Handbook of Telecommunications, 2003.
- Will New Regulation Derail the Railroads?, Competitive Enterprise Institute, October 2001
- "Sources of Bias and Solutions to Bias in the CPI", NBER Discussion paper 9298, Oct. 2002, Journal of Economic Perspectives, 2003.
- CPI Bias from Supercenters: Does the BLS Know that Wal-Mart Exists?, with E. Leibtag, presented at conference on Index Numbers, Vancouver, June 2004, NBER Discussion Paper w10712, August 2004.
- "Did Mandatory Unbundling Achieve Its Purpose? Empirical Evidence from Five Countries," with G. Sidak, Journal of Competitive Law and Economics, 2005.
- "Telecommunications Regulation: Current Approaches with the End in Sight," NBER conference on regulation, September 2005.

"Commentary on International Taxation: Tax Policy when Corporate Profits are a Return to Labor rather than Capital," with Roger Gordon, March 2007

"The Walmart Effect on CPI Construction," with E. Leibtag, January 2007 mimeo

III. Applied Micro Models

"Project Independence Report: A Review of U.S. Energy Needs up to 1985," Bell Journal of Economics, Autumn 1975.

"Individual Discount Rates and the Purchase and Utilization of Energy Using Durables," Bell Journal of Economics, Spring 1979.

"Voluntary Participation in the Arizona Time of Day Electricity Experiment," with D. Aigner, in EPRI Report, Modeling and Analysis of Electricity Demand by Time of Day, 1979; Bell Journal of Economics, 1980.

"A Two-level Electricity Demand Model: Evaluation of the Connecticut Time-of-Day Pricing Test," in EPRI Report, Modeling and Analysis of Electricity Demand by Time of Day, 1979; Journal of Econometrics, 1979.

"Assessing the Potential Demand for Electric Cars," with S. Beggs and S. Cardell, Journal of Econometrics, 1981.

"Assessment and Validation of Energy Models," in Validation and Assessment of Energy Models, ed. S. Gass, Washington: Department of Commerce, 1981.

"Exact Consumer Surplus and Deadweight Loss," American Economic Review, 71, 1981.

"Appliance Purchase and Usage Adaptation to a Permanent Time of Day Electricity Rate Schedule," with J. Trimble, Journal of Econometrics, 1984.

"Evaluating the Costs and Benefits of Appliance Efficiency Standards," with P. Joskow, American Economic Review, 72, 1982.

"Information Costs, Competition and Collective Ratemaking in the Motor Carrier Industry," American University Law Review, 1983.

"An Overview of IFFS," in Intermediate Future Forecasting System, ed. S. Gass et al., Washington: 1983.

"Choice of Conservation Actions in the AHS," in Energy Simulation Models, ed. R. Crow, 1983.

"Patents and R&D: Searching for a Lag Structure," with B. Hall and Z. Griliches, in Actes du Colloque Econometrie de la Recherche, Paris: 1983.

"The Demand for Optional Local Measured Telephone Service," in H. Trebing ed., Adjusting to Regulatory, Pricing and Marketing Realities, East Lansing: 1983.

"Patents and R&D: Is There a Lag?," with B. Hall and Z. Griliches, 1985; International Economic Review, 1986.

"Price Discrimination and Patent Policy," with J. MacKie-Mason, Rand Journal of Economics, 1988.

"Residential End-Use Load Shape Estimation from Whole-House Metered Data," with I. Schick, P. Vsoro, and M. Ruane, IEEE Transactions on Power Systems, 1988.

"Competition in Telecommunications for Large Users in New York," with H. Ware and T. Tardiff, Telecommunications in a Competitive Environment, 1989.

- "Innovation and International Trade Policy," with J. MacKie-Mason, Oxford Review of Economic Policy, 1988.
- "The Evolution of the Central Office Switch Industry," with W. E. Kohlberg, in ed. S. Bradley and J. Hausman, Future Competition in Telecommunications, 1989.
- "Future Competition in Telecommunications," 1987; ed. S. Bradley and J. Hausman, Future Competition in Telecommunications, 1989.
- "Joint Ventures, Strategic Alliances and Collaboration in Telecommunications," Regulation, 1991.
- "An Ordered Probit Model of Intra-day Securities Trading," with A. Lo and C. MacKinlay, Journal of Financial Economics, 1992.
- "A Proposed Method for Analyzing Competition Among Differentiated Products," with G. Leonard and J.D. Zona, Antitrust Law Journal, 60, 1992.
- "Global Competition and Telecommunications," in Bradley, et al., ed., Globalization, Technology and Competition, 1993.
- "The Bell Operating Companies and AT&T Venture Abroad and British Telecom and Others Come to the US," in Bradley, et al., ed., Globalization, Technology and Competition, 1993.
- "The Effects of the Breakup of AT&T on Telephone Penetration in the US," with T. Tardiff and A. Belinfante, American Economic Review, 1993.
- "Competitive Analysis with Differentiated Products," with G. Leonard and D. Zona, Annales, D'Economie et de Statistique, 34, 1994.
- "Proliferation of Networks in Telecommunications," ed. D. Alexander and W. Sichel, Networks, Infrastructure, and the New Task for Regulation, University of Michigan Press, 1996.
- "Valuation of New Goods Under Perfect and Imperfect Competition," ed. T. Bresnahan and R. Gordon, The Economics of New Goods, University of Chicago Press, 1997.
- "Competition in Long Distance and Equipment Markets: Effects of the MFJ," Journal of Managerial and Decision Economics, 1995.
- "State Regulation of Cellular Prices," Wireless Communications Forum, Volume III, April 1995.
- "Efficient Local Exchange Competition," with T. Tardiff, Antitrust Bulletin, 1995.
- "Superstars in the National Basketball Association: Economic Value and Policy," with G. Leonard, Journal of Labor Economics, 15, 4, 1997.
- "Valuation of New Services in Telecommunications," with T. Tardiff, The Economics of the Information Society, ed. A. Dumort and J. Dryden, Office for Official Publications of the European Communities, Luxembourg, 1997.
- "Market Definition Under Price Discrimination," with G. Leonard and C. Velluro, Antitrust Law Journal, Vol. 64, 1996.
- "Characteristics of Demand for Pharmaceutical Products: An Examination of Four Cephalosporins," with S. Fisher Ellison, I. Cockburn and Z. Griliches, Rand Journal of Economics, 28, 3, 1997.
- "Telecommunications: Building the Infrastructure for Value Creation," S. Bradley and R. Nolan, eds. Sense and Respond, 1998.
- "Achieving Competition: Antitrust Policy and Consumer Welfare," with G. Leonard, World Economic Affairs, Vol.

1, No. 2, 1997.

"The CPI Commission and New Goods," The American Economic Review, May 1997.

"Economic Analysis of Differentiated Products Mergers Using Real World Data," with G. Leonard, George Mason Law Review, 5, 3, 1997.

"Cellular Telephone, New Products and the CPI," Journal of Business and Economics Statistics, 1999.

"Regulation by TSLRIC: Economic Effects on Investment and Innovation," Multimedia Und Recht, 1999; also in J.G. Sidak, C. Engel, and G. Knieps eds., Competition and Regulation in Telecommunications, Boston: Kluwer Academic Publishers, 2000.

"Efficiencies from the Consumer Viewpoint," with G. Leonard, George Mason Law Review, 7, 3, 1999.

"The Effect of Sunk Costs in Telecommunication Regulation," in J. Alleman and E. Noam, eds, The New Investment Theory of Real Options and its Implications for Telecommunications Economics, 2002.

"A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks," with J. Gregory Sidak, Yale Law Journal, 1999.

"Competition in U.S. Telecommunications Services Four Years After the 1996 Act, with R. Crandall, in S. Peltzman and C. Winston, eds., Deregulation of Network Industries, 2000.

"Cable Modems and DSL: Broadband Internet Access for Residential Customers," with J. Gregory Sidak, and Hal J. Singer, American Economic Review, 91, 2001

"The Competitive Effects of a New Product Introduction: A Case Study," with G. Leonard, Journal of Industrial Economics, 50, 2002.

"Mobile Telephone," in M. Cave et. al. eds, Handbook of Telecommunications Economics, North Holland, 2002.

"Competition and Regulation for Internet-related Services", in Korea Institute for Industrial Economics and Trade, Industrial Competitiveness and Competition Policy in the Era of Telecommunication Convergence. 2001. (also translated into Korean in a book)

"From 2G to 3G: Wireless Competition for Internet-Related Services," presented at Brookings Conference, October 2001, R. Crandall and J. Alleman ed., Broadband, Brookings, 2002.

"Competition and Regulation for Internet-related Services: Results of Asymmetric Regulation", presented at Columbia Univ. conference, October 2001, R. Crandall and J. Alleman ed., Broadband, Brookings, 2002

"Does Bell Company Entry into Long-Distance Telecommunications Benefit Consumers?," with G. Leonard and J.G. Sidak, Antitrust Law Journal, 70, 2002.

"On Exclusive Membership in Competing Joint Ventures," with G. Leonard and J. Tirole, Rand Journal of Economics, 2003.

"Why do the Poor and the Less-Educated Pay More for Long-Distance Calls?," with J.G. Sidak, Topics in Economics Analysis and Policy 2004.

"Estimation of Patent Licensing Value Using a Flexible Demand Specification", with G. Leonard, forthcoming Journal of Econometrics, 2007.

"Cellular, 3G, Broadband and WiFi", Shann Memorial Lecture, University of Western Australia, March 2003, published in R. Cooper R and G. Madden (eds.) (2004) Frontiers of Broadband, Electronic and

Mobile Commerce, Physica-Verlag.

“Using Merger Simulation Models: Testing the Underlying Assumptions,” with G. Leonard, International Journal of Industrial Organization, 2005

“Competitive Analysis Using a Flexible Demand Specification,” with G. Leonard, Journal of Competitive Law and Economics, 2005.

“Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart,” with E. Leibtag, presented at EC2 conference, Marseille, Dec. 2004, forthcoming Journal of Applied Econometrics.

“Measurement of the Change in Economic Efficiency from New Product Introduction,” with E Berndt, P. Chwelos, and I. Cockburn, August 2005, MIT mimeo, presented At EARIE conference, Porto, September 2005

“Two Sided Markets with Substitution: Mobile Termination Revisited,” with J. Wright, June 2006

“Real Options and Patent Damages: The Legal Treatment of Non-Infringing Alternatives, and Incentives to Innovate,” with G. Leonard, Journal of Economic Surveys, 2006. (reprinted in M. McAleer and L Oxley, eds, Economic and Legal Issues in Intellectual Property (Blackwell, 2007)

“The Falsification of Contingent Valuation: A Case Study,” with T. Bock, October 2006.

“Patent Damages and Real Options: How Judicial Characterization of Non-Infringing Alternatives Reduces Incentives to Innovate,” with G. Leonard and G. Sidak, forthcoming in Berkeley Journal of Law and Technology, 2007.

“Evaluation of Market Power: Prices vs. HHIs,” with G. Sidak, September 2006, forthcoming Antitrust Law Review

JOINT REPORTS, TESTIMONY, AND BOOKS:

"Project Independence: An Economic Analysis," Technology Review, May 1974.

"The FEA's Project Independence Report: Testimony before Joint Economic Committee," U.S. Congress, March 18, 1975.

"The FEA's Project Independence Report: An Analytical Assessment and Evaluation," NSF Report, June 1975.

"Energy Demand in the ERDA Plan," with D. Wood, Energy Laboratory Report, August 1975.

"A Note on Computational Simplifications and Extensions of the Conditional Probit Model," EPRI report on choice models, September 1977.

"Labor Supply Response of Males to a Negative Income Tax," Testimony for U.S. Senate Finance Subcommittee on Public Assistance, November 22, 1978.

"Appliance Choice with Time of Day Pricing," Energy Laboratory Report, January 1980.

"Discrete Choice Models with Uncertain Attributes," Oak Ridge National Laboratories Report, January 1980.

"Individual Savings Behavior," with P. Diamond, Report to the National Commission on Social Security, May 1980.

"Wealth Accumulation and Retirement," with P. Diamond, Report to the Department of Labor, May 1982.

"A Review of IFFS," Report to the Energy Information Agency, February 1982.

"A Model of Heating System and Appliance Choice," with J. Berkovec and J. Rust, Report to the Department of Energy, December 1983.

"Labor Force Behavior of Older Men After Involuntary Job Loss," with L. Paquette, Report to Department of Health and Human Services, December 1985.

"Pollution and Work Days Lost," with D. Wise and B. Ostrow, NBER Working Paper, January 1984; Revised 1985.

"Demand for Interstate Long Distance Telephone Service," with A. Jafee and T. Tardiff, November 1985.

"Competition in the Information Market 1990", August 1990.

"The Welfare Cost to the US Economy of Regulatory Restriction in Telecommunications," January 1995.

"Benefits and Costs of Vertical Integration of Basic and Enhanced Telecommunications Services," April 1995.

"Statement on the Natural Resource Damage Provisions of CERCLA," Testimony before the U.S. Senate Committee on Environment and Public Works, May 11, 1995; Testimony before the U.S. House of Representatives, Transportation & Infrastructure Committee, Water Resources & Environment Subcommittee, July 11, 1995.

"Competition in Cellular Markets," Testimony before the U.S. House of Representatives, Committee on Commerce, October 12, 1995.

"Merger Policy in Declining Demand Industries," Testimony before the U.S. Federal Trade Commission, November 14, 1995.

"Expected Results from Early Auctions of Television Spectrum," Testimony before the U.S. Senate Budget Committee and the U.S. House of Representatives, Committee on Commerce, March 13, 1996.

“Declaration and testimony to the Australian Consumer and Competition Commission (ACCC) regarding Cellular Telephone Competition,” Feb. 2000

“Estimation of Benchmark Interconnection Rates for China,” with Xinzhu Zhang, report to China Minister of Information, June 2003.

Declaration and testimony to the New Zealand Commerce Commission (NZCC) regarding unbundling of the local loop, November 2003.

Potential use of mobile technology for debit payments in China, 2004

“Competition Should Replace Regulation in Australia's Telecommunications Sector,” Australian Financial Review, August 7, 2006, with J. Gans.

The Choice and Utilization of Energy Using Durables, ed. J. Hausman, Palo Alto: EPRI, 1981.

Social Experimentation, ed. J. Hausman and D. Wise, Chicago: 1985.

Future Competition in Telecommunications, ed. S. Bradley and J. Hausman, Harvard: 1989.

Contingent Valuation: A Critical Appraisal, ed. J. Hausman, North Holland, 1993.

Globalization, Technology and Competition, ed. S. Bradley, J. Hausman, R. Nolan, Harvard: 1993.

Economic Impact of Deregulating U.S. Communications Industries, The WEFA Group, Burlington, MA, February 1995.