

# Value Of Local Showrooms To Online Competitors

## Paper Replication with R

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# Background I

- Online Shopping vs Offline

- Online Info Hub

- ① Usually lower price
    - ② Various types
    - ③ Less time

- Offline Showroom

- ① Physically experienced
    - ② Real-time assistance
    - ③ Instant gratification

- Customer interacts between online and offline

# Background II

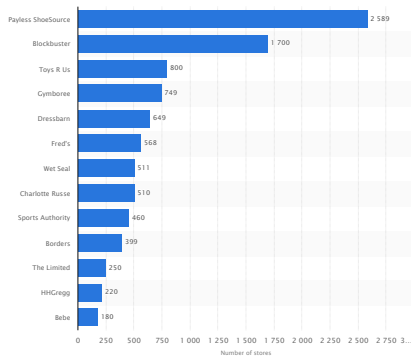


Figure 1: Num Of Store Closures by Selected Retailers in US From 2010 to 2020 <sup>1</sup>

- Values of offline store closures for online retailers?

<sup>1</sup>source link: [statista.com](https://www.statista.com)

# Research Questions

- ① How would a retailer closing a physical store impact
  - its customers' shopping searching behaviors,
  - their resultant purchasing behaviorswith an online competitor?

# Data Description

- Natural Experiment: Circuit City closed 155 local stores (physical showroom providers) due to severe competitions (exogenous event) on Nov, 2008
- Data Scheme: individual customer click-stream dataset (search and purchase) during each month of 2008 and 2009
  - time stamp
  - visited domain
  - referring domain
  - # of pages
  - Duration
  - Purchase Flag
  - Paid Amount
  - Zip Code
  - Demographics
- Focused Online Retailer: Amazon (pure) and Bestbuy (multi)
- Treatment: Residents in 155 Zip codes / 5-miles radius of 155
- Control: Residents who never had CC stores within 5 miles



# Data Process

- Referring Domain Filter: blank or search engine
- Target Domain Filter: amazon, staples, dell, walmart, bestbuy
- Product Categories Filter: only types sold at CC
- Variables Construction:
  - CCStorePresent
  - AfterStoreClosing
  - BBStorePresent
  - NoReferringDomain
  - ReferringDomainIsSearchEngine
  - Dependent Variables
- Panel Data Aggregation
  - Group by Zip Code, Month-Year, Target Domain
  - Calculate Dependent Variables
  - Unbalanced Data Imputation

# Effects on Online Sales I

To examine whether a competing online retailer benefits from the presence of a local showroom, we run the following regressions for Amazon and BestBuy

$$\begin{aligned} & \log(\text{TotalMonthlySales} + 1)_{i,t} \\ &= \mu_i + \tau_t \\ &+ \beta_1 \text{CCStorePresent}_i \times \text{AfterStoreClosing}_t \\ &+ \beta_2 \text{CCStorePresent}_i \times \text{AfterStoreClosing}_t \times \text{BBStorePresent}_i \\ &+ \epsilon_{i,t} \end{aligned} \tag{1}$$



# Effects on Online Sales II

Table 1: Results of the Sales Effect (All Product Categories)

	Amazon-0 Mile	log(TotalMonthlySales + 1) Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles
	(1)	(2)	(3)	(4)
$\beta_1$	0.014 (0.015)	-0.005 (0.008)	-0.002 (0.033)	-0.002 (0.008)
$\beta_2$	-0.033 (0.022)	0.003 (0.010)	0.009 (0.036)	0.002 (0.010)
Observations	68,472	75,096	14,664	16,848
R <sup>2</sup>	0.00003	0.00001	0.00002	0.00000
Adjusted R <sup>2</sup>	-0.044	-0.044	-0.045	-0.045
F Statistic	1.091 (df = 2; 65594)	0.278 (df = 2; 71942)	0.154 (df = 2; 14028)	0.035 (df = 2; 16121)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



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# Effects on Online Search Behavior I

To measure the impact of the exit of local showrooms on consumer online search intensity and the moderating effect of Best Buy Stores as an alternative local showroom, we run the following regressions

$$\begin{aligned} & \log(\text{PagesPerDollar} + 1, \text{MinsPerDollar} + 1)_{i,t} \\ &= \mu_i + \tau_t \\ &+ \beta_1 \text{CCStorePresent}_i \times \text{AfterStoreClosing}_t \\ &+ \beta_2 \text{CCStorePresent}_i \times \text{AfterStoreClosing}_t \times \text{BBStorePresent}_i \\ &+ \epsilon_{i,t} \end{aligned} \tag{2}$$

# Effects on Online Search Behavior II

Table 2: Results of the Search Effect (All Product Categories)

	Amazon-0 Mile	log(PagesPerDollar + 1)			Amazon-0 Mile	log(MinsPerDollar + 1)		
		Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles		Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_1$	0.003 (0.012)	-0.019*** (0.007)	0.001 (0.016)	0.002 (0.004)	0.004 (0.012)	-0.021*** (0.007)	0.001 (0.013)	0.003 (0.003)
$\beta_2$	-0.068*** (0.018)	0.018** (0.009)	0.003 (0.018)	-0.001 (0.005)	-0.057*** (0.017)	0.022*** (0.008)	0.0004 (0.014)	-0.002 (0.004)
Observations	68,472	75,096	14,664	16,848	68,472	75,096	14,664	16,848
R <sup>2</sup>	0.0004	0.0001	0.00003	0.00004	0.0003	0.0001	0.00001	0.0001
Adjusted R <sup>2</sup>	-0.043	-0.044	-0.045	-0.045	-0.044	-0.044	-0.045	-0.045
F Statistic	12.530*** (df = 2, 65594)	3.985** (df = 2, 71942)	0.202 (df = 2, 14028)	0.337 (df = 2, 16121)	8.867*** (df = 2, 65594)	5.187*** (df = 2, 71942)	0.046 (df = 2, 14028)	0.451 (df = 2, 16121)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Effects on Online Sales vs Prod Types I

We then test whether the show-rooming effect upon online sales is stronger for experience goods.

**Table 3: Results of the Sales Effect: Experience and Search Products**

	log(TotalMonthlySales + 1)							
	Amazon-0 Mile-Exp	Amazon-5 Miles-Exp	Amazon-0 Mile-Search	Amazon-5 Miles-Search	BestBuy-0 Mile-Exp	BestBuy-5 Miles-Exp	BestBuy-0 Mile-Exp	BestBuy-5 Miles-Search
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_1$	0.005 (0.017)	-0.007 (0.010)	0.005 (0.013)	-0.008 (0.006)	-0.011 (0.009)	-0.009 (0.007)	-0.001 (0.023)	-0.010 (0.008)
$\beta_2$	-0.043* (0.024)	0.009 (0.012)	-0.002 (0.018)	0.009 (0.008)		0.013 (0.008)	0.000 (0.028)	0.009 (0.010)
Observations	32,112	35,568	52,392	57,648	10,224	11,712	5,664	6,600
R <sup>2</sup>	0.0002	0.00002	0.00000	0.00003	0.0001	0.0002	0.00000	0.0002
Adjusted R <sup>2</sup>	-0.044	-0.044	-0.044	-0.044	-0.046	-0.045	-0.048	-0.047
F Statistic	2.775* (df = 2; 30749)	0.318 (df = 2; 34061)	0.101 (df = 2; 50184)	0.774 (df = 2; 55221)	1.377 (df = 1; 9774)	1.297 (df = 2; 11199)	0.004 (df = 2; 5403)	0.746 (df = 2; 6300)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Effects on Online Search Behavior vs Prod Types I

We want to test whether the show-rooming effect is stronger for experience goods

Table 4: Results of the Online Search Effect: Experience Products

	log(PagesPerDollar + 1)				log(MinsPerDollar + 1)			
	Amazon-0 Mile	Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles	Amazon-0 Mile	Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_1$	0.007 (0.015)	-0.037*** (0.008)	0.006** (0.002)	0.001 (0.002)	0.006 (0.015)	-0.039*** (0.008)	0.003 (0.002)	0.001 (0.001)
$\beta_2$	-0.077*** (0.020)	0.030*** (0.010)		-0.0001 (0.002)	-0.067*** (0.020)	0.034*** (0.010)		-0.001 (0.002)
Observations	32,112	35,568	10,224	11,712	32,112	35,568	10,224	11,712
R <sup>2</sup>	0.001	0.001	0.001	0.00003	0.001	0.001	0.0003	0.0001
Adjusted R <sup>2</sup>	-0.043	-0.044	-0.045	-0.046	-0.044	-0.044	-0.046	-0.046
F Statistic	12.857*** (df = 2; 30749)	10.009*** (df = 2; 34061)	5.763** (df = 1; 9774)	0.143 (df = 2; 11199)	10.349*** (df = 2; 30749)	11.626*** (df = 2; 34061)	2.508 (df = 1; 9774)	0.438 (df = 2; 11199)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



# Effects on Online Search Behavior vs Prod Types II

Table 5: Results of the Online Search Effect: Search Products

	log(PagesPerDollar + 1)				log(MinsPerDollar + 1)			
	Amazon-0 Mile	Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles	Amazon-0 Mile	Amazon-5 Miles	BestBuy-0 Mile	BestBuy-5 Miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_1$	0.001 (0.012)	0.006 (0.006)	0.001 (0.014)	0.009* (0.005)	0.003 (0.012)	0.004 (0.006)	0.0001 (0.012)	0.009* (0.005)
$\beta_2$	-0.019 (0.017)	-0.002 (0.008)	-0.000 (0.017)	-0.007 (0.006)	-0.019 (0.017)	0.001 (0.008)	-0.000 (0.015)	-0.008 (0.006)
Observations	52,392	57,648	5,664	6,600	52,392	57,648	5,664	6,600
R <sup>2</sup>	0.00005	0.00002	0.00000	0.001	0.00004	0.00003	0.00000	0.001
Adjusted R <sup>2</sup>	-0.044	-0.044	-0.048	-0.047	-0.044	-0.044	-0.048	-0.047
F Statistic	1.138 (df = 2; 50184)	0.553 (df = 2; 55221)	0.011 (df = 2; 5403)	1.590 (df = 2; 6300)	0.935 (df = 2; 50184)	0.696 (df = 2; 55221)	0.0001 (df = 2; 5403)	1.927 (df = 2; 6300)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Effects on Referring Domain I

To capture the expected change in the odds ratio of the impact of Circuit City store closures and the moderating effect of Best Buy stores as an alternative local showroom, we run the following regressions:

$$\begin{aligned}
 &\text{Logit}(\text{ReferringDomainIsSearchEngine}, \text{NoReferringDomain})_{i,t} \\
 &= \mu_i + \tau_t \\
 &+ \beta_1 \text{CCStorePresent}_i \times \text{AfterStoreClosing}_t \\
 &+ \beta_2 \text{CCStorePresent}_i \times \text{AfterStoreClosing}_t \times \text{BBStorePresent}_i \\
 &+ \epsilon_{i,t}
 \end{aligned} \tag{3}$$

Table 6 presents the effect of store closure on referring domain.

# Effects on Referring Domain II

Table 6: Results of Logistic Regression for Referring Domain

	ReferringDomainIsSearchEngine		NoReferringDomain	
	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile
	(1)	(2)	(3)	(4)
$\beta_1$	-0.817* (0.337)	-15.12*** (0.611)	0.325 (0.346)	-0.223 (1.259)
$\beta_2$	0.697 (0.564)	14.43*** (0.944)	-0.415 (0.544)	0.916 (1.615)
Observations	10,791	1,225	10,791	1,225

Note:

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$



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# Alternative Measure of Search Intensity I

By applying more traditional online search measures, we perform the same DID analysis for Amazon and bestbuy.com, to further investigate if the increase in search intensity manifests itself independent of sales amount.

**Table 7: Results of the Online Sales and Search Effect (All Product Categories)**

	log(SalesPerTransaction + 1)		log(PagesPerTransaction + 1)		log(MinsPerTransaction + 1)	
	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_1$	0.012 (0.013)	-0.001 (0.032)	0.004 (0.009)	0.0002 (0.017)	0.006 (0.011)	0.0002 (0.020)
$\beta_2$	-0.018 (0.019)	0.010 (0.034)	-0.021* (0.013)	0.005 (0.018)	-0.021 (0.016)	-0.003 (0.021)
Observations	68,472	14,664	68,472	14,664	68,472	14,664
R <sup>2</sup>	0.00002	0.00003	0.0001	0.00004	0.00003	0.00001
Adjusted R <sup>2</sup>	-0.044	-0.045	-0.044	-0.045	-0.044	-0.045
F Statistic	0.539 (df = 2; 65594)	0.213 (df = 2; 14028)	1.867 (df = 2; 65594)	0.304 (df = 2; 14028)	0.939 (df = 2; 65594)	0.066 (df = 2; 14028)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Self-selection of Store Location I

- To further investigate if the increase in search intensity has a causal link to the Circuit City store closures, not due to other endogenous reason
- We adopt CEM to match each zip code from the treatment group with an equivalent zip code from the control group, using zip code level demographics.
- The matching results left us with 56 zip codes in each group. Using the data from the combined 112 zip codes, we ran the models for sales and search.

# Self-selection of Store Location II

**Table 8: Results of the Online Sales and Search Effect After Matching Zip Codes: TotalMonthlySales, PagesPerDollar, and MinsPerDollar (All Product Categories)**

	log(TotalMonthlySales + 1)		log(PagesPerDollar + 1)		log(MinsPerDollar + 1)	
	Amazon-0 Mile	BesyBuy-0 Mile	Amazon-0 Mile	BesyBuy-0 Mile	Amazon-0 Mile	BesyBuy-0 Mile
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_1$	0.019 (0.019)	-0.0002 (0.002)	0.006 (0.012)	-0.001 (0.003)	0.003 (0.011)	-0.0002 (0.002)
$\beta_2$	-0.026 (0.024)		-0.023 (0.016)		-0.024* (0.013)	
Observations	1,776	384	1,776	384	1,776	384
R <sup>2</sup>	0.001	0.00002	0.001	0.0001	0.002	0.00003
Adjusted R <sup>2</sup>	-0.058	-0.113	-0.057	-0.113	-0.056	-0.113
F Statistic	0.740 (df = 2; 1677)	0.008 (df = 1; 344)	1.183 (df = 2; 1677)	0.030 (df = 1; 344)	1.931 (df = 2; 1677)	0.012 (df = 1; 344)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Heterogeneity within a Zip Code I

To examine the possible heterogeneity within the geographic zip code area which may be unaccounted for, we add location specific demographics in the regression equations as interaction terms with DID term.

**Table 9:** Results of the Online Sales and Search Effect with Zip Code Demographics as Interactions and Time Fixed Effects (All Product Categories)

	log(TotalMonthlySales + 1)		log(PagesPerDollar + 1)		log(MinsPerDollar + 1)	
	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_1$	-0.00001 (0.0001)	-0.00001 (0.0002)	0.0001 (0.0001)	0.00001 (0.0001)	0.0001 (0.0001)	0.00000 (0.0001)
$\beta_2$	-0.00001 (0.0002)	-0.0001 (0.0002)	-0.0002* (0.0001)	0.00002 (0.0001)	-0.0002 (0.0001)	0.00001 (0.0001)
Observations	68,472	14,664	68,472	14,664	68,472	14,664
R <sup>2</sup>	0.00000	0.00004	0.00005	0.00002	0.00003	0.00001
Adjusted R <sup>2</sup>	-0.044	-0.045	-0.044	-0.045	-0.044	-0.045
F Statistic	0.019 (df = 2; 65594)	0.255 (df = 2; 14028)	1.478 (df = 2; 65594)	0.114 (df = 2; 14028)	1.131 (df = 2; 65594)	0.053 (df = 2; 14028)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



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# Serial Correlation I

In order to address the serial correlation issue, the first solution is to ignore the time series and the results is in Table 10.

**Table 10:** Results of the Online Sales and Search Effect After Matching Zip Codes: TotalMonthlySales, PagesPerDollar, and MinsPerDollar (All Product Categories)

	log(TotalMonthlySales + 1)		log(PagesPerDollar + 1)		log(MinsPerDollar + 1)	
	Amazon-0 Mile	BesyBuy-0 Mile	Amazon-0 Mile	BesyBuy-0 Mile	Amazon-0 Mile	BesyBuy-0 Mile
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_1$	0.023 (0.015)	-0.001 (0.003)	0.007 (0.010)	-0.003 (0.006)	0.009 (0.008)	-0.001 (0.004)
$\beta_2$	-0.026 (0.024)		-0.023 (0.015)		-0.024* (0.013)	
Observations	1,776	208	1,776	208	1,776	208
R <sup>2</sup>	0.001	0.0003	0.001	0.001	0.002	0.0004
Adjusted R <sup>2</sup>	-0.043	-0.083	-0.043	-0.083	-0.042	-0.083
F Statistic	1.169 (df = 2; 1700)	0.052 (df = 1; 191)	1.182 (df = 2; 1700)	0.197 (df = 1; 191)	1.663 (df = 2; 1700)	0.078 (df = 1; 191)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



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# Serial Correlation II

Another solution is to use a White-like estimator to calculate the variance-covariance matrix of the error term. The results are in Table 11.

**Table 11: Results of the Online Sales and Search Effect with Arbitrary Variance-Covariance Matrix Corrections (All Product Categories)**

	log(TotalMonthlySales + 1)		log(PagesPerDollar + 1)		log(MinsPerDollar + 1)	
	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile	Amazon-0 Mile	BestBuy-0 Mile
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_1$	0.019 (0.019)	-0.001 (0.003)	0.006 (0.006)	-0.003 (0.006)	0.003 (0.011)	-0.001 (0.004)
$\beta_2$	-0.026 (0.028)		-0.023*** (0.001)		-0.024*** (0.006)	
Observations	1,776	208	1,776	208	1,776	208
R <sup>2</sup>	0.001	0.0002	0.001	0.001	0.002	0.0003
Adjusted R <sup>2</sup>	-0.058	-0.156	-0.057	-0.156	-0.056	-0.156
F Statistic	0.740 (df = 2; 1677)	0.036 (df = 1; 179)	1.183 (df = 2; 1677)	0.136 (df = 1; 179)	1.931 (df = 2; 1677)	0.054 (df = 1; 179)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



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# Takeaways

- ① Showrooms do add value to online retailers
  - Not necessarily in increasing sales
  - But perhaps in customers' level of purchase readiness
- ② Large online only retailers such as Amazon should differentiate between customers from H/L showroom concentration
- ③ Online retailers should evaluate their product reviews and descriptions for showroom experience customers

# Reference I