Online appendices for

"The effects of banning advertising in junk food markets"

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A Dynamic oligopoly competition in prices and advertising

In Section 3.2 of the paper we argue that because i) prices do not directly affect future demand or the evolution of the state variables and ii) we observe the advertising state variables, optimal price are determined by a static equilibrium pricing condition, and for the purposes of considering an advertising ban, we can restrict our attention to this optimality condition. Here we outline an example of a fully dynamic oligopoly game which implies additional optimality conditions (not required in our case) that will characterise dynamic equilibrium advertising strategies. This is one example of many games that is consistent with the validity of focusing only on the price first order conditions for our counterfactual of considering an advertising ban. We abstract from explicitly considering entry and exit for notational simplicity, but as will become clear, identification of marginal costs of products present in the market is independent of whether we allow for entry and exit of firms or products.

Before turning to discuss a fully dynamic oligopoly game in advertising we discuss some reduced form evidence supporting no dynamics in prices.

A.1 Omitted unobserved heterogeneity or habits?

In models of habit formation (e.g Meghir and Weber (1996)) intertemporal nonseparabilities result in past consumption having a causal impact on current consumption. We consider the reduced form relationship between current quantity purchased and past purchase decisions by estimating the reduced form regression:

$$q_{it} = \sum_{k=1}^{8} \beta^k w_{it}^k + \tau_t + c_i + e_{it}, \tag{1.1}$$

where q_{it} is the quantity of potato chips household i purchased in week t, and w_{it}^k are dummy variables equal to one if the last time household i purchased potato chips was k weeks ago, τ_t are week effects and c_i are household fixed effects.

The coefficient β^k can be interpreted as capturing habits, i.e. the effect of past purchases on the quantity of potato chips purchased today, conditional on unobserved heterogeneity and aggregate time effects, with the baseline being not purchasing potato chips any time in the last two months. We estimate this separately by demographic group.

We first estimate equation (1.1) *without the unobserved heterogeneity term*, c_i. The estimated coefficients in Table A.1 shows considerable evidence of a strong association between past purchase behaviour and current behaviour; having purchased potato chips recently is associated with purchasing more potato chips now.

However, as Heckman (1981) and others have argued, this association seen in Table A.1 could be driven by omitted unobserved heterogeneity, reflecting spurious state dependence, rather than structural state dependence. Therefore, in Table A.2 we include c_i, and see that once we include heterogeneity in the form of household fixed effects the relationship between recent past purchases of potato chips and the current purchase level is very small, and almost everywhere not statistically different from zero.

Table A.1: *Relationship between current and past purchases: no unobserved preference heterogeneity*

Dep var: quantity purchased	No kids, high income, high skill	No kids, medium income, high skill	No kids, low income, high skill	No kids, high-medium income, low skill	No kids, low income, low skill	Pensioners	Kids, high income, high skill	Kids, medium income, high skill	Kids, low income, high skill	Kids, high-medium income, low skill	Kids, low income, low skill
Purchased:											
1 week ago (β^1)	0.101***	0.135***	0.128***	0.113***	0.150***	0.0733***	0.137***	0.165***	0.161***	0.151***	0.179***
	(0.00266)	(0.00407)	(0.00447)	(0.00481)	(0.00447)	(0.00342)	(0.00487)	(0.00627)	(0.0106)	(0.00986)	(0.00772)
2 weeks ago (β^2)	0.0836***	0.0905***	0.104***	0.0850***	0.112***	0.0610***	0.110***	0.133***	0.133***	0.121***	0.138***
	(0.00348)	(0.00494)	(0.00555)	(0.00595)	(0.00543)	(0.00427)	(0.00552)	(0.00724)	(0.0119)	(0.0105)	(0.00865)
3 weeks ago (β^3)	0.0641***	0.0639***	0.0694***	0.0613***	0.0854***	0.0399***	0.0850***	0.110***	0.102***	0.0875***	0.103***
	(0.00427)	(0.00578)	(0.00620)	(0.00687)	(0.00665)	(0.00475)	(0.00635)	(0.00879)	(0.0135)	(0.0116)	(0.00960)
4 weeks ago (β^4)	0.0519***	0.0443***	0.0567***	0.0396***	0.0749***	0.0354***	0.0730***	0.0722***	0.0878***	0.0713***	0.0776***
	(0.00465)	(0.00632)	(0.00747)	(0.00783)	(0.00778)	(0.00529)	(0.00731)	(0.00988)	(0.0164)	(0.0128)	(0.0114)
5 weeks ago (β^5)	0.0483***	0.0280***	0.0403***	0.0381***	0.0481***	0.0299***	0.0502***	0.0599***	0.0528**	0.0545***	0.0489***
	(0.00561)	(0.00611)	(0.00792)	(0.00936)	(0.00832)	(0.00579)	(0.00857)	(0.0112)	(0.0172)	(0.0144)	(0.0124)
6 weeks ago (β^6)	0.0164**	0.0272***	0.0292***	0.0212*	0.0341***	0.0161**	0.0490***	0.0536***	0.0834***	0.0176	0.0422**
	(0.00511)	(0.00766)	(0.00843)	(0.00845)	(0.00885)	(0.00537)	(0.00998)	(0.0133)	(0.0235)	(0.0159)	(0.0145)
7 weeks ago (β^7)	0.0262***	0.0208**	0.0268**	0.0135	0.0450***	0.0217***	0.0225*	0.0362**	0.0257	0.0185	0.0231
	(0.00576)	(0.00797)	(0.00946)	(0.00904)	(0.0113)	(0.00629)	(0.00981)	(0.0138)	(0.0242)	(0.0163)	(0.0155)
8 weeks ago (β^8)	0.0187**	0.0414***	0.0248*	0.0201	0.0332**	0.0144*	0.0237*	0.00924	0.0208	0.0171	0.0142
	(0.00661)	(0.0107)	(0.00971)	(0.0108)	(0.0124)	(0.00637)	(0.0120)	(0.0126)	(0.0280)	(0.0188)	(0.0153)
Time-group effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household effects	No	No	No	No	No	No	No	No	No	No	No
Number observations	20011	11405	10985	8867	13140	11995	18143	12564	6264	13422	13036

Notes: Each column is a separate regression of the quantity of potato chips a household purchases in a week (at home and on-the-go) on eight indicator variables indicating whether the household purchased any potato chips in the previous week, two weeks ago, etc. for each of the previous 8 weeks. Household fixed effects are not included. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, ***, $p < 0.001$.

Table A.2: *Relationship between current and past purchases: unobserved preference heterogeneity included*

Dep var: quantity purchased	No kids, high income, high skill	No kids, medium income, high skill	No kids, low income, high skill	No kids, high-medium income, low skill	No kids, low income, low skill	Pensioners	Kids, high income, high skill	Kids, medium income, high skill	Kids, low income, high skill	Kids, high-medium income, low skill	Kids, low income, low skill
Purchased:											
1 week ago (β^1)	0.00247	-0.00713	0.00257	0.00162	0.00774	-0.00726	0.00941	0.0127	0.0311*	-0.000953	0.0104
	(0.00433)	(0.00635)	(0.00677)	(0.00728)	(0.00739)	(0.00500)	(0.00764)	(0.0115)	(0.0150)	(0.0122)	(0.0106)
2 weeks ago (β^2)	0.0103*	-0.00116	0.0179*	0.00733	0.0102	0.00343	0.0186*	0.0231*	0.0340*	0.0117	0.0197
	(0.00435)	(0.00621)	(0.00693)	(0.00759)	(0.00742)	(0.00482)	(0.00788)	(0.0115)	(0.0159)	(0.0121)	(0.0108)
3 weeks ago (β^3)	0.00802	-0.00554	0.00398	0.00349	0.00828	-0.00427	0.0129	0.0277*	0.0211	0.00493	0.0138
	(0.00447)	(0.00654)	(0.00693)	(0.00846)	(0.00808)	(0.00523)	(0.00756)	(0.0115)	(0.0151)	(0.0122)	(0.0122)
4 weeks ago (β^4)	0.00906	-0.00871	0.00571	-0.00429	0.0122	-0.00129	0.0161	0.00959	0.0195	0.0103	0.00715
	(0.00483)	(0.00698)	(0.00785)	(0.00884)	(0.00829)	(0.00554)	(0.00828)	(0.0115)	(0.0181)	(0.0146)	(0.0134)
5 weeks ago (β^5)	0.0152**	-0.0130*	-0.000740	0.00431	-0.00263	-0.00157	0.00567	0.0113	0.00163	0.00804	-0.00417
	(0.00509)	(0.00618)	(0.00855)	(0.0103)	(0.00834)	(0.00587)	(0.0101)	(0.0123)	(0.0198)	(0.0141)	(0.0128)
6 weeks ago (β^6)	-0.00757	-0.00745	-0.00335	-0.00404	-0.00664	-0.0102	0.0141	0.0174	0.0410	-0.0182	-0.0000541
	(0.00480)	(0.00809)	(0.00788)	(0.00981)	(0.0111)	(0.00551)	(0.0106)	(0.0135)	(0.0222)	(0.0160)	(0.0150)
7 weeks ago (β^7)	0.00655	-0.00674	0.000714	-0.00709	0.0105	-0.00155	-0.00457	0.00828	-0.00405	-0.0117	-0.0103
	(0.00611)	(0.00843)	(0.00905)	(0.00903)	(0.0109)	(0.00552)	(0.0109)	(0.0154)	(0.0207)	(0.0159)	(0.0163)
8 weeks ago (β^8)	0.00464	0.0184	0.00755	0.00454	0.00485	-0.00345	-0.0000289	-0.0115	0.00454	-0.00577	-0.00901
	(0.00606)	(0.0105)	(0.00997)	(0.0112)	(0.0127)	(0.00597)	(0.0114)	(0.0120)	(0.0226)	(0.0208)	(0.0175)
Time-group effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	20011	11405	10985	8867	13140	11995	18143	12564	6264	13422	13036

Notes: Each column is a separate regression of the quantity of potato chips a household purchases in a week (at home and on-the-go) on eight indicator variables indicating whether the household purchased any potato chips in the previous week, two weeks ago, etc. for each of the previous 8 weeks. Household fixed effects are included. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, ***, $p < 0.001$.

A.2 A fully dynamic oligopoly game in advertising

We model demand as depending on individual stocks of advertising exposure, $\mathfrak{a}_{it} = (\mathfrak{a}_{i1t}, ..., \mathfrak{a}_{iBt})$ and collect the vectors of all consumer specific advertising states into $\mathfrak{a}_t$. Firms do not directly choose $\mathfrak{a}_t$, as this depends also on the TV watching behaviour of households. We denote by $\mathbf{e}_{bt}$ the vector of advertising choices made by a firm for brand b at time t. This includes how many adverts to air on each station on each time-slot. We denote the cost of this advertising by $C(\mathbf{e}_{bt})$.

Before describing the details of the dynamic oligopoly game, we start by writing the objective function of a firm as a function of strategic variables, prices and advertising, and the vectors of state variables. The firm owning product j chooses the product's price, p_{jt}, and advertising, $\mathbf{e}_{b(j)t}$ in each period t. The intertemporal variable profit of firm f at period 0 is:

$$\sum\nolimits_{t=0}^{\infty} \beta^t \left[\sum\nolimits_{j \in \mathcal{J}_f} \left(p_{jt} - c_{jt} \right) s_j \left(\mathfrak{a}_{\mathbf{t}}, \mathbf{p_t}, \boldsymbol{\tau_t} \right) M_t - \sum\nolimits_{b \in \mathcal{B}_f} C(\mathbf{e}_{bt}) \right], \tag{A.1}$$

As outlined in Section 4.1.3 of the main paper we assume $\mathfrak{a}_{ibt} = \delta \mathfrak{a}_{ibt-1} + a_{ibt}$ where a_{ibt} denotes the households current period advertising exposure. a_{ibt} will be a function of $\mathbf{e}_{bt}$ as well as the household's TV watching behaviour. The stock $\mathfrak{a}_{ibt}$ will be a function of current and past advertising choices $\mathbf{e}_{bt}, \mathbf{e}_{bt-1}, ...$

Suppose that at each period t all firms observe the total market size, M_t, the vector of all firms' marginal costs $\mathbf{c_t}$, and the aggregate demand shocks $\boldsymbol{\tau_t}$. Denote the information set $\theta_t = (M_t, \mathbf{c_t}, \boldsymbol{\tau_t})$. Suppose that firms form symmetric expectations about future shocks according to the assumption: Marginal costs and market size follow independent Markov processes such that for all t, $E_t \left[c_{jt+1} \right] = c_{jt}$, $E_t \left[M_{t+1} \right] = M_t$ and $E_t \left[\boldsymbol{\tau_{t+1}} \right] = \boldsymbol{\tau_t}$.

The majority of the empirical literature restricts attention to pure Markov strategies (see, inter alia, Ryan (2012), Sweeting (2013) and Dubé et al. (2005)). This restricts firms' strategies to depend only on payoff relevant state variables, $(\mathfrak{a}_{\mathbf{t-1}}, \theta_t)$. For each firm f, a Markov strategy σ_f is a mapping between the state variables $(\mathfrak{a}_{\mathbf{t-1}}, \theta_t)$, and the firm f decisions $\left\{ p_{jt} \right\}_{j \in \mathcal{J}_f} \left\{ \mathbf{e}_{bt} \right\}_{b \in B_f}$, which consist of choosing prices and advertising expenditures for the firm's own products $(\sigma_f \left(\mathfrak{a}_{t-1}, \theta_t \right) = (\left\{ p_{jt} \right\}_{j \in \mathcal{J}_f} \left\{ \mathbf{e}_{bt} \right\}_{b \in B_f}))$.

There is no guarantee that a Markov Perfect Equilibrium (MPE) in pure strategies of this dynamic game exists. In a discrete version of this game, existence of a symmetric MPE in pure strategies follows from the arguments in Doraszelski and Satterthwaite (2003, 2010), provided that we impose an upper bound on advertising strategies. Ericson and Pakes (1995) and Doraszelski and Satterthwaite (2003) provide general conditions for the existence of equilibria in similar games, but as our model set up differs, the conditions cannot be directly applied in our case. If we assume the technical conditions for the existence of a subgame

perfect Markov Perfect Equilibrium of this game are satisfied, we can use necessary conditions to characterise an equilibrium (Maskin and Tirole (2001)). However, we do not need to assume that an equilibrium is unique, and indeed it is perfectly possible that this game has multiple equilibria.

In this dynamic oligopoly game, each firm f makes an assumption on the competitors' strategy profiles denoted σ_{-f}, where $\sigma_{-f}(\mathfrak{a}_{t-1}, \theta_t) = (\sigma_1(\mathfrak{a}_{t-1}, \theta_t), .., \sigma_{f-1}(\mathfrak{a}_{t-1}, \theta_t), \sigma_{f+1}(\mathfrak{a}_{t-1}, \theta_t), .., \sigma_F(\mathfrak{a}_{t-1}, \theta_t))$. Equilibrium decisions are generated by a value function, $\pi_f^*(.,.)$, that satisfies the following Bellman equation

$$\pi_f^*(\mathfrak{a}_{t-1}, \theta_t) = \max_{(\{p_{jt}\}_{j\in\mathcal{J}_f}, \{\mathbf{e}_{bt}\}_{b\in\mathcal{B}_f})} \Big\{ \sum_{j\in\mathcal{J}_f} (p_{jt} - c_{jt}) s_j(\mathfrak{a}_t, \mathbf{p_t}, \boldsymbol{\tau_t}) M_t - \sum_{b\in\mathcal{B}_f} C(\mathbf{e}_{bt}) + \beta E_t\left[\pi_f^*(\mathfrak{a}_t, \theta_{t+1})\right] \Big\},$$

where $\pi_f^*(\mathfrak{a}_t, \theta_{t+1})$ is the next period discounted profit of firm f, given the future advertising states. The Bellman equation is conditional on a specific competitive strategy profile σ_{-f}. A MPE is then a list of strategies, σ_f^* for $f = 1, .., F$, such that no firm deviates from the action prescribed by σ_f^* in any subgame that starts at some state $(\mathfrak{a}_{t-1}, \theta_t)$.

Assuming that the technical conditions for the profit function to be differentiable in price and have a single maximum are satisfied, we can use the first order conditions of firm f profit with respect to prices for each $j \in \mathcal{J}_f$:

$$s_j(\mathfrak{a}_t, \mathbf{p_t}, \boldsymbol{\tau_t}) + \sum_{j'\in\mathcal{J}_f} (p_{j't} - c_{j't}) \frac{\partial s_{j'}(\mathfrak{a}_t, \mathbf{p_t}, \boldsymbol{\tau_t})}{\partial p_{jt}} = 0 \tag{A.2}$$

We can identify price-cost margins using the condition (A.2) provided this system of equations is invertible, which will be the case if goods are "connected substitutes" as in Berry and Haile (2014). Another set of conditions for the optimal choice of advertising flows exists and characterises the equilibrium relationship between advertising flows, prices and all state variables including past advertising. We however do not need to use such a condition for identifying marginal costs since the price first order conditions are sufficient. Thus, we do not need to impose differentiability of the profit function with respect to advertising, nor continuity, we only need to use the necessary first order condition on price, which depends on the observed state vector $\mathfrak{a}_t$. In addition, if we allowed for entry and exit of firms we still would be able to identify marginal costs using equation (A.2); entry and exit would change optimal advertising and the set of the firms in the market (both of which we observe), but it would not change the form of the price first order condition for active firms.

As shown by Dubé et al. (2005) and Villas-Boas (1993), this type of dynamic game can give rise to alternating strategies or pulsing strategies in advertising, corresponding to each MPE profile σ. However, the identification of marginal costs, c_{jt}, does not depend on the equilibrium value function π_f^* for a given level of observed optimal prices and advertising $(\mathbf{p_t}, \mathbf{e_t})$. First order conditions will depend on equilibrium strategies

only through observed prices and advertising decisions, and marginal costs will simply be the solution of the system of equations (A.2). Therefore we can identify marginal costs without making assumptions about the uniqueness of dynamic equilibria, whether firms' value function are differentiable, or whether the same equilibria is played in each market.

B Demand linkages between segments

We denote the set of potato chip products available for food at home purchase occasions as Ω_{in} and the set available for food on-the-go purchase occasions as Ω_{out}. The two sets of products are disjoint; $\Omega_{in} \cap \Omega_{out} = \varnothing$.

We denote the set of households we observe making decisions on food at home purchase occasions by $\mathbb{I}_{in}$ and the set of individuals we observe making decisions for food on-the-go purchase occasions by $\mathbb{I}_{out}$. The individuals who we observe making food on-the-go decisions are drawn from the households that we observe making food at home decisions (although the individuals need not be the household main shopper).

We allow for the possibility that the demands of individuals on food on-the-go purchase occasions are influenced by recent food at home purchases made by the household the individual belongs to. Specifically we define a dummy variable indicating whether the household the consumer belongs to was observed purchasing potato chips on a food at home purchase occasion in the preceding week – we denote this variable by fi_{it}. We include this variable in the payoff function of potato chip products targeted at on-the-go consumption. This allows for the possibility that a recent food at home purchase lowers (or increases) the probability an individual purchases potato chips while on-the-go. The payoff functions associated with the various purchase options are then:

$$
\begin{aligned}
\bar{v}_{ijt} =& \alpha_{1i} p_{jt} + \psi_{1i} \mathbf{x}_j + \\
& \left[\lambda_i \mathfrak{a}_{ib(j)t} + \alpha_{2i} \mathfrak{a}_{ib(j)t} p_{jt} + \psi_{2i} \mathfrak{a}_{ib(j)t} n_{b(j)} + \rho_i \left(\sum\nolimits_{l \neq b(j)} \mathfrak{a}_{ilt} \right) \right] + \xi_{ib(j)} + \tau^d_{b(j)t} + \epsilon_{ijt} \quad \forall j \in \Omega_{in} \\
\bar{v}_{ijt} =& \alpha_{1i} p_{jt} + \psi_{1i} \mathbf{x}_j + \phi_i fi_{it} + \\
& \left[\lambda_i \mathfrak{a}_{ib(j)t} + \alpha_{2i} \mathfrak{a}_{ib(j)t} p_{jt} + \psi_{2i} \mathfrak{a}_{ib(j)t} n_{b(j)} + \rho_i \left(\sum\nolimits_{l \neq b(j)} \mathfrak{a}_{ilt} \right) \right] + \xi_{ib(j)} + \tau^d_{b(j)t} + \epsilon_{ijt} \quad \forall j \in \Omega_{out} \\
\bar{v}_{i\underline{0}t} =& \xi_{i\underline{0}j} + \psi_{1i} x_{\underline{0}} + \tau^d_{\underline{0}t} + \epsilon_{i\underline{0}t} \\
\bar{v}_{i\overline{0}t} =& \epsilon_{i\overline{0}t},
\end{aligned}
$$

and the purchase decision of consumers in each market segment is then:

$$
\begin{aligned}
\forall\, i \in \mathbb{I}_{in} : \text{select } j \text{ if } \quad \bar{v}_{ijt} \geq \bar{v}_{ij't} \quad \forall\, j' \in (\Omega_{in} \cup \{\underline{0}, \overline{0}\}) \\
\forall\, i \in \mathbb{I}_{out} : \text{select } j \text{ if } \quad \bar{v}_{ijt} \geq \bar{v}_{ij't} \quad \forall\, j' \in (\Omega_{out} \cup \{\underline{0}, \overline{0}\})
\end{aligned}
$$

C Expected utility under characteristics view of advertising

Our model specification leads, under the characteristic view of advertising, to expected utility given (up to an additive constant) by:

$$W_i\left(\mathfrak{a}_{it}, \mathbf{p_t}\right) = \ln\left[\exp\left(\xi_{i\underline{0}j} + \psi_{1i}x_{\underline{0}} + \tau^d_{\underline{0}t}\right) + \sum_{j>0}\exp\left(\alpha_{1i}p_{jt} + \psi_{1i}\mathbf{x}_j + \xi_{ib(j)} + \tau^d_{b(j)t} + \right.\right.$$
$$\left.\left.\left[\lambda_i\mathfrak{a}_{ib(j)t} + \alpha_{2i}\mathfrak{a}_{ib(j)t}p_{jt} + \psi_{2i}\mathfrak{a}_{ib(j)t}n_{b(j)} + \rho_i\left(\sum\nolimits_{l\neq b(j)}\mathfrak{a}_{ilt}\right)\right]\right)\right]$$

An alternative to our model specification is:

$$\widetilde{v}_{ijt} = \alpha_{1i}p_{jt} + \psi_{1i}\mathbf{x}_j + \left[\tilde{\lambda}_i\mathfrak{a}_{ib(j)t} + \alpha_{2i}\mathfrak{a}_{ib(j)t}p_{jt} + \psi_{2i}\mathfrak{a}_{ib(j)t}n_{b(j)}\right] + \xi_{ib(j)} + \tau^d_{b(j)t} + \epsilon_{ijt} \tag{C.1}$$
$$\widetilde{v}_{i\underline{0}t} = \xi_{i\underline{0}j} + \psi_{1i}x_{\underline{0}} + \tau^d_{\underline{0}t} + \tilde{\rho}_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right) + \epsilon_{i\underline{0}t} \tag{C.2}$$
$$\widetilde{v}_{i\overline{0}t} = \tilde{\rho}_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right) + \epsilon_{i\overline{0}t}. \tag{C.3}$$

Note:

$$\widetilde{v}_{ijt} - \widetilde{v}_{i\overline{0}t} = \alpha_{1i}p_{jt} + \psi_{1i}\mathbf{x}_j + \left[\tilde{\lambda}_i\mathfrak{a}_{ib(j)t} - \tilde{\rho}_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right) + \alpha_{2i}\mathfrak{a}_{ib(j)t}p_{jt} + \psi_{2i}\mathfrak{a}_{ib(j)t}n_{b(j)}\right] + \xi_{ib(j)} + \tau^d_{b(j)t} + \left(\epsilon_{ijt} - \epsilon_{i\overline{0}t}\right)$$
$$\widetilde{v}_{i\underline{0}t} - \widetilde{v}_{i\overline{0}t} = \xi_{i\underline{0}j} + \psi_{1i}x_{\underline{0}} + \tau^d_{\underline{0}t} + \left(\epsilon_{i\underline{0}t} - \epsilon_{i\overline{0}t}\right)$$

Setting $\widetilde{\lambda}_i = \lambda_i - \rho_i$ and $\widetilde{\rho}_i = -\rho_i$ shows that $\widetilde{v}_{ijt} - \widetilde{v}_{i\overline{0}t} = \bar{v}_{ijt} - \bar{v}_{i\overline{0}t}$, while clearly $\widetilde{v}_{i\underline{0}t} - \widetilde{v}_{i\overline{0}t} = \bar{v}_{i\underline{0}t} - \bar{v}_{i\overline{0}t}$. Hence this alternative specification yields observationally equivalent demand to our main specification.

However, expected utility under equations (C.1)-(C.3) is given by

$$\begin{aligned}
\widetilde{W}_i\left(\mathfrak{a}_{it}, \mathbf{p_t}\right) = \quad & \ln\left[\sum\nolimits_{j>0}\exp\left[\quad \alpha_{1i}p_{jt} + \psi_{1i}\mathbf{x}_j + \left[\tilde{\lambda}_i\mathfrak{a}_{ib(j)t} + \alpha_{2i}\mathfrak{a}_{ib(j)t}p_{jt} + \psi_{2i}\mathfrak{a}_{ib(j)t}n_{b(j)}\right] + \xi_{ib(j)} + \tau^d_{b(j)t}\right]\right. \\
& \left. \qquad + \exp\left[\xi_{i\underline{0}j} + \psi_{1i}x_{\underline{0}} + \tau^d_{\underline{0}t} + \tilde{\rho}_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right)\right] + \exp\left[\tilde{\rho}_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right)\right]\right] \\
= \quad & \ln\left[\sum\nolimits_{j>0}\exp\left[\quad \alpha_{1i}p_{jt} + \psi_{1i}\mathbf{x}_j + \xi_{ib(j)} + \tau^d_{b(j)t} + \left[\tilde{\lambda}_i\mathfrak{a}_{ib(j)t} + \alpha_{2d}\mathfrak{a}_{ib(j)t}p_{jt} + \rho_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right) + \psi_{2d}\mathfrak{a}_{ib(j)t}n_{b(j)}\right]\right]\right. \\
& \left. \qquad + \exp\left[\xi_{i\underline{0}j} + \psi_{1i}x_{\underline{0}} + \tau^d_{\underline{0}t} + \tilde{\rho}_i\right]\right] - \rho_i\left(\sum\nolimits_l \mathfrak{a}_{ilt}\right) \\
= \quad & W_i\left(\mathfrak{a}_{it}, \mathbf{p_t}\right) - \rho_i \quad \sum\nolimits_l \mathfrak{a}_{ilt}
\end{aligned}$$

Therefore the two specifications, giving rise to identical demand, lead to different welfare conclusions. Under the characteristic view of advertising, welfare is not identified without an assumption about whether competitor advertising is included in inside product utilities or whether total advertising is included in outside option utility.

D Additional Figures and Tables

In the paper we consider how to measure consumer welfare under the views that advertising is persuasive or that it is a product characteristic. Figure D.1 shows prominent examples of potato chip advertising, from which the reader can take their own view.

Figure D.1: *Example adverts for potato chip brands*

Notes: The advertisement on the top left shows supermodel Elle Macpherson eating Walkers potato chips; the one on the lower left shows an ex-professional football player and TV personality Gary Lineker with the FA Cup (football) trophy full of Walkers potato chips; the top right shows one of a series of adverts for KP Hola Hoops aimed at children, and the bottom right shows a model with Golden Wonder Skins.

D.1 Coefficients Estimates

Table D.1: *Coefficient estimates for food at home - part 1*

		No kids, high inc., high sk.	No kids, medium inc., high sk.	No kids, low inc., high sk.	No kids, high-medium inc., low sk.	No kids, low inc., low sk.	Pensioners
Random coefficients							
Means	Price	-0.0168	0.5908	0.1717	0.6665	0.3769	0.5577
		0.0703	0.0600	0.0887	0.0576	0.0576	0.0680
	Brand advertising	0.2087	-0.2060	0.0391	-0.1066	0.0135	-0.3212
		0.0919	0.1140	0.1201	0.1301	0.0957	0.1429
	Competitor advertising	0.1272	0.0243	0.0262	0.2519	0.1346	0.1530
		0.0344	0.0416	0.0481	0.0545	0.0355	0.0485
Std. deviations	Price	0.4901	0.3969	0.3681	0.2828	0.2458	0.3620
		0.0300	0.0256	0.0306	0.0190	0.0153	0.0297
	Brand advertising	0.2517	0.4010	0.4891	0.2589	0.4447	0.5222
		0.0183	0.0517	0.0270	0.0200	0.0268	0.0332
	Competitor advertising	0.3845	0.4451	0.3625	0.3988	0.3943	0.3231
		0.0131	0.0187	0.0149	0.0173	0.0157	0.0140
	Nutrient score	0.0577	0.0517	0.0536	0.0572	0.0663	0.0578
		0.0020	0.0023	0.0025	0.0024	0.0028	0.0023
	Walkers	1.1359	1.0317	0.9544	0.8573	1.1725	1.6661
		0.0583	0.0463	0.0470	0.0709	0.0502	0.0767
Fixed coefficients							
	Size	0.0157	0.0225	0.0159	0.0226	0.0197	0.0179
		0.0008	0.0011	0.0010	0.0012	0.0009	0.0011
	Size squared	-0.0157	-0.0209	-0.0139	-0.0202	-0.0174	-0.0163
		0.0011	0.0014	0.0012	0.0015	0.0011	0.0014
	Price*Brand advertising	0.0609	0.0745	0.0332	0.1033	0.0968	0.1496
		0.0182	0.0234	0.0224	0.0259	0.0184	0.0281
	Nutrient score*Brand advertising	-0.0183	0.0023	-0.0124	-0.0017	-0.0103	0.0021
		0.0056	0.0067	0.0067	0.0075	0.0056	0.0089
	Pringles	-0.7571	-1.2205	-0.8833	-1.0926	-1.1005	-1.1489
		0.2000	0.2626	0.2627	0.2811	0.2435	0.3148
	Walkers Regular	-0.1795	0.1177	0.2999	0.1940	0.3344	-0.1314
		0.1787	0.2097	0.1825	0.2314	0.1566	0.2654
	Walkers Sensations	-1.3215	-1.7494	-2.2248	-1.3587	-2.3061	-2.7820
		0.0855	0.1146	0.1309	0.1306	0.1201	0.1735
	Walkers Doritos	-1.6412	-1.7466	-2.2237	-1.7334	-2.3937	-3.1287
		0.0787	0.0894	0.1101	0.1127	0.0986	0.1573
	Walkers Other	0.0132	0.1402	-0.0665	0.2579	0.0318	-0.3358
		0.0687	0.0821	0.0901	0.1011	0.0833	0.1035
	KP	-0.5126	-0.7673	-0.4281	-0.3918	-0.5677	-1.2660
		0.0650	0.0820	0.0824	0.0982	0.0765	0.1026
	Golden Wonder	-2.6271	-2.8302	-2.6358	-1.9780	-2.3935	-2.3342
		0.1197	0.1554	0.1425	0.1467	0.1189	0.1426
	Asda	-2.2531	-2.6026	-2.5739	-2.6312	-2.2339	-3.2279
		0.0894	0.1128	0.1194	0.1422	0.0967	0.1547
	Tesco	-1.9697	-2.0158	-1.9980	-2.1284	-2.0374	-1.8927
		0.0835	0.1004	0.1068	0.1266	0.0952	0.1161
	Unhealthy Outside	4.1946	3.5160	3.9868	4.2590	4.0322	3.8942
		0.1739	0.2328	0.2371	0.2684	0.2017	0.2507
	Healthy Outside	3.3431	2.4587	2.7485	3.1482	2.5344	2.6580
		0.1883	0.2630	0.2654	0.2951	0.2323	0.2716
Brand-time effects		Yes	Yes	Yes	Yes	Yes	Yes
Region effects		Yes	Yes	Yes	Yes	Yes	Yes

Notes: Each column represents a separate estimation (one for each consumer type group), standard errors are reported below coefficient estimates. Random coefficients have normal distributions except for the price coefficient which is log normal.

Table D.2: *Coefficient estimates for food at home - part 2*

		Kids, high inc., high sk.	Kids, medium inc., high sk.	Kids, low inc., high sk.	Kids, high-med inc., low sk.	Kids, low inc., low sk.
Random coefficients						
Means	Price	0.3305	0.4212	0.2525	0.3532	0.2703
		0.0526	0.0534	0.0904	0.0563	0.0623
	Brand advertising	-0.3341	-0.3529	0.0380	-0.2641	-0.1703
		0.0811	0.1013	0.1321	0.0906	0.0929
	Competitor advertising	-0.0442	0.0179	-0.1184	0.1590	0.0578
		0.0329	0.0387	0.0427	0.0361	0.0364
Std. deviations	Price	0.3260	0.3863	0.3666	0.3732	0.3502
		0.0199	0.0245	0.0353	0.0244	0.0232
	Brand advertising	0.2786	0.3606	0.1624	0.2977	0.2810
		0.0233	0.0233	0.0203	0.0181	0.0196
	Competitor advertising	0.2816	0.3429	0.3401	0.2588	0.1338
		0.0117	0.0162	0.0176	0.0148	0.0125
	Nutrient score	0.0497	0.0458	0.0507	0.0582	0.0511
		0.0022	0.0026	0.0030	0.0028	0.0029
	Walkers	1.0012	0.8024	1.1057	1.0026	0.9034
		0.0474	0.0397	0.0635	0.0424	0.0542
Fixed coefficients						
	Size	0.0199	0.0202	0.0202	0.0217	0.0183
		0.0008	0.0009	0.0013	0.0009	0.0008
	Size squared	-0.0174	-0.0173	-0.0170	-0.0191	-0.0135
		0.0010	0.0011	0.0016	0.0011	0.0010
	Price*Brand advertising	0.0393	0.0562	0.0563	0.0638	0.0595
		0.0172	0.0209	0.0266	0.0184	0.0196
	Nutrient score*Brand advertising	0.0170	0.0188	-0.0060	0.0050	0.0085
		0.0046	0.0056	0.0074	0.0050	0.0051
	Pringles	-1.7730	-0.9653	-1.8418	-0.3797	-0.5909
		0.2238	0.2091	0.4839	0.1745	0.2082
	Walkers Regular	0.0204	0.3537	0.3962	1.0984	0.8195
		0.1447	0.1594	0.2060	0.1287	0.1351
	Walkers Sensations	-1.6537	-1.9435	-1.6145	-1.7102	-2.2232
		0.0855	0.1122	0.1517	0.0979	0.1318
	Walkers Doritos	-1.6270	-1.6347	-1.6377	-1.5902	-1.5503
		0.0703	0.0848	0.1211	0.0777	0.0847
	Walkers Other	0.1389	0.3509	0.3917	0.5388	0.4517
		0.0674	0.0803	0.1120	0.0706	0.0781
	KP	-0.4334	-0.2258	0.0335	-0.0662	0.0402
		0.0562	0.0681	0.0945	0.0654	0.0685
	Golden Wonder	-2.9515	-3.1130	-2.3539	-2.4497	-1.9833
		0.1196	0.1588	0.1832	0.1164	0.1095
	Asda	-2.4922	-1.9399	-1.4080	-2.1574	-1.6769
		0.0833	0.0890	0.1184	0.0895	0.0881
	Tesco	-1.7888	-1.6075	-1.2958	-1.7677	-1.3378
		0.0724	0.0857	0.1202	0.0849	0.0854
	Unhealthy Outside	3.7751	4.1851	3.5957	4.7109	4.6910
		0.1635	0.2005	0.2495	0.1893	0.1840
	Healthy Outside	2.3760	2.6866	1.8465	2.9409	2.7740
		0.1961	0.2371	0.3285	0.2367	0.2388
Brand-time effects		Yes	Yes	Yes	Yes	Yes
Region effects		Yes	Yes	Yes	Yes	Yes

Notes: Each column represents a separate estimation (one for each consumer type group), standard errors are reported below coefficient estimates. Random coefficients have normal distributions except for the price coefficient which is log normal.

Table D.3: *Coefficient estimates for food on-the-go - part 1*

		No kids, high inc., high sk.	No kids, medium inc., high sk.	No kids, low inc., high sk.	No kids, high-medium inc., low sk.	No kids, low inc., low sk.	Pensioners
Random coefficients							
Means	Price	2.2190	2.2697	2.3476	2.3585	2.5566	1.6297
		0.0644	0.0784	0.0793	0.0848	0.0642	0.1860
	Brand advertising	-0.0643	0.5110	-0.3377	-1.1439	0.4329	0.7301
		0.1597	0.1962	0.2075	0.2305	0.2080	0.2992
	Competitor advertising	-0.0041	-0.2862	0.1747	0.3013	-0.6367	-0.2117
		0.0602	0.0759	0.0637	0.0684	0.0845	0.0898
Std. deviations	Price	0.3643	0.2421	0.2943	0.2033	0.3216	0.2193
		0.0257	0.0228	0.0262	0.0183	0.0207	0.0444
	Brand advertising	0.4108	0.3986	0.5150	0.5199	0.4596	0.3688
		0.0354	0.0243	0.0326	0.0359	0.0337	0.0332
	Competitor advertising	0.4466	0.5901	0.3492	0.6635	0.7329	0.5360
		0.0200	0.0240	0.0204	0.0308	0.0272	0.0299
	Nutrient score	0.1053	0.1032	0.0916	0.1391	0.0870	0.1060
		0.0039	0.0046	0.0035	0.0061	0.0030	0.0065
Fixed coefficients							
	Food in purchase	0.1080	-0.0917	0.0588	0.0116	-0.0360	0.2286
		0.0564	0.0713	0.0684	0.0809	0.0712	0.0958
	Size	0.1673	0.2222	0.1214	0.0511	0.1738	0.0925
		0.0129	0.0172	0.0169	0.0207	0.0191	0.0257
	Size squared	-1.6745	-2.1109	-1.2073	-0.3290	-1.3660	-1.1047
		0.1247	0.1683	0.1620	0.1929	0.1803	0.2469
	Price*Brand advertising	-0.7900	-1.2331	0.1955	0.3814	-1.1697	-1.3569
		0.2538	0.3016	0.3268	0.3221	0.3295	0.4508
	Nutrient score*Brand advertising	0.0308	0.0095	0.0077	0.0472	0.0241	0.0016
		0.0071	0.0099	0.0095	0.0113	0.0099	0.0158
	Walkers Regular	0.0596	0.2551	0.0877	0.8054	0.7231	0.1321
		0.1507	0.2017	0.1886	0.2173	0.1987	0.2941
	Walkers Sensations	-1.2068	-1.6118	-1.7029	-3.0508	-2.5429	-2.6812
		0.1146	0.1943	0.1768	0.3990	0.3381	0.3588
	Walkers Doritos	-1.9873	-1.2532	-1.5789	-1.4638	-0.9979	-1.8196
		0.1188	0.1385	0.1432	0.1712	0.1444	0.2133
	Walkers Other	-0.1507	0.4051	-0.2114	-0.3048	0.2143	-0.7124
		0.0703	0.0973	0.0984	0.1267	0.1126	0.1368
	KP	-0.0773	-0.4113	-0.3293	-0.2600	-0.2299	-0.6847
		0.0855	0.1261	0.1228	0.1546	0.1362	0.1730
	Golden Wonder	-2.5480	-1.5341	-2.8857	-2.4053	-2.1619	-1.7653
		0.1173	0.1442	0.1706	0.1783	0.1736	0.1833
	Unhealthy Outside	0.8079	2.3118	0.3405	-1.5001	-1.1891	1.7083
		0.3646	0.4562	0.4289	0.4932	0.5247	0.5919
	Healthy Outside	0.0550	2.9034	-0.7107	-1.0354	-0.8878	1.3293
		0.3894	0.4648	0.4384	0.5015	0.5258	0.6293
Brand-time effects		Yes	Yes	Yes	Yes	Yes	Yes
Region effects		Yes	Yes	Yes	Yes	Yes	Yes

Notes: Each column represents a separate estimation (one for each consumer type group), standard errors are reported below coefficient estimates. Random coefficients have normal distributions except for the price coefficient which is log normal.

Table D.4: *Coefficient estimates for food on-the-go - part 2*

		Kids, high inc., high sk.	Kids, medium inc., high sk.	Kids, low inc., high sk.	Kids, high-med inc., low sk.	Kids, low inc., low educ	Kid purchaser
Random coefficients							
Mean	Price	2.0420	2.1705	2.1833	2.4339	2.0701	1.0912
		0.0986	0.0910	0.1269	0.0623	0.0981	0.2652
	Brand advertising	0.1278	-0.8830	0.2564	-1.2480	0.2307	0.6294
		0.1640	0.2019	0.2827	0.1709	0.1985	0.3003
	Competitor advertising	0.1729	-0.0785	-0.1309	0.3942	0.2405	-0.1968
		0.0451	0.0548	0.0672	0.0513	0.0536	0.0834
Std. deviation	Price	0.2554	0.2919	0.2728	0.2664	0.2951	0.6586
		0.0353	0.0321	0.0381	0.0159	0.0382	0.1239
	Brand advertising	0.1962	0.4618	0.5295	0.6286	0.3516	0.6029
		0.0228	0.0394	0.0432	0.0250	0.0252	0.0469
	Competitor advertising	0.6945	0.5500	0.4217	0.6502	0.4362	0.6032
		0.0282	0.0240	0.0277	0.0238	0.0203	0.0334
	Nutrient score	0.1203	0.1015	0.0996	0.1375	0.0944	0.1281
		0.0058	0.0051	0.0065	0.0051	0.0041	0.0093
Fixed coefficients							
	Food in purchase	0.0814	0.0599	0.1095	0.2164	0.0853	0.1042
		0.0514	0.0601	0.0850	0.0576	0.0633	0.0966
	Size	0.1912	0.1438	0.1823	0.1835	0.0763	0.0214
		0.0163	0.0164	0.0237	0.0159	0.0193	0.0269
	Size squared	-2.0272	-1.5028	-1.8581	-1.8859	-0.9120	-0.3758
		0.1612	0.1568	0.2278	0.1555	0.1896	0.2783
	Price*Brand advertising	-0.7210	0.5037	-0.4771	1.3611	-0.8152	-0.5570
		0.2902	0.3097	0.4575	0.2643	0.3229	0.4339
	Nutrient score*Brand advertising	0.0204	0.0419	-0.0058	0.0230	0.0033	-0.0104
		0.0067	0.0085	0.0126	0.0076	0.0094	0.0137
	Walkers Regular	0.4663	0.3221	0.0503	0.0041	-0.1471	0.4407
		0.1505	0.1893	0.3086	0.1728	0.2022	0.3577
	Walkers Sensations	-1.2745	-1.7250	-1.9443	-2.2908	-1.8475	-1.3808
		0.1407	0.1795	0.2456	0.1908	0.2049	0.3256
	Walkers Doritos	-0.7651	-1.2350	-0.6725	-1.1384	-1.3102	-0.6640
		0.0995	0.1230	0.1422	0.1062	0.1411	0.2342
	Walkers Other	-0.0661	-0.1207	-0.0818	-0.2598	-0.4489	0.0791
		0.0851	0.0923	0.1249	0.0849	0.1063	0.1708
	KP	0.3141	-0.1246	-0.2311	-0.3781	-0.1436	0.9850
		0.0959	0.1097	0.1509	0.1031	0.1241	0.1925
	Golden Wonder	-2.4898	-2.5407	-2.9543	-3.1530	-1.7497	-1.1466
		0.1458	0.1543	0.2276	0.1493	0.1391	0.2310
	Unhealthy Outside	3.1550	0.8663	1.8230	0.9019	1.3096	2.0650
		0.3835	0.3936	0.5767	0.4102	0.4381	0.6551
	Healthy Outside	2.2844	0.3361	1.3153	0.0188	0.9685	1.5527
		0.3846	0.4039	0.5963	0.4183	0.4575	0.6757
Brand-time effects		Yes	Yes	Yes	Yes	Yes	Yes
Region effects		Yes	Yes	Yes	Yes	Yes	Yes

Notes: Each column represents a separate estimation (one for each consumer type group), standard errors are reported below coefficient estimates. Random coefficients have normal distributions except for the price coefficient which is log normal.

Table D.5: *Own and cross price elasticities*

Selected food at home products

	Walkers Regular		Walkers Sensations		Walkers Doritos		Walkers Other			Pringles	
	150-300g	300g+	150-300g	300g+	150-300g	300g+	150-300g	300g+	<150g	150-300g	300g+
Walkers Regular:150-300g	-1.6252	0.4191	0.0159	0.0373	0.0282	0.0595	0.0512	0.1086	0.1752	0.0187	0.0592
Walkers Regular:300g+	0.0748	-2.6133	0.0107	0.0370	0.0196	0.0623	0.0348	0.0881	0.2052	0.0134	0.0651
Walkers Sensations:150-300g	0.0900	0.3400	-1.7804	0.0479	0.0310	0.0632	0.0486	0.1040	0.1697	0.0163	0.0508
Walkers Sensations:300g+	0.0661	0.3638	0.0150	-2.9423	0.0226	0.0650	0.0357	0.0884	0.1934	0.0124	0.0548
Walkers Doritos:150-300g	0.0947	0.3684	0.0182	0.0427	-1.6728	0.0668	0.0494	0.1065	0.1743	0.0179	0.0559
Walkers Doritos:300g+	0.0687	0.4005	0.0127	0.0423	0.0229	-2.8249	0.0360	0.0900	0.2008	0.0134	0.0608
Walkers Other:<150g	0.0953	0.3615	0.0160	0.0374	0.0273	0.0578	-1.6400	0.1171	0.1891	0.0192	0.0608
Walkers Other:150-300g	0.0834	0.3776	0.0141	0.0384	0.0242	0.0597	0.0481	-2.1122	0.2029	0.0173	0.0639
Walkers Other:300g+	0.0599	0.3913	0.0103	0.0376	0.0178	0.0596	0.0347	0.0904	-3.0477	0.0128	0.0666
Pringles:150-300g	0.0552	0.2216	0.0085	0.0207	0.0156	0.0340	0.0305	0.0665	0.1117	-1.4524	0.0960
Pringles:300g+	0.0404	0.2479	0.0062	0.0214	0.0114	0.0360	0.0223	0.0570	0.1333	0.0219	-2.6616
Unhealthy outside option	0.0341	0.1248	0.0059	0.0132	0.0107	0.0217	0.0196	0.0405	0.0626	0.0144	0.0415
Healthy outside option	0.0391	0.1347	0.0070	0.0151	0.0114	0.0219	0.0179	0.0365	0.0546	0.0118	0.0326

Food on-the-go products

	Walkers Regular		Walkers	Walkers	Walkers Other		KP	GW		Other	
	34.5g	50g	40g	40g	<30g	30g+	50g	<40g	40g+	<40g	40g+
Walkers Regular:34.5g	-3.2867	0.3119	0.0466	0.1161	0.1958	0.2070	0.4459	0.0645	0.0119	0.3670	0.1082
Walkers Regular:50g	0.7708	-4.8376	0.0497	0.1137	0.1739	0.2139	0.4226	0.0550	0.0127	0.3372	0.1121
Walkers Sensations:40g	0.6127	0.2617	-4.5445	0.1211	0.1749	0.2199	0.4895	0.0726	0.0170	0.3291	0.0888
Walkers Doritos:40g	0.6726	0.2634	0.0538	-4.4182	0.1935	0.2316	0.5528	0.0796	0.0162	0.3402	0.0986
Walkers Other:<30g	0.6791	0.2419	0.0460	0.1158	-3.8517	0.2388	0.5395	0.0772	0.0142	0.3711	0.1060
Walkers Other:30g+	0.6420	0.2661	0.0518	0.1244	0.2134	-4.8103	0.5447	0.0666	0.0153	0.3584	0.1123
KP:50g	0.6026	0.2294	0.0503	0.1283	0.2108	0.2372	-3.7453	0.0753	0.0148	0.3616	0.1054
Golden Wonder:<40g	0.6303	0.2132	0.0541	0.1332	0.2132	0.2043	0.5280	-3.2817	0.0244	0.3147	0.0877
Golden Wonder:40g+	0.5536	0.2381	0.0569	0.1220	0.1842	0.2217	0.4939	0.1092	-5.0471	0.2932	0.0980
Other:<40g	0.6884	0.2557	0.0470	0.1115	0.2034	0.2189	0.5094	0.0615	0.0122	-3.9393	0.1174
Other:40g+	0.7017	0.2954	0.0443	0.1126	0.2004	0.2378	0.5075	0.0598	0.0144	0.4068	-5.3570
Unhealthy outside option	0.1981	0.0630	0.0135	0.0384	0.0705	0.0657	0.1823	0.0300	0.0046	0.1146	0.0271
Healthy outside option	0.2505	0.0814	0.0157	0.0268	0.0516	0.0489	0.0942	0.0196	0.0031	0.1049	0.0260

Notes: The top panel gives matrix of price elasticities in the food at home segment for the set of products produced by the two firms that advertise most. The bottom panel gives matrix of price elasticities in the food on-the-go segment. Each cell contains the price elasticity of demand for the product indicated in column 1 with respect to the price of the product in row 1. Numbers are means across markets.

D.3 Marginal costs estimates

Table D.6: *Marginal costs*

	Price (£)	Cost (£)	Margin
Selected food at home products			
Walkers Regular:150-300g	1.11	0.32	0.72
		[0.28, 0.36]	[0.68, 0.75]
Walkers Regular:300g+	2.60	1.61	0.38
		[1.56, 1.65]	[0.37, 0.40]
Walkers Sensations:150-300g	1.26	0.09	0.93
		[0.04, 0.15]	[0.89, 0.97]
Walkers Sensations:300g+	2.79	1.36	0.51
		[1.29, 1.43]	[0.49, 0.54]
Walkers Doritos:150-300g	1.30	0.15	0.91
		[0.10, 0.20]	[0.87, 0.95]
Walkers Doritos:300g+	2.58	1.23	0.53
		[1.17, 1.28]	[0.51, 0.55]
Walkers Other:<150g	1.20	0.07	0.95
		[0.02, 0.12]	[0.90, 0.98]
Walkers Other:150-300g	2.48	1.13	0.54
		[1.07, 1.19]	[0.52, 0.57]
Walkers Other:300g+	1.24	0.08	0.94
		[0.03, 0.14]	[0.89, 0.98]
Pringles:150-300g	1.77	0.51	0.71
		[0.46, 0.58]	[0.68, 0.74]
Pringles:300g+	3.17	1.68	0.47
		[1.61, 1.75]	[0.45, 0.49]
Food on-the-go products			
Walkers Regular:34.5g	0.45	0.27	0.39
		[0.26, 0.28]	[0.37, 0.42]
Walkers Regular:50g	0.64	0.44	0.31
		[0.42, 0.45]	[0.29, 0.33]
Walkers Sensations:40g	0.60	0.41	0.33
		[0.39, 0.42]	[0.31, 0.35]
Walkers Doritos:40g	0.54	0.36	0.34
		[0.34, 0.37]	[0.32, 0.37]
Walkers Other:<30g	0.45	0.28	0.38
		[0.27, 0.29]	[0.36, 0.40]
Walkers Other:30g+	0.61	0.42	0.31
		[0.41, 0.43]	[0.29, 0.33]
KP:50g	0.51	0.38	0.27
		[0.37, 0.38]	[0.25, 0.28]
Golden Wonder:<40g	0.39	0.27	0.31
		[0.26, 0.27]	[0.29, 0.33]
Golden Wonder:40g+	0.71	0.57	0.21
		[0.55, 0.58]	[0.19, 0.22]
Other:<40g	0.49	0.36	0.26
		[0.35, 0.37]	[0.25, 0.28]
Other:40g+	0.66	0.52	0.21
		[0.51, 0.53]	[0.20, 0.22]

Notes: The top panel gives numbers for the food at home segment for the set of products produced by the two firms that advertise most. The bottom panel gives numbers for the food on-the-go segment. Margins are defined as $(p - mc)/p$*. Numbers are means across markets. 95% confidence intervals are given in square brackets.*

D.4 Profits

Table D.7 disaggregates the impact of the ban by firm and reports the average impact across months. The first panel reports pre ban numbers, showing the average price, total quantity of potato chips sold and total variable profits. The second panel details the percent change in quantity sold and variable profits resulting from the ban if firms do not re-optimize their prices in response. The final panel shows the impact on prices, quantity and variable profits following the ban in equilibrium, when firms are allowed to re-optimize prices.

Table D.7: *Advertising ban: Impact by firm*

	Walkers	Pringles	KP	Golden Wonder	Asda	Tesco	Other
Pre ban							
Price (£)	1.76	1.85	1.33	1.47	1.40	1.27	1.51
	[1.76, 1.77]	[1.85, 1.85]	[1.33, 1.34]	[1.46, 1.48]	[1.40, 1.40]	[1.27, 1.27]	[1.51, 1.51]
Quantity (mKg)	7.01	0.85	2.74	0.27	0.42	0.81	2.70
	[6.92, 7.15]	[0.83, 0.89]	[2.67, 2.78]	[0.25, 0.29]	[0.39, 0.43]	[0.79, 0.84]	[2.62, 2.76]
Profits (£m)	26.94	2.12	7.22	0.65	0.92	1.77	8.01
	[25.55, 28.45]	[2.06, 2.29]	[6.81, 7.55]	[0.60, 0.71]	[0.88, 0.98]	[1.68, 1.86]	[7.53, 8.38]
Post ban: No firm response							
% change in quantity	-12.70	-22.17	-16.28	-19.31	-12.96	-15.51	-18.44
	[-15.29, -9.65]	[-24.49, -18.72]	[-18.22, -13.53]	[-22.49, -14.39]	[-15.86, -6.91]	[-18.32, -9.09]	[-21.19, -15.37]
% change in profits	-10.28	-10.06	-14.73	-21.28	-14.23	-16.85	-16.10
	[-12.75, -7.18]	[-13.99, -6.69]	[-16.78, -12.04]	[-24.63, -17.09]	[-17.01, -8.23]	[-19.49, -10.46]	[-18.89, -12.87]
Post ban: With firm response							
% change in price	-6.09	-3.99	-1.90	3.13	1.76	1.62	-6.35
	[-7.00, -5.09]	[-5.40, -2.83]	[-2.99, -0.31]	[0.82, 5.47]	[1.24, 2.11]	[1.00, 2.13]	[-7.46, -5.21]
% change in quantity	-3.54	-18.32	-14.81	-24.71	-20.00	-22.05	-11.45
	[-5.21, -0.70]	[-20.72, -15.16]	[-16.84, -12.35]	[-29.14, -19.24]	[-22.89, -13.99]	[-24.73, -15.91]	[-13.86, -8.38]
% change in profits	-10.90	-14.19	-18.27	-24.41	-19.08	-21.54	-18.60
	[-13.22, -7.83]	[-18.08, -10.47]	[-20.05, -15.46]	[-27.51, -20.24]	[-21.54, -12.63]	[-23.89, -14.79]	[-21.41, -15.48]

Notes: "No firm response" refers to case of an advertising ban when prices are held at their pre ban level; "Firm response" refers to case of an advertising ban when firms reoptimize their prices. Price refers to the quantity weighted mean price set by the firm, quantity refers to the total amount of produce sold and profits are variable profits. Numbers are means across markets. 95% confidence intervals are given in square brackets.

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