

Online Appendix to Cross-channel competition and complementarities in US retail

Hiroki Saruya Michael Sullivan

Department of Economics, Yale University

May 29, 2023

O.1 Data processing

We chose the offline retailers to include in the analysis (as listed by Table 1) based on a consideration of national store counts as reported by Tables O.2 through O.4. In particular, we chose retailers that appear within the top three retailers in their respective categories for at least one year, excluding retailers that specialize in a narrow subcategories of their respective retailing categories (e.g., we do not include a large religious book retailer, Family Christian Book Store, in our analysis). Although Office Depot and Office Max merged in 2013, the merged firm—which goes by the name Office Depot—continued operating offline stores under each of the Office Depot and Office Max brands. We consider these brands as distinct offline retailers in analyzing the office supplies category in 2017–2018.

We identify offline stores in the book and office supplies categories by querying the Infogroup data for business locations with the following six-digit Standard Industrial Classification (SIC) codes: 594201 (“Book Stores”) for books and 594301 (“Office Sup-

plies”) for office supplies. For electronics, we query for stores with the following four-digit SIC codes: 5731 (“Radio, Television, and Consumer Electronics Stores”), 5734 (“Computer and Computer Software Stores”), and 5946 (“Camera and Photographic Supply Stores”).

Our procedure for categorizing websites begins by identifying the most popular sites in the Comscore browsing data by visits and unique users. In particular, for each of the time periods (i) January to February 2007, (ii) November to December 2008, (iii) January to February 2017, and (iv) November to December 2018, we construct a list of the top 500 sites by number of visits in the Comscore browsing data as well as a list of the top 500 sites by number of unique visitors in these data. We then concatenate these lists and drop duplicated sites from the combined list. For each site, we manually determine in which of the aforementioned categories the site belongs. Some sites are not well described by any of these categories, and we do not place these sites in any category. Additionally, we do not place sites that are not in our list in any category.

De Los Santos et al. [2012] find that the Comscore data was largely representative of online buyers in the United States via a comparison of Comscore’s 2002 and 2004 datasets with the Internet and Computer Use Supplement of the Current Population Survey (CPS) and an additional survey conducted by a market research company. We arrive at a similar conclusion. Table O.1 characterizes the representativeness of the Comscore Web Behavior Database’s panelists for the year 2007 by comparing the demographic profile of these panelists with demographic distributions reported in publications for the 2007 Current Population Survey (CPS) of the United States Census Bureau. The table suggests that the Comscore panelists are broadly representative of the population of United States internet users, with a few exceptions. We replicate the finding of De Los Santos et al. [2012] that Comscore over-samples Hispanic people relative to the share of Hispanic internet users reported by the CPS Computer and Internet Supplement. We additionally find that Comscore over-samples white people and under-samples Asian people. Note that we use the CPS for all households to obtain information on variables that are not available in the CPS Computer and Internet Use Supplement (e.g., household income

and census region of residence).

We focus on the 2007–2008 time period because the Comscore panel’s coverage of transactions is lower in 2017–2018. In 2017 and 2018, for example, there were respectively 92 and 101 million US members of Amazon Prime (Amazon’s premium subscription service) (see here: <https://www.digitalcommerce360.com/2019/07/11/82-of-us-households-have-a-amazon-prime-membership/>). Additionally, in an October 2017 survey, 92% of Prime members reported ordering from Amazon at least once a month, as did 61% of survey respondents who did not subscribe to Prime (see here: <https://www.forbes.com/sites/louiscolumbus/2018/03/04/10-charts-that-will-change-your-perspective-of-amazon-primes-growth/?sh=42b198b43fee>). Yet only 18.3% of Comscore panelists made a transaction at Amazon in the 2017–2018 time period. Together, the facts that (i) most US consumers used Amazon in 2017–2018, (ii) Amazon reported only 81 million active accounts (Prime or non-Prime) in 2008 (see here: <https://www.nytimes.com/2008/10/12/business/12giants.html>), and (iii) the share of Comscore panelists using Amazon increased only from 14.3% in 2007–2008 to 18.3% in 2017–2018 suggest that the Comscore panel’s coverage of e-commerce transactions markedly decreased between our time periods.

Table O.1: Representativeness of the Comscore Web Behavior Database for 2007

Variable	Comscore	CPS (All households)	CPS (Internet users)
Age: Under 24	0.02	0.06	0.06
Age: 25-34	0.15	0.16	0.18
Age: 35-44	0.27	0.19	0.23
Age: 45-54	0.28	0.21	0.24
Age: 55+	0.27	0.38	0.30
Hispanic	0.23	-	0.08
Race: White	0.94	-	0.84
Race: Black	0.05	-	0.09
Race: Asian	0.01	-	0.07
Race: Other	0.00	-	0.00
Household size: 1	0.06	0.28	-
Household size: 2	0.34	0.33	-
Household size: 3	0.24	0.16	-
Household size: 4	0.19	0.14	-
Household size: 5+	0.17	0.10	-
Census region: Northeast	0.19	0.18	-
Census region: North Central	0.22	0.22	-
Census region: South	0.39	0.37	-
Census region: West	0.20	0.22	-
Household income: Under 15k	0.13	0.13	-
Household income: 15-24k	0.08	0.12	-
Household income: 25-34k	0.10	0.11	-
Household income: 35-49k	0.15	0.14	-
Household income: 50-74k	0.22	0.18	-
Household income: 75-99k	0.14	0.11	-
Household income: 100k+	0.18	0.20	-
Broadband	0.87	-	0.82

Notes: This table compares the distribution of demographic variables among 2007 Comscore Web Behavior Database panelists with the distributions of these variables from the household-level 2007 Current Population Survey—which is labelled “CPS (All households)” in the table—and the 2007 Computer and Internet Use Supplement of the Current Population Survey, which is labelled “CPS (Internet users)” in the table. The table’s figures from the Computer and Internet Use Supplement describe the distribution of demographic variables within the population of householders that uses the internet.

Table O.2: Top book retailers by store count

Rank	2007		2008		2017		2018	
	Retailer	Count	Retailer	Count	Retailer	Count	Retailer	Count
1	Barnes and Noble	929	Barnes and Noble	929	Barnes and Noble	1012	Barnes and Noble	948
2	Borders Books and Music	566	Borders Books and Music	566	Books-a-Million	246	Books-a-Million	231
3	Waldenbooks	383	Waldenbooks	383	Follett Higher Education Group	150	Follett Higher Education Group	147
4	Family Christian Book Store	269	Family Christian Book Store	269	Half Price Books	144	Half Price Books	144
5	Books-a-Million	177	Books-a-Million	177	Scholastic Book Fairs	52	Scholastic Book Fairs	37

Table O.3: Top electronics retailers by store count

Rank	2007		2008		2017		2018	
	Retailer	Count	Retailer	Count	Retailer	Count	Retailer	Count
1	Radio Shack	5699	Radio Shack	5699	Best Buy	1171	Best Buy	1092
2	Best Buy	993	Best Buy	993	Radioshack	1133	Radioshack	286
3	Circuit City	753	Circuit City	753	Apple Store	282	Apple Store	278
4	Ritz Camera Ctr	413	Ritz Camera Ctr	413	Bose Corp	115	Eye Level Learning Ctr	167
5	Compusa	235	Magnolia Home Theatre	235	Spectrum	72	Microsoft Corp	110

Table O.4: Top office supplies retailers by store count

Rank	2007		2008		2017		2018	
	Retailer	Count	Retailer	Count	Retailer	Count	Retailer	Count
1	Staples	1609	Staples	1609	Staples	1380	Staples	1321
2	Office Depot	1307	Office Depot	1307	Office Depot	968	Office Depot	961
3	Office Max	1068	Office Max	1068	Office Max	622	Office Max	540
4	Cartridge World	77	Corporate Express	77	w b Mason	25	w b Mason	15
5	Corporate Express	55	Indoff Inc	55	Office Shop	14	Office Shop	13

O.2 Additional data description

Table O.5: Summary of consumer panel, 2007–2008

(a) Cross-category retailers

Store	Unconditional		Conditional on positive spending		
	Average spending	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	18.51	14.32	129	53	461
Costco	3.27	0.54	607	280	1989
Target	3.84	3.47	111	60	360
Walmart	7.16	6.07	118	50	424

(b) Bookstores

Store	Unconditional		Conditional on positive spending		
	Average panelist	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	6.90	8.28	83	39	290
Barnes & Noble	1.08	1.83	59	30	191
Books-a-Million	0.07	0.13	55	32	182

(c) Electronics

Store	Unconditional		Conditional on positive spending		
	Spending per panelist	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	4.12	1.83	226	109	755
Best Buy	2.75	0.88	311	180	1000
Circuit City	2.47	0.76	323	180	1255

(d) Office supplies

Store	Unconditional		Conditional on positive spending		
	Spending per panelist	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	0.08	0.10	83	41	330
Office Depot	4.36	0.57	768	279	3277
Office Max	0.39	0.11	350	169	1543
Staples	5.47	0.84	653	233	2888

Note: “Average spending” reports the mean dollar amount spent at the store across panelists. “Pct. spending” reports the percentage of panelists who make at least one purchase from the indicated store. “Average spending,” “Median spending,” and “95th percentile spending” describe the distribution of spending among panelists who make at least one purchase. When Amazon is included as an online store in panels (b) onward, only its transactions within the indicated category are included. Table O.6 describes panelist spending in 2017–2018.

Table O.6: Summary of consumer panel, 2017–2018

(a) Cross-category retailers

Store	Unconditional		Conditional on positive spending		
	Spending per consumer	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	52.47	18.30	287	109	1123
Costco	2.23	0.54	414	140	1500
Target	1.20	1.06	114	59	353
Walmart	6.06	4.41	137	60	478

(b) Bookstores

Store	Unconditional		Conditional on positive spending		
	Spending per consumer	Pct. spending	Average spending	Median spending	95th percentile spending
amazon	4.68	4.95	95	45	339
barnesandnoble.com	0.15	0.30	52	29	187

(c) Electronics

Store	Unconditional		Conditional on positive spending		
	Spending per consumer	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	15.00	7.96	188	76	698
Best Buy	2.74	0.67	408	200	1460

(d) Office supplies

Store	Unconditional		Conditional on positive spending		
	Spending per consumer	Pct. spending	Average spending	Median spending	95th percentile spending
Amazon	2.09	1.85	113	56	390
Office Depot	0.28	0.10	289	93	1151
Staples	0.35	0.13	269	85	918

Note: See the notes for Table O.5.

Table O.7: Description of offline retail presence variables

(a) 2007–2008

Category	Store	# stores (20km)					Min. distance					# stores (total - 2007)
		Mean	0.25	0.50	0.75	0.95	Mean	0.25	0.50	0.75	0.95	
Cross-category	Costco	2.34	0	0	4	10	75.13	8.54	25.77	106.10	302.47	374
Cross-category	Target	7.48	0	4	12	24	33.41	3.89	7.44	22.96	84.41	1446
Cross-category	Walmart	8.33	2	6	12	23	8.66	3.06	5.34	10.02	25.82	3411
Books	Barnes	5.66	0	2	8	18	26.37	5.43	11.10	32.80	96.77	832
Books	Books-a-Million	0.51	0	0	0	3	474.97	32.06	134.02	504.68	2093.03	178
Books	Borders	4.35	0	2	6	19	45.23	6.30	14.29	56.97	186.00	660
Books	Waldenbooks	1.73	0	1	3	7	53.92	9.31	23.64	56.56	153.75	464
Books	Other	71.42	6	23	67	299	7.08	1.40	3.04	7.50	28.01	11251
Electronics	Apple	1.46	0	0	2	7	86.19	13.35	36.70	117.27	308.64	169
Electronics	Best Buy	4.95	0	2	8	17	23.75	5.20	9.59	27.47	89.86	851
Electronics	Circuit City	4.16	0	2	6	16	33.75	5.63	10.79	33.66	119.36	685
Electronics	Radio Shack	24.41	4	12	30	90	7.01	1.78	3.27	6.85	26.70	5095
Electronics	Other	157.68	10	47	161	694	4.90	0.92	1.94	4.57	20.80	23011
Office Supplies	Office Depot	7.11	0	4	11	28	26.09	4.24	9.31	31.15	96.82	1262
Office Supplies	Office Max	4.73	0	2	8	18	29.18	5.25	12.19	39.27	103.81	982
Office Supplies	Staples	10.63	0	2	11	44	41.76	3.93	9.05	33.37	127.92	1486
Office Supplies	Other	29.31	3	11	33	115	9.56	2.32	4.79	11.65	33.92	5543

(b) 2017–2018

Category	Store	# stores (20km)					Min. distance					# stores (total - 2017)
		Mean	0.25	0.50	0.75	0.95	Mean	0.25	0.50	0.75	0.95	
Cross-category	Costco	3.46	0	2	6	13	40.11	6.52	13.65	50.63	161.63	510
Cross-category	Target	10.89	2	6	16	37	15.11	3.16	5.54	13.35	66.92	1809
Cross-category	Walmart	12.72	4	10	18	35	6.74	2.49	4.16	7.37	19.94	4318
Books	Barnes	5.91	0	4	8	20	21.48	5.07	9.69	23.65	78.89	953
Books	Books-a-Million	0.57	0	0	0	3	190.94	21.52	48.98	149.75	803.83	238
Books	Other	64.96	6	24	65	239	7.76	1.59	3.36	7.83	31.02	8957
Electronics	Apple	2.62	0	1	4	11	53.67	9.45	19.97	65.44	209.02	274
Electronics	Best Buy	6.32	2	4	9	21	18.28	4.43	7.91	17.52	72.86	1024
Electronics	Radio Shack	2.56	0	1	3	11	47.08	10.55	26.39	53.14	132.64	1124
Electronics	Other	166.01	13	61	196	724	4.88	0.89	1.84	4.11	21.06	21188
Office Supplies	Office Depot	5.36	0	2	8	23	31.83	4.88	11.86	36.61	123.91	968
Office Supplies	Office Max	2.54	0	1	4	10	41.24	7.78	20.34	56.88	145.96	622
Office Supplies	Staples	9.74	0	4	9	37	36.65	4.05	8.27	24.43	104.62	1380
Office Supplies	Other	26.20	3	10	27	105	10.76	2.62	5.24	12.37	38.78	4313

Table O.8: Regressions of online spending on high-income share (2017–2018)

	costco.com	Spending target.com	walmart.com
	(4)	(5)	(6)
N. stores (log-transformed)	0.797*** (0.105)	0.162*** (0.030)	−0.585*** (0.094)
High income	1.154*** (0.238)	0.277*** (0.082)	0.309 (0.210)
Race: White	−0.497** (0.251)	0.443*** (0.087)	1.898*** (0.220)
Race: Black	−1.473*** (0.300)	−0.290*** (0.104)	−0.465* (0.265)
Hispanic	−0.360 (0.266)	−0.044 (0.092)	−0.048 (0.234)
Broadband internet	1.385* (0.712)	1.039*** (0.246)	4.333*** (0.629)
College graduate	2.643*** (0.275)	0.624*** (0.095)	1.211*** (0.242)
High income (average)	1.541*** (0.509)	0.449** (0.176)	−1.279*** (0.444)
Mean dep. var.	1.76	0.98	4.76
Observations	172,596	172,578	172,462

Note: “N. stores (log-transformed)” is the log of one plus the number of offline stores operated by the retailer indicated by the column header within 20km of the consumer. “High income (average)” is the share of people within 20km of the consumer that have household incomes exceeding \$75,000. We include year fixed effects; indicators for the panelist’s head of household being under 40 years of age and between 40 and 54 years of age; an an indicator for the presence of children in the panelist’s household. We omit, however, these regressors’ estimated coefficients from the table.

Table O.9: Number of sessions including web browsing in various categories

Category	2007–2008		2017–2018	
	Median	90th percentile	Median	90th percentile
Adult	2	66	0	36
Advert	9	80	0	1
Career	1	15	0	5
Dating	0	5	0	0
Directory	0	1	0	2
Downloads	0	7	0	2
Finance	6	97	1	39
Gaming	2	106	0	41
Government	2	19	0	6
Info	19	93	3	39
Internet/wireless	4	58	0	10
Malware	6	150	0	4
Media	10	95	1	16
News	3	29	1	15
Portal	393	1577	88	697
Retail	42	223	7	98
Social Media	33	585	5	107
Sports	1	21	0	3
Travel	2	24	0	9
Video	8	99	6	133
Weather	2	67	0	2
Webservice	41	320	0	9
Total	2228	8063	476	3464

Note: This table reports the cross-panelist distribution of the number of times that a panelist visited a website in various categories. The “Total” row describes the distribution of the number of distinct visits to web domains made by panelists. Recall that a panelist is defined as a pair of a web user in the Comscore data and a calendar year. Increased mobile usage at the expense of personal computer usage between the time periods may explain the decrease in the number of visits between the time periods.

O.3 Additional Nadaraya-Watson kernel regressions

This section presents additional results of Nadaraya-Watson kernel regressions, analogous to those in Figure 1 in the main text. To illustrate heterogeneous relationships between online sales and offline retail presence, we present the regression results for both within- and between-retailer relationships between online sales and offline presence, focusing on major retailers in each category shown in Tables 2 and O.6. We present the results for the 2007-2008 period and 2017-2018 period separately.

Electronics (2007-2008). Figure O.1a displays the result of the regression of positive spending at Best Buy’s online store on the consumer’s distance from the closest Best Buy store. It shows a mildly negative relationship between distance and transaction, which is consistent with a positive effect of own offline stores on online sales. Figure O.1b depicts the results of the regression of positive spending on electronics products at Amazon on the distance from Best Buy’s offline store. We find a mildly negative relationship (up to around 15km), which is consistent with a positive showrooming effect of Best Buy’s physical stores on the sales at Amazon.

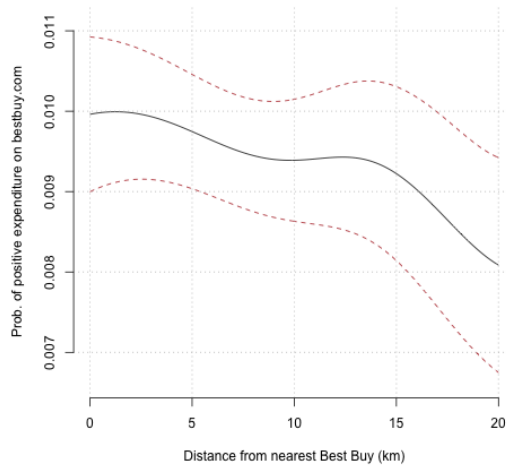
Office Supplies. (2007-2008). Figures O.1c and O.1d show the results of the regression of positive spending on office supplies at Staples’ online store on the distance from the physical store of Staples and OfficeMax, respectively. As the distance from the nearest Staples store increases (up to around 10km), consumers are less likely to spend on office supplies at Staples’ online store. By contrast, consumers are more likely to make a purchase at Staples online as they become further away from OfficeMax’s physical store. This stark contrast is consistent with the Staples online store being subject to a positive own-store effect and a negative rival-store effect, though the relationships are not necessarily causal.

2017-2018. Figure O.2 presents the regression results for the same pairs of retailers as the 2007-2008 regression analysis shown in Figures 1 and O.1. The relationship between

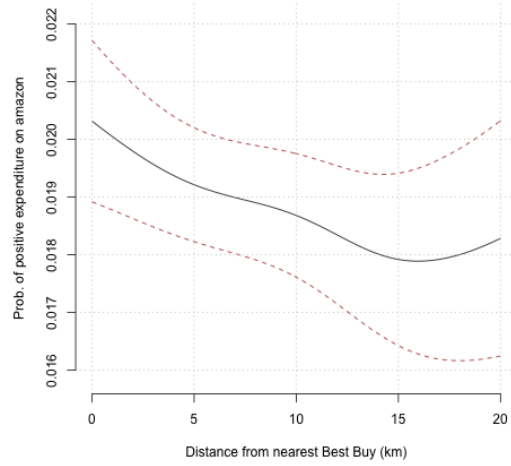
online sales of a retailer and its offline presence, measured by proximity, is overall positive except for Walmart. Also, offline store presence of a retailer is overall negatively related to the online sales of a rival multichannel retailer, whereas its relationships to Amazon's sales are ambiguous or slightly positive.

These results together with Figure 1 show mostly consistent qualitative patterns: offline store presence of a retailer is positively related to the sales of its own online store but negatively related to those of a rival retailer, except for Amazon. As discussed in the main text, however, these relationships are just descriptive and not necessarily causal. We discuss our formal approach to causal estimation and its empirical results in the main text.

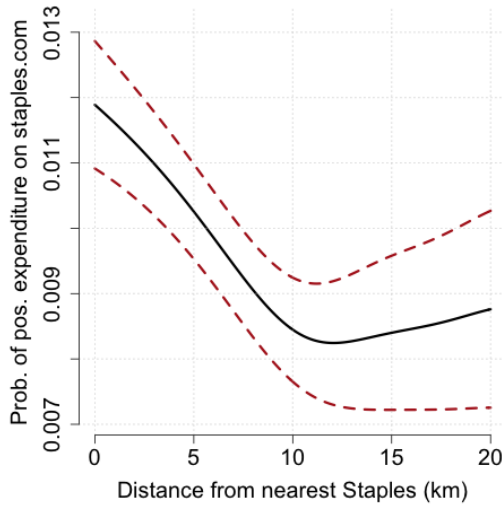
Figure O.1: Additional regressions of online spending on distance from retailer, 2007–2008



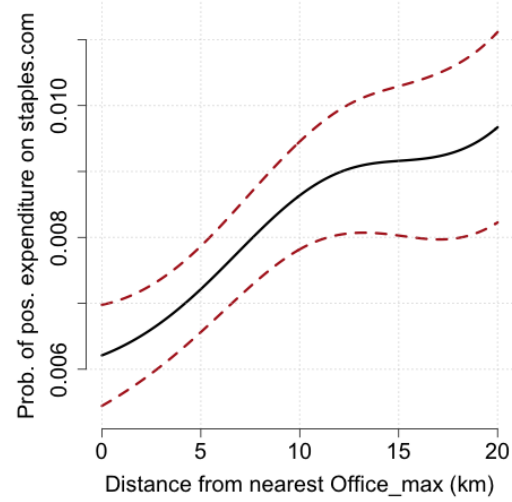
(a) Probability of transaction on bestbuy.com by distance from Best Buy



(b) Probability of transaction on Amazon by distance from Best Buy

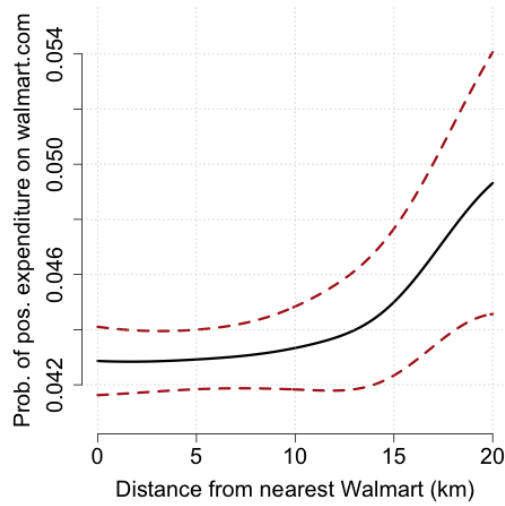


(c) Probability of transaction on staples.com by distance from Staples

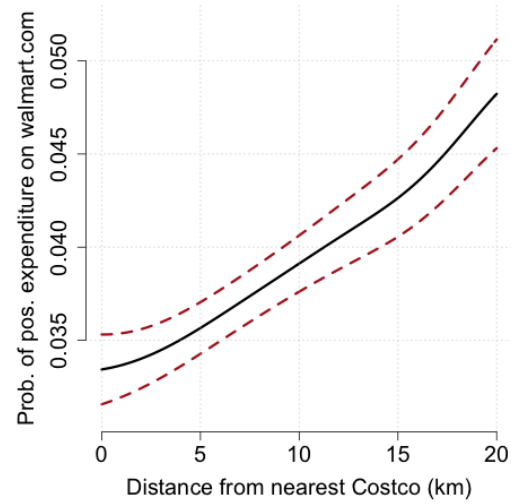


(d) Probability of transaction on staples.com by distance from Office-MaX

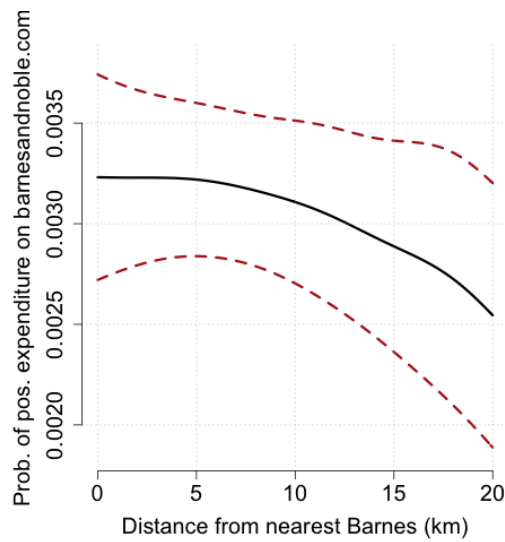
Figure O.2: Additional regressions of online spending on distance from retailer, 2017–2018



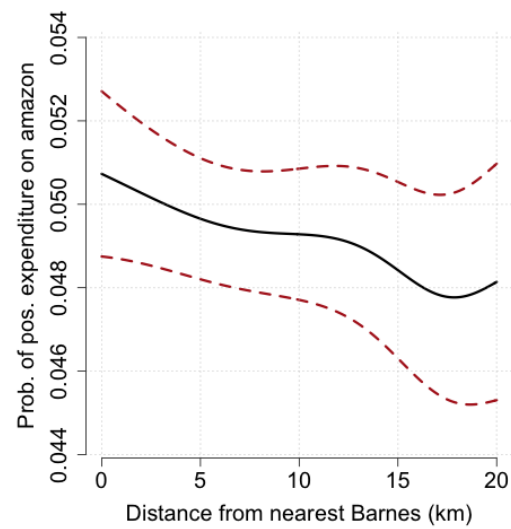
(a) Probability of transaction on walmart.com by distance from Walmart



(b) Probability of transaction on walmart.com by distance from Costco

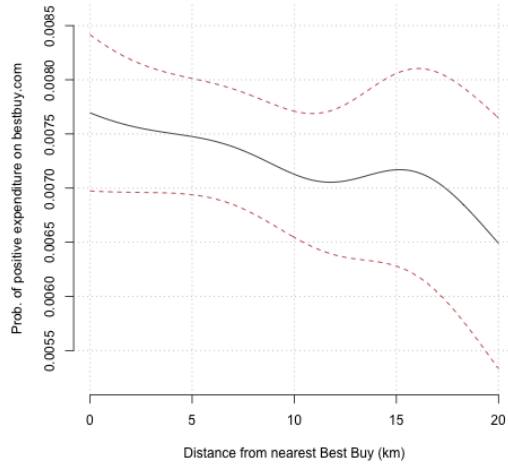


(c) Probability of transaction on barnesandnoble.com by distance from Barnes & Noble

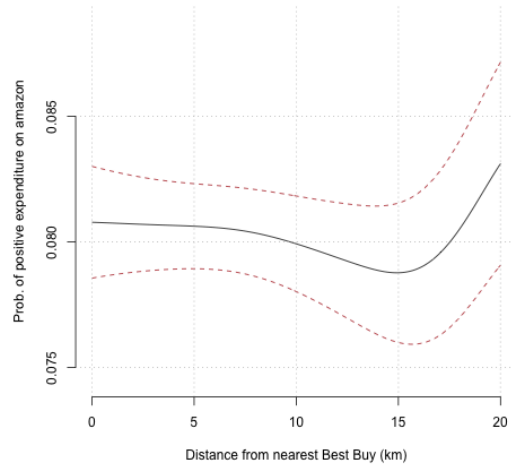


(d) Probability of transaction on Amazon by distance from Barnes & Noble

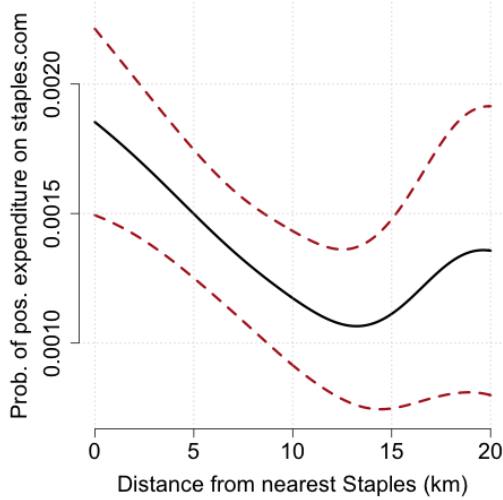
Figure O.2: Additional regressions of online spending on distance from retailer, 2017–2018
(Continued)



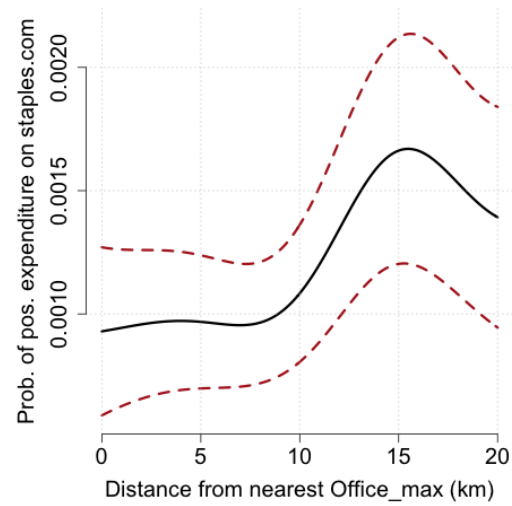
(e) Probability of transaction on bestbuy.com by distance from Best Buy



(f) Probability of transaction on Amazon by distance from Best Buy



(g) Probability of transaction on staples.com by distance from Staples



(h) Probability of transaction on staples.com by distance from Office-MaX

O.4 Measures of rival effects and cross-channel complementarities

This section develops scale-free measures of offline stores' effects on online spending that facilitate comparisons across regressions. Our discussion of scale-free measures requires additional notation: let \mathcal{J}^{off} denote the set of offline retailers, of which there are $J = |\mathcal{J}^{\text{off}}|$, and let \mathcal{J}^{on} denote the set of online retailers. We do not identify time period or category in our notation to avoid notational clutter, although we run our analysis separately for each period/category pair (e.g., books in 2007–2008).

We begin by constructing a measure of the effect of a particular offline store j on the spending at a particular online store s . Note that consumer i 's expected spending at online retailer s conditional on the regressors is

$$\mathbb{E}[y_{is} \mid n_i, z_i, q_i, \rho_{R(i),s}, w_{r(i)}] = h(n_i)' \alpha_s + z_i' \tilde{\beta}_s + q_i' \gamma_s + \rho_{R(i),s}^{\text{FE}} + w_{r(i)}' \phi. \quad (1)$$

This equation follows from equation (6) in the main text, although we have added store s subscripts to signify that we estimate (4) separately for each online store s .

We measure the effect of n_{ij} on spending by the percentage change in expected spending when the number n_{ij} of stores of offline retailer j is exogenously increased from \bar{n}_j to $\bar{n}_j + 1$, holding all other explanatory variables fixed at their mean values. Letting \bar{x} denote the mean of a random variable x_i , we define the relative effect of j on s as

$$\begin{aligned} \theta_{js} &= \frac{\mathbb{E}[y_{is} \mid \bar{n}_j + 1, \bar{n}_{-j}, \bar{z}, \bar{q}, \bar{\rho}_s, \bar{w}] - \mathbb{E}[y_{is} \mid \bar{n}_j, \bar{n}_{-j}, \bar{z}, \bar{q}, \bar{\rho}_s, \bar{w}]}{\mathbb{E}[y_{is} \mid \bar{n}_j, \bar{n}_{-j}, \bar{z}, \bar{q}, \bar{\rho}_s, \bar{w}]} \\ &= \frac{(h(\bar{n}_j + 1, \bar{n}_{-j}) - h(\bar{n}_j, \bar{n}_{-j}))' \alpha_s}{h(\bar{n})' \alpha_s + \bar{z}' \tilde{\beta}_s + \bar{q}' \gamma_s + \bar{\rho}_s + g(\bar{w})}. \end{aligned} \quad (2)$$

We estimate θ_{js} by substituting our estimates of unknown parameters into (2).

Using the store-pair-specific effects defined by (2), we define the measures of rival and

own effects. First, define the *store-specific average rival effect* as

$$\theta_s^{\text{rival}} = \sum_{j \in \mathcal{J}^{\text{off}} \setminus \{s\}} w_{js}^{\text{off}} \theta_{js} \quad (3)$$

where $\{w_{js}^{\text{off}}\}_j$ are weights for offline retailers j satisfying $\sum_{j \in \mathcal{J}^{\text{off}}} w_{js}^{\text{off}} = 1$ and $w_{js}^{\text{off}} = 0$ for $j = s$. We set w_{js}^{off} proportional to retailer j 's number of stores in the time period under analysis.

The rival effect defined in (3) includes all effects of rival offline stores on online spending. Therefore, a positive value for this measure would indicate that a showrooming effect outweighs the competitive effect as long as the former effect is positive and the latter is negative. The converse of this statement is true for a negative rival effect.

We take θ_{ss} as a measure of *store-specific own effect*. Its interpretation is similar to that of θ_s^{rival} . This measure will be positive (negative) if cross-channel complementarities are larger (smaller) than cannibalization, assuming that the former is positive and the latter is negative.

We also interpret averages of our store-specific average rival and own effects for each retailing category in each time period. These averages are defined as

$$\bar{\theta}^{\text{rival}} = \sum_{s \in \mathcal{J}^{\text{on}} \cap \mathcal{J}^{\text{off}}} w_s^{\text{on}} \theta_s^{\text{rival}} \quad (4)$$

$$\bar{\theta}^{\text{own}} = \sum_{s \in \mathcal{J}^{\text{on}} \cap \mathcal{J}^{\text{off}}} w_s^{\text{on}} \theta_{ss} \quad (5)$$

for weights $\{w_s^{\text{on}}\}_s$ on stores s that sum to one across s . In practice, we set w_s^{on} proportional to the mean of y_{is} . Note that each of the average measures defined above is taken over multichannel retailers $s \in \mathcal{J}^{\text{on}} \cap \mathcal{J}^{\text{off}}$. We also compute an average of rival effects over all online retailers, including Amazon:

$$\bar{\theta}_{\text{incl}}^{\text{rival}} = \sum_{s \in \mathcal{J}^{\text{on}}} w_s^{\text{on}} \theta_s^{\text{rival}}.$$

O.5 Store-specific spending regressions for 2017–2018

This appendix provides results for store-specific spending regressions on the 2017–2018 data.

Table O.10: Store-specific cross-category spending in 2017–2018

(a) Coefficients

	Spending			
	amazon	costco.com	target.com	walmart.com
	(1)	(2)	(3)	(4)
N. Stores: Costco	−0.135 (0.776)	0.851*** (0.210)	0.010 (0.070)	−0.027 (0.186)
N. Stores: Target	0.809 (0.984)	−0.015 (0.281)	0.159* (0.085)	−0.111 (0.242)
N. Stores: Walmart	−3.688*** (0.766)	−0.278 (0.231)	−0.209*** (0.076)	−0.007 (0.174)
Mean dep. var.	41.38	1.74	0.98	4.77
Observations	170,599	171,207	171,189	171,074
R ²	0.143	0.009	0.019	0.047

(b) Rival and own effects

	amazon	costco.com	target.com	walmart.com
	(1)	(2)	(3)	(4)
Rival	−0.012 (0.004)	−0.034 (0.033)	−0.051 (0.027)	−0.008 (0.014)
Own		0.331 (0.079)	0.069 (0.037)	−0.000 (0.013)

Note: See the notes for Table 11.

Table O.11: Store-specific books spending in 2017–2018

(a) Coefficients

	amazon	Spending barnesandnoble.com
	(1)	(2)
N. Stores: Barnes	0.123 (0.135)	0.025 (0.016)
N. Stores: Books-a-Million	−0.300** (0.129)	0.001 (0.019)
N. Stores: Other	0.236* (0.125)	−0.006 (0.014)
Mean dep. var.	3.80	0.13
Observations	171,056	171,215
R ²	0.052	0.003

(b) Rival and own effects

	amazon	barnesandnoble.com
	(1)	(2)
Rival	0.009 (0.008)	−0.011 (0.036)
Own		0.108 (0.070)

Note: See the notes for Table 11.

Table O.12: Store-specific electronics spending in 2017–2018

(a) Coefficients

	amazon	Spending apple.com	bestbuy.com
	(1)	(2)	(3)
N. Stores: Apple	0.462 (0.338)	−0.048 (0.193)	0.141 (0.215)
N. Stores: Best Buy	−0.379 (0.423)	0.315 (0.209)	0.181 (0.247)
N. Stores: Radio Shack	−0.300 (0.276)	0.259 (0.160)	−0.179 (0.191)
Mean dep. var.	11.69	1.09	2.26
Observations	170,953	171,220	171,202
R ²	0.064	0.002	0.006

(b) Rival effects and own effects

	amazon	apple.com	bestbuy.com
	(1)	(2)	(3)
Rival	−0.005 (0.009)	0.163 (0.082)	−0.007 (0.043)
Own		−0.035 (0.143)	0.041 (0.056)

Note: See the notes for Table 11.

Table O.13: Store-specific office supplies spending in 2017–2018

(a) Coefficients

	amazon	Spending officedepot.com	staples.com
	(1)	(2)	(3)
N. Stores: Office Depot	−0.064 (0.078)	0.062 (0.048)	−0.052 (0.044)
N. Stores: Office Max	−0.022 (0.074)	0.058 (0.052)	−0.009 (0.044)
N. Stores: Other	0.019 (0.076)	−0.006 (0.043)	−0.025 (0.037)
N. Stores: Staples	−0.027 (0.077)	−0.001 (0.057)	0.075** (0.035)
Mean dep. var.	1.69	0.21	0.22
Observations	171,162	171,222	171,221
R ²	0.029	0.002	0.002

(b) Rival and own effects

	amazon	officedepot.com	staples.com
	(1)	(2)	(3)
Rival	−0.007 (0.012)	0.033 (0.072)	−0.066 (0.056)
Own		0.177 (0.133)	0.168 (0.075)

Note: See the notes for Table 11.

O.6 Robustness to alternative specifications

In this section, we evaluate robustness of our main results shown in Section 6 to alternative specifications. Specifically, we show that the qualitative results of overall and store-specific regressions remain unchanged if we change functional forms (from linear to Poisson) or dependent variables (from expenditure levels to positive-spending indicator¹). For overall regressions, we also show that results are similar if we allow the effect of store counts to depend on some local and demographic characteristics. For the sake of space, we only present the results for 2007–2008. Additional results with state fixed effects are reported separately in Appendix O.7.

Overall regressions. Tables O.14 presents the results of overall regressions under various specifications. Panel O.14a replicates the main result 8a for ease of comparison. For large cross-category retailers, the effect of the number of stores on overall online sales is negative in all specifications, although the estimate for positive-spending regression is imprecise. For bookstores and electronics retailers, the effect of the store count is positive for all specifications, though the estimate for electronics in the positive spending regression is imprecise. For office supplies retailers, the sign of the estimated effect depends on specifications.

Overall regressions with heterogeneous effects. We also conduct overall regressions where we allow the effect of offline store presence on online sales to depend on the urbanity of panelists' neighbourhood and their own income and age. Specifically, we include interactions of store count with (normalized) indicators for (i) local population above median, (ii) household income above \$75,000, (iii) head of household being under 40 years of age and (iv) head of household being between 40 and 54 years of age. We subtract from each indicator its mean, so the coefficient on uninteracted store count represents the average effect of store count on online sales.

¹We multiply the indicator by 100 so that the coefficients are interpretable as a percentage-point change as the number of stores increases by one.

Table O.15 presents the results. We note that the coefficients on uninteracted store count are quite similar to those reported in Table 8a and Table O.14a (except for office supplies), which suggests that the overall regression results are robust to effect heterogeneity. For coefficients on interactions, we do not find robust patterns across categories.

Store-specific Poisson expenditure regressions. Tables O.16 through O.19 show the estimates of coefficients, rival effects, and own effects from Poisson expenditure regressions. For cross-category retailers and bookstores, we observe the same patterns as in our main results in Tables 11 and 12: (i) Among multichannel retailers, the rival effects are negative and the own effects are positive. (ii) Amazon faces less negative rival effects than multichannel competitors. Also, for electronics retailers and office supplies retailers, Tables O.18 and O.19 replicate the same qualitative patterns as in Tables 13 and 14. For electronics, Best Buy and Circuit City stores impact respective own online sales positively and the other's online sales negatively, whereas the own effects of Apple and Radio Shack are negative. For office supplies, the effects of offline stores of a retailer on the sales of its own online channel are all positive. The estimates of rival effects and own effects in Tables O.18 and O.19 have the same signs as those in Tables 13 and 14, and the magnitudes are somewhat similar, especially for electronics.

Store-specific positive-spending regressions. Tables O.20 through O.23 present the results of linear positive-spending regressions. The results are qualitatively similar to the main results, with multichannel retailers typically having negative rival effects and positive own effects, especially for cross-category retailers and bookstores. The rival effects on Amazon are also less negative than those on multichannel retailers. This suggests that our main results are not driven by the choice of studying the impact of offline retail presence on the intensive margin, rather than the extensive margin, of online purchase behavior.

Table O.14: Overall spending regressions

(a) 2007–2008 (expenditures, linear)

	Cross-category retailers (1)	Bookstores (2)	Electronics (3)	Office supplies (4)
N. Stores: Total	−11.754*** (2.476)	0.789*** (0.190)	2.517** (1.199)	0.468 (0.771)
Mean dep. var.	187.35	9.14	47.37	12.91
Observations	145,345	146,506	146,404	146,765

(b) 2007–2008 (expenditures, Poisson)

	Cross-category retailers (1)	Bookstores (2)	Electronics (3)	Office supplies (4)
N. Stores: Total	−0.053*** (0.0005)	0.096*** (0.002)	0.062*** (0.001)	0.049*** (0.002)
Mean dep. var.	187.35	9.14	47.37	12.91
Observations	145,345	146,506	146,404	146,765

(c) 2007–2008 (positive spending, linear)

	Cross-category retailers (1)	Bookstores (2)	Electronics (3)	Office supplies (4)
N. Stores: Total	−0.250 (0.300)	1.121*** (0.157)	0.189 (0.213)	−0.027 (0.107)
Mean dep. var.	51.99	12.49	15.97	3.66
Observations	146,873	146,873	146,873	146,873

Note: This table presents the coefficients from the regressions of overall spending measures on the number of offline stores in each category. Panel O.14a replicates the benchmark results of linear expenditure regressions. Panel O.14b displays the results of Poisson expenditure regressions. Panel O.14c displays the results of linear regressions using the indicator of positive overall spending as a dependent variable. The positive-spending indicator is rescaled so that the coefficients represent a percentage-point change in the probability of positive spending when the number of stores is increased by one. The “Mean dep. var” row presents the averages of the dependent variable.

Table O.15: Overall spending regressions with heterogeneous effects

(a) 2007–2008

	Cross-category retailers	Bookstores	Electronics	Office supplies
	(1)	(2)	(3)	(4)
N. Stores: Total	−13.568*** (2.510)	0.765*** (0.190)	2.238* (1.220)	0.154 (0.780)
N. Stores: Total × Large Population	5.082*** (1.152)	0.130 (0.087)	0.495 (0.381)	0.958*** (0.355)
N. Stores: Total × High Income	1.241 (2.033)	−0.141 (0.140)	0.066 (0.695)	−0.308 (0.549)
N. Stores: Total × Young	0.228 (2.454)	−0.262 (0.165)	−0.840 (0.830)	−0.543 (0.657)
N. Stores: Total × Middle Age	−2.578 (2.191)	−0.304** (0.148)	−1.465** (0.742)	−0.811 (0.587)
Mean dep. var.	187.35	9.14	47.37	12.91
Observations	145,345	146,506	146,404	146,765

Note: This table presents the coefficients from the regressions of overall expenditures on the number of offline stores in each category and its interactions with (normalized) indicators for (i) the population of the panelist’s neighbourhood being above median, (ii) the panelist’s household income above \$75,000, (iii) the panelist’s head of household being under 40 years of age and (iv) the panelist’s head of household being between 40 and 54 years of age. Each indicator is normalized by its mean so that the coefficient on uninteracted store count represents the average effect of store count on online sales. The “Mean dep. var” row presents the averages of the dependent variable.

Table O.16: Store-specific cross-category spending in 2007–2008 (Poisson)

(a) Coefficients

	Spending			
	amazon	costco.com	target.com	walmart.com
	(1)	(2)	(3)	(4)
N. Stores: Costco	0.034*** (0.001)	1.038*** (0.004)	0.064*** (0.003)	0.020*** (0.002)
N. Stores: Target	−0.025*** (0.002)	−0.005 (0.004)	0.129*** (0.004)	−0.157*** (0.002)
N. Stores: Walmart	−0.084*** (0.001)	−0.158*** (0.003)	−0.175*** (0.003)	0.142*** (0.002)
Mean dep. var.	14.10	2.51	3.20	5.71
Observations	146,451	146,857	146,770	146,694

(b) Rival effects and own effects

	amazon	costco.com	target.com	walmart.com
	(1)	(2)	(3)	(4)
Rival	−0.015 (0.000)	−0.036 (0.001)	−0.035 (0.001)	−0.045 (0.001)
Own		1.378 (0.009)	0.065 (0.002)	0.062 (0.001)

Note: See the notes for Table 11.

Table O.17: Store-specific books spending in 2007–2008 (Poisson)

(a) Coefficients

	amazon	Spending barnesandnoble.com	booksamillion.com
	(1)	(2)	(3)
N. Stores: Barnes	0.023*** (0.003)	0.402*** (0.007)	0.130*** (0.025)
N. Stores: Books-a-Million	0.054*** (0.003)	−0.074*** (0.007)	0.660*** (0.020)
N. Stores: Borders	0.076*** (0.002)	−0.239*** (0.006)	−0.296*** (0.023)
N. Stores: Other	0.111*** (0.002)	−0.041*** (0.006)	−0.162*** (0.019)
N. Stores: Waldenbooks	−0.003 (0.002)	0.117*** (0.005)	−0.181*** (0.021)
Mean dep. var.	5.53	0.86	0.06
Observations	146,629	146,819	146,869

(b) Rival effects and own effects

	amazon	barnesandnoble.com	booksamillion.com
	(1)	(2)	(3)
Rival	0.030 (0.000)	−0.028 (0.001)	−0.054 (0.004)
Own		0.264 (0.005)	2.095 (0.108)

Note: See the notes for Table 11.

Table O.18: Store-specific electronics spending in 2007–2008 (Poisson)

(a) Coefficients

	Spending				
	amazon	apple.com	bestbuy.com	circuitcity.com	radioshack.com
	(1)	(2)	(3)	(4)	(5)
N. Stores: Apple	0.066*** (0.003)	−0.061*** (0.003)	−0.160*** (0.003)	−0.114*** (0.004)	0.686*** (0.022)
N. Stores: Best Buy	−0.011*** (0.004)	−0.121*** (0.005)	0.238*** (0.005)	−0.268*** (0.005)	0.147*** (0.028)
N. Stores: Circuit City	0.017*** (0.004)	0.240*** (0.005)	−0.228*** (0.005)	0.256*** (0.005)	−0.112*** (0.028)
N. Stores: Radio Shack	0.112*** (0.005)	0.221*** (0.005)	0.090*** (0.006)	0.067*** (0.006)	−0.635*** (0.024)
Mean dep. var.	3.22	2.39	2.31	2.13	0.08
Observations	146,819	146,853	146,847	146,850	146,869

(b) Rival effects and own effects

	amazon	apple.com	bestbuy.com	circuitcity.com	radioshack.com
	(1)	(2)	(3)	(4)	(5)
Rival	0.025 (0.001)	0.059 (0.001)	−0.039 (0.001)	−0.044 (0.001)	0.200 (0.009)
Own		−0.061 (0.003)	0.146 (0.003)	0.170 (0.004)	−0.194 (0.007)

Note: See the notes for Table 11.

Table O.19: Store-specific office supplies spending in 2007–2008 (Poisson)

(a) Coefficients

	Spending			
	amazon	officedepot.com	officemax.com	staples.com
	(1)	(2)	(3)	(4)
N. Stores: Office Depot	0.411*** (0.022)	0.743*** (0.003)	−0.464*** (0.007)	−0.073*** (0.002)
N. Stores: Office Max	0.091*** (0.016)	0.160*** (0.002)	0.778*** (0.010)	−0.221*** (0.002)
N. Stores: Other	−0.302*** (0.018)	−0.118*** (0.003)	−0.196*** (0.008)	−0.168*** (0.002)
N. Stores: Staples	0.096*** (0.017)	−0.024*** (0.002)	−0.318*** (0.006)	0.661*** (0.003)
Mean dep. var.	0.07	3.59	0.33	4.54
Observations	146,870	146,856	146,869	146,848

(b) Rival effects and own effects

	amazon	officedepot.com	officemax.com	staples.com
	(1)	(2)	(3)	(4)
Rival	0.038 (0.005)	0.001 (0.001)	−0.130 (0.001)	−0.068 (0.000)
Own		0.478 (0.003)	0.607 (0.010)	0.405 (0.002)

Note: See the notes for Table 11.

Table O.20: Store-specific cross-category positive spending in 2007–2008

(a) Coefficients

	Probability of Positive Spending			
	amazon	costco.com	target.com	walmart.com
	(1)	(2)	(3)	(4)
N. Stores: Costco	0.051 (0.177)	0.364*** (0.037)	0.100 (0.097)	−0.024 (0.118)
N. Stores: Target	0.135 (0.205)	0.061 (0.038)	0.380*** (0.108)	−0.863*** (0.149)
N. Stores: Walmart	−0.599*** (0.186)	−0.212*** (0.047)	−0.532*** (0.101)	1.011*** (0.123)
Mean dep. var.	14.35	0.54	3.48	6.08
Observations	146,873	146,873	146,873	146,873
R ²	0.090	0.014	0.032	0.050

(b) Rival effects and own effects

	amazon	costco.com	target.com	walmart.com
	(1)	(2)	(3)	(4)
Rival	−0.006 (0.003)	−0.066 (0.022)	−0.039 (0.012)	−0.048 (0.008)
Own		0.562 (0.053)	0.054 (0.015)	0.070 (0.008)

Note: See the notes for Table 11.

Table O.21: Store-specific books positive spending in 2007–2008

(a) Coefficients

	Probability of Positive Spending		
	amazon	barnesandnoble.com	booksamillion.com
	(1)	(2)	(3)
N. Stores: Barnes	0.137 (0.159)	0.660*** (0.076)	−0.005 (0.024)
N. Stores: Books-a-Million	0.303* (0.156)	−0.238*** (0.071)	0.122*** (0.029)
N. Stores: Borders	0.483*** (0.149)	−0.351*** (0.077)	−0.046** (0.021)
N. Stores: Other	0.753*** (0.134)	−0.013 (0.065)	−0.005 (0.019)
N. Stores: Waldenbooks	0.073 (0.128)	−0.023 (0.063)	−0.039** (0.017)
Mean dep. var.	8.28	1.83	0.13
Observations	146,873	146,873	146,873
R ²	0.061	0.014	0.003

(b) Rival effects and own effects

	amazon	barnesandnoble.com	booksamillion.com
	(1)	(2)	(3)
Rival	0.024 (0.003)	−0.039 (0.009)	−0.079 (0.028)
Own		0.210 (0.024)	1.574 (0.351)

Note: See the notes for Table 11.

Table O.22: Store-specific electronics positive spending in 2007–2008

(a) Coefficients

	Probability of Positive Spending				
	amazon	apple.com	bestbuy.com	circuitcity.com	radioshack.com
	(1)	(2)	(3)	(4)	(5)
N. Stores: Apple	0.227*** (0.074)	0.029 (0.048)	−0.116** (0.053)	−0.107** (0.053)	0.016 (0.018)
N. Stores: Best Buy	−0.080 (0.097)	−0.009 (0.062)	0.226*** (0.072)	−0.225*** (0.067)	−0.014 (0.024)
N. Stores: Circuit City	−0.067 (0.094)	0.075 (0.057)	−0.156** (0.072)	0.333*** (0.064)	0.014 (0.023)
N. Stores: Radio Shack	0.157 (0.104)	0.058 (0.061)	0.005 (0.072)	0.077 (0.064)	−0.004 (0.027)
Mean dep. var.	1.83	0.68	0.89	0.77	0.11
Observations	146,873	146,873	146,873	146,873	146,873
R ²	0.024	0.006	0.008	0.010	0.001

(b) Rival effects and own effects

	amazon	apple.com	bestbuy.com	circuitcity.com	radioshack.com
	(1)	(2)	(3)	(4)	(5)
Rival	0.015 (0.009)	0.029 (0.016)	−0.047 (0.019)	−0.049 (0.020)	0.028 (0.058)
Own		0.044 (0.073)	0.146 (0.046)	0.266 (0.051)	−0.011 (0.086)

Note: See the notes for Table 11.

Table O.23: Store-specific office supplies positive spending in 2007–2008

(a) Coefficients

	Probability of Positive Spending			
	amazon	officedepot.com	officemax.com	staples.com
	(1)	(2)	(3)	(4)
N. Stores: Office Depot	0.026 (0.018)	0.277*** (0.031)	−0.018 (0.020)	−0.145*** (0.048)
N. Stores: Office Max	0.009 (0.014)	−0.005 (0.032)	0.047*** (0.012)	−0.151*** (0.039)
N. Stores: Other	−0.016 (0.016)	−0.051 (0.034)	−0.006 (0.017)	−0.075* (0.044)
N. Stores: Staples	0.006 (0.013)	−0.056* (0.032)	−0.033** (0.016)	0.276*** (0.031)
Mean dep. var.	0.10	0.57	0.11	0.84
Observations	146,873	146,873	146,873	146,873
R ²	0.002	0.008	0.003	0.011

(b) Rival effects and own effects

	amazon	officedepot.com	officemax.com	staples.com
	(1)	(2)	(3)	(4)
Rival	0.028 (0.035)	−0.031 (0.015)	−0.073 (0.039)	−0.067 (0.012)
Own		0.257 (0.028)	0.256 (0.063)	0.169 (0.018)

Note: See the notes for Table 11.

O.7 Regressions with state fixed effects

This section presents the results of regressions which include state fixed effects rather than census region fixed effects, and implied measures of rival and own effects. As discussed in Section 4, we prefer to exploit both cross-sectional and time-series variation in store counts rather than use the latter alone, because the former is likely more informative and less error-driven than the latter (which will have little real variation and be subject to a time aggregation problem with our two-period yearly panel). Still, the state fixed effects regressions and implied measures of rival effects and own effects below exhibit patterns similar to our main results.

Table O.24 presents the results of overall regressions. As in Table 8, it shows that the effect of the total number of stores on overall online spending is negative for cross-category retailers and positive for specialized retailers, although the effects seem to be somewhat attenuated with the inclusion of state fixed effects. Next, Tables O.25 through O.28 show store-level regression results and implied rival and own effects. The qualitative patterns are again similar to the main results reported in Tables 11, 12, 13 and 14: rival effects are typically negative and own effects are typically positive, especially for cross-category retailers and booksellers. Finally, Table O.29 displays category-level rival and own effects. As in Table 9a, rival effects (excluding Amazon) are negative and own effects are positive, and multichannel booksellers face the strongest rival effect, though the rival effect on book sales is positive if Amazon is included. One difference between our main results and the results with state fixed effects is that the estimates from state fixed effects regressions are sometimes less precise (especially store-level rival effects).

Table O.24: Overall spending regressions for 2007-2008 (with state fixed effects)

	Cross-category retailers (1)	Bookstores (2)	Electronics (3)	Office supplies (4)
N. Stores: Total	-7.506*** (2.607)	0.677*** (0.197)	2.409* (1.245)	0.795 (0.798)
Mean dep. var.	187.35	9.14	47.37	12.91
Observations	145,345	146,506	146,404	146,765

Note: This table presents the overall regression results analogous to those in Table 8, with state fixed effects rather than census region fixed effects. The “Mean dep. var” row presents the averages of the dependent variable. Heteroskedasticity-robust standard errors in parentheses.

Table O.25: Store-specific cross-category spending in 2007–2008 (with state fixed effects)

(a) Coefficients

	Spending			
	amazon (1)	costco.com (2)	target.com (3)	walmart.com (4)
N. Stores: Costco	0.300 (0.316)	1.925*** (0.268)	0.134 (0.133)	0.201 (0.195)
N. Stores: Target	-0.100 (0.375)	0.102 (0.326)	0.447*** (0.156)	-0.580** (0.257)
N. Stores: Walmart	-1.316*** (0.364)	-0.283 (0.350)	-0.409*** (0.153)	0.536** (0.219)
Mean dep. var.	14.10	2.51	3.20	5.71
Observations	146,451	146,857	146,770	146,694
R ²	0.058	0.008	0.018	0.024

(b) Rival effects and own effects

	amazon (1)	costco.com (2)	target.com (3)	walmart.com (4)
Rival	-0.016 (0.006)	-0.017 (0.033)	-0.028 (0.018)	-0.024 (0.015)
Own		0.640 (0.078)	0.069 (0.024)	0.040 (0.016)

Note: This table shows the results of store-specific regressions and implied rival effects and own effects, as in Table 11, with state fixed effects rather than census region fixed effects.

Table O.26: Store-specific books spending in 2007–2008 (with state fixed effects)

(a) Coefficients

	amazon	Spending barnesandnoble.com	booksamillion.com
	(1)	(2)	(3)
N. Stores: Barnes	0.253 (0.177)	0.321*** (0.055)	0.009 (0.017)
N. Stores: Books-a-Million	0.378** (0.179)	−0.063 (0.057)	0.052** (0.022)
N. Stores: Borders	0.421*** (0.163)	−0.198*** (0.062)	−0.019 (0.015)
N. Stores: Other	0.517*** (0.148)	−0.035 (0.049)	−0.005 (0.012)
N. Stores: Waldenbooks	−0.037 (0.147)	0.080* (0.046)	−0.006 (0.012)
Mean dep. var.	5.53	0.86	0.06
Observations	146,629	146,819	146,869
R ²	0.034	0.009	0.002

(b) Rival effects and own effects

	amazon	barnesandnoble.com	booksamillion.com
	(1)	(2)	(3)
Rival	0.030 (0.006)	−0.033 (0.014)	−0.040 (0.047)
Own		0.218 (0.037)	1.449 (0.585)

Note: See the notes for Table O.25.

Table O.27: Store-specific electronics spending in 2007–2008 (with state fixed effects)

(a) Coefficients

	Spending				
	amazon	apple.com	bestbuy.com	circuitcity.com	radioshack.com
	(1)	(2)	(3)	(4)	(5)
N. Stores: Apple	0.266 (0.208)	−0.189 (0.294)	−0.398* (0.208)	−0.303 (0.217)	0.053** (0.023)
N. Stores: Best Buy	0.146 (0.270)	−0.355 (0.428)	0.721*** (0.268)	−0.474 (0.339)	0.025 (0.029)
N. Stores: Circuit City	−0.066 (0.259)	0.460 (0.359)	−0.665** (0.268)	0.647** (0.316)	−0.008 (0.034)
N. Stores: Radio Shack	0.283 (0.299)	0.460 (0.438)	0.179 (0.289)	0.117 (0.289)	−0.063* (0.036)
Mean dep. var.	3.22	2.39	2.31	2.13	0.08
Observations	146,819	146,853	146,847	146,850	146,869
R ²	0.011	0.002	0.004	0.005	0.001

(b) Rival effects and own effects

	amazon	apple.com	bestbuy.com	circuitcity.com	radioshack.com
	(1)	(2)	(3)	(4)	(5)
Rival	0.025 (0.014)	0.039 (0.033)	−0.057 (0.028)	−0.046 (0.034)	0.178 (0.101)
Own		−0.082 (0.128)	0.178 (0.066)	0.187 (0.091)	−0.271 (0.143)

Note: See the notes for Table O.25.

Table O.28: Store-specific office supplies spending in 2007–2008 (with state fixed effects)

(a) Coefficients

	Spending			
	amazon	officedepot.com	officemax.com	staples.com
	(1)	(2)	(3)	(4)
N. Stores: Office Depot	0.023 (0.022)	1.701*** (0.414)	0.039 (0.148)	−0.140 (0.506)
N. Stores: Office Max	0.004 (0.018)	0.789** (0.380)	0.172*** (0.061)	−0.695 (0.432)
N. Stores: Other	−0.019 (0.018)	−0.222 (0.337)	−0.023 (0.095)	−0.201 (0.417)
N. Stores: Staples	0.006 (0.014)	0.179 (0.393)	−0.193** (0.096)	1.623*** (0.317)
Mean dep. var.	0.07	3.59	0.33	4.54
Observations	146,870	146,856	146,869	146,848
R ²	0.001	0.004	0.001	0.005

(b) Rival effects and own effects

	amazon	officedepot.com	officemax.com	staples.com
	(1)	(2)	(3)	(4)
Rival	0.021 (0.061)	0.029 (0.027)	−0.078 (0.086)	−0.034 (0.023)
Own		0.250 (0.059)	0.319 (0.101)	0.184 (0.035)

Note: See the notes for Table O.25.

Bibliography

Babur De Los Santos, Ali Hortaçsu, and Matthijs R. Wildenbeest. Testing models of consumer search using data on web browsing purchasing behavior. *American Economic Review*, 102(6):2955–2980, 2012.

Table O.29: Category-level rival and own effects on expenditures (with state fixed effects)

(a) 2007–2008

	Cross-category retailers	Bookstores	Electronics	Office supplies
	(1)	(2)	(3)	(4)
Rival	-0.024 (0.012)	-0.033 (0.014)	-0.018 (0.018)	-0.009 (0.017)
Rival (incl. amazon)	-0.019 (0.007)	0.021 (0.005)	-0.004 (0.013)	-0.009 (0.017)
Own	0.180 (0.020)	0.299 (0.053)	0.086 (0.057)	0.217 (0.032)

Note: See the notes for Table 9.