

**Reviews Without a Purchase:  
Low Ratings, Loyal Customers, and Deception**

**Web Appendix**

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## Definition of Variables

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### Review Characteristics

|                          |                                                                                   |
|--------------------------|-----------------------------------------------------------------------------------|
| No Confirmed Transaction | 1 if the review does not have a confirmed transaction; and 0 otherwise.           |
| Review Date              | The date of the review measures in years since the date of the very first review. |
| Word Count               | The number of words in the review text comments.                                  |
| Word Length              | The average length of the words in the review text comments.                      |
| Family                   | 1 if the review contains words describing members of the family; and 0 otherwise. |
| Repeated !!              | 1 if the review contains repeated exclamation points; 0 otherwise.                |

### Item Characteristics

|                         |                                                                                                       |
|-------------------------|-------------------------------------------------------------------------------------------------------|
| Any Fit                 | 1 if the review contained words describing the fit of the product; and 0 otherwise.                   |
| Any Feel                | 1 if the review contained words describing the fit of the product; and 0 otherwise.                   |
| Product Age             | The number of years between the date of the review and the first transaction for that product.        |
| Prior Units             | The number of units of that item sold in the 12 months before the review date.                        |
| Average Selling Price   | The average selling price of the product in the 12-months before and 12-months after the review date. |
| % Sold in Retail Stores | The percentage of all unit sales of the item that occurred in the firm's physical retail stores.      |
| % Sold via Catalog      | The percentage of all unit sales of the item that occurred in the firm's catalog.                     |

### Reviewer Characteristics

|                           |                                                                                                      |
|---------------------------|------------------------------------------------------------------------------------------------------|
| Number of Reviews         | The number of reviews written by that household.                                                     |
| Items Purchased           | The number of items purchased by that household.                                                     |
| Average Item Price        | The average price paid for items purchased by that household.                                        |
| Overall Discount Received | The average % discount received for items purchased by that household.                               |
| Discount Frequency        | The percentage of items purchased at a discount for that household.                                  |
| Return Rate               | The number of items that the household returned as a percentage of their total purchases.            |
| Years Since First Order   | The number of years between the review date and the first purchase by any members of that household. |
| Number of Children        | The number of children in the household.                                                             |
| Married                   | 1 if the head of household is married; and 0 otherwise.                                              |
| Age                       | The age of the head of the household.                                                                |
| Estimated Home Value      | The estimated value of the household's home.                                                         |
| Est. Household Income     | The estimated household income.                                                                      |
| Graduate Degree           | 1 if the head of household has a graduate degree; and zero otherwise.                                |

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### Summary Statistics

|                                 | Mean       | Std Dev    | Sample Size |
|---------------------------------|------------|------------|-------------|
| <b>Review Characteristics</b>   |            |            |             |
| No Confirmed Transaction        | 0.05       | 0.21       | 325,869     |
| Review Date                     | 2.01       | 1.02       | 325,869     |
| Word Count                      | 52.88      | 40.53      | 325,869     |
| Word Length                     | 4.15       | 0.52       | 325,405     |
| Family                          | 0.19       | 0.39       | 325,869     |
| Repeated !!                     | 0.05       | 0.21       | 325,869     |
| Any Fit                         | 0.48       | 0.50       | 325,869     |
| Any Feel                        | 0.55       | 0.50       | 325,869     |
| <b>Item Characteristics</b>     |            |            |             |
| Product Age                     | 4.71       | 5.32       | 325,754     |
| Prior Units                     | 31,974.41  | 45,134.87  | 325,643     |
| Average Selling Price           | 52.87      | 55.05      | 325,643     |
| % Sold in Retail Stores         | 0.14       | 0.11       | 325,754     |
| % Sold via Catalog              | 0.41       | 0.14       | 325,754     |
| <b>Reviewer Characteristics</b> |            |            |             |
| Number of Reviews               | 3.73       | 8.35       | 325,869     |
| Items Purchased                 | 169.59     | 266.97     | 325,869     |
| Average Item Price              | 40.05      | 16.01      | 325,869     |
| Overall Discount Received       | 0.08       | 0.09       | 325,869     |
| Discount Frequency              | 0.20       | 0.19       | 325,832     |
| Return Rate                     | 0.17       | 0.18       | 325,832     |
| Years Since First Order         | 12.94      | 6.46       | 325,869     |
| Number of Children              | 0.48       | 0.97       | 297,099     |
| Married                         | 0.73       | 0.44       | 315,488     |
| Age                             | 56.99      | 14.17      | 274,767     |
| Estimated Home Value            | 279,857.70 | 268,397.20 | 294,967     |
| Est. Household Income           | 103,186.80 | 60,791.58  | 313,847     |
| Graduate Degree                 | 0.32       | 0.47       | 315,488     |

### Pair-wise Correlations: Review Characteristics

|                                 | Review Date | Word Count | Word Length | Family   | Repeated | Any Fit  | Any Feel |
|---------------------------------|-------------|------------|-------------|----------|----------|----------|----------|
| <b>No Confirmed Transaction</b> | -0.084**    | 0.096**    | -0.017**    | 0.011**  | 0.022**  | -0.017** | -0.015** |
| <b>Review Date</b>              |             | 0.035**    | -0.016**    | -0.004*  | -0.011** | 0.046**  | -0.004*  |
| <b>Word Count</b>               |             |            | -0.188**    | 0.148**  | 0.053**  | 0.246**  | 0.138**  |
| <b>Word Length</b>              |             |            |             | -0.042** | 0.024**  | -0.127** | 0.068**  |
| <b>Family</b>                   |             |            |             |          | 0.025**  | -0.041** | -0.022** |
| <b>Repeated !!</b>              |             |            |             |          |          | -0.013** | -0.006** |
| <b>Any Fit</b>                  |             |            |             |          |          |          | 0.022**  |

The table reports Pearson correlation coefficients. The unit of analysis is a review. The sample size is 325,869 except for the correlations with Word Count, where the correlations are 325,405 (a very small number of reviews do not have any text comments). \* Significantly different from zero,  $p < 0.05$ , and \*\* significantly different from zero,  $p < 0.01$ .

### Pair-wise Correlations: Item Characteristics

|                         | Prior<br>Units | Average<br>Selling<br>Price | % Sold in<br>Retail<br>Stores | % Sold<br>via<br>Catalog |
|-------------------------|----------------|-----------------------------|-------------------------------|--------------------------|
| Product Age             | -0.275 **      | 0.028 *                     | -0.174 **                     | 0.513 **                 |
| Prior Units             |                | -0.135 **                   | -0.195 **                     | 0.268 **                 |
| Average Selling Price   |                |                             | 0.003                         | 0.092 **                 |
| % Sold in Retail Stores |                |                             |                               | -0.650 **                |

The table reports Pearson correlation coefficients. The unit of analysis is an item. We restrict attention to items that appear in at least one review. The sample size is 8,270. \*Significantly different from zero,  $p < 0.05$ , and \*\* significantly different from zero,  $p < 0.01$ .

### Pair-wise Correlations: Reviewer Characteristics

|                                   | Items Purchased | Average Item Price | Overall Discount Received | Discount Frequency | Return Rate | Years Since First Order | Number of Children | Married  | Age      | Estimated Home Value | Estimated Household Income | Graduate Degree |
|-----------------------------------|-----------------|--------------------|---------------------------|--------------------|-------------|-------------------------|--------------------|----------|----------|----------------------|----------------------------|-----------------|
| Number of Reviews                 | -0.215**        | -0.039**           | 0.091**                   | 0.088**            | 0.053**     | 0.060**                 | -0.007**           | -0.001   | 0.001    | -0.003               | 0.001                      | 0.016**         |
| Items Purchased                   |                 | -0.099**           | 0.121**                   | 0.112**            | 0.155**     | 0.416**                 | -0.017**           | 0.073**  | 0.059**  | 0.101**              | 0.105**                    | 0.112**         |
| Average Item Price                |                 |                    | -0.262**                  | -0.229**           | 0.096**     | -0.091**                | -0.058**           | -0.033** | -0.022** | 0.018**              | 0.007**                    | 0.002           |
| Overall Discount Received         |                 |                    |                           | 0.910**            | 0.068**     | 0.015**                 | 0.073**            | -0.0001  | -0.078** | -0.041**             | -0.027**                   | -0.008**        |
| Discount Frequency                |                 |                    |                           |                    | 0.076**     | 0.005*                  | 0.081**            | 0.002    | -0.091** | -0.037**             | -0.024**                   | -0.006**        |
| Return Rate                       |                 |                    |                           |                    |             | 0.065**                 | 0.015              | -0.004   | -0.045** | 0.027**              | 0.024**                    | 0.015**         |
| Years Since 1 <sup>st</sup> Order |                 |                    |                           |                    |             |                         | -0.078**           | 0.101**  | 0.223**  | 0.127**              | 0.142**                    | 0.186**         |
| Number of Children                |                 |                    |                           |                    |             |                         |                    | 0.178**  | -0.321** | 0.036**              | 0.100**                    | -0.006**        |
| Married                           |                 |                    |                           |                    |             |                         |                    |          | -0.125** | 0.136**              | 0.199**                    | 0.088**         |
| Age                               |                 |                    |                           |                    |             |                         |                    |          |          | -0.009**             | -0.076**                   | -0.061**        |
| Estimated Home Value              |                 |                    |                           |                    |             |                         |                    |          |          |                      | 0.452**                    | 0.188**         |
| Est. Household Income             |                 |                    |                           |                    |             |                         |                    |          |          |                      |                            | 0.259**         |

The table reports Pearson correlation coefficients. The unit of analysis is a reviewer. The sample size varies from 178,786 to 213,205.

\*Significantly different from zero,  $p < 0.05$ , and \*\*significantly different from zero,  $p < 0.05$ .

**Product Ratings: Logistic and OLS Models**

|                                 |                              | <b>Rating = 1</b>     | <b>Product Rating</b> |
|---------------------------------|------------------------------|-----------------------|-----------------------|
| <b>Review Characteristics</b>   | No Confirmed Transaction     | 0.0431**<br>(0.0035)  | -0.2732**<br>(0.0277) |
|                                 | Review Date                  | 0.0019*<br>(0.0008)   | -0.0261**<br>(0.0055) |
|                                 | Word Count (10s)             | 0.0005**<br>(0.0002)  | -0.0031**<br>(0.0008) |
|                                 | Word Length                  | 0.0003<br>(0.0007)    | 0.0040<br>(0.0044)    |
|                                 | Family                       | -0.0058**<br>(0.0015) | 0.0724**<br>(0.0078)  |
|                                 | Repeated !!                  | 0.0036<br>(0.0022)    | 0.0133<br>(0.0109)    |
|                                 | Any Fit                      | 0.0025<br>(0.0014)    | -0.0707**<br>(0.0079) |
|                                 | Any Feel                     | -0.0106**<br>(0.0014) | 0.0631**<br>(0.0079)  |
| <b>Item Characteristics</b>     | Product Age (years)          | -0.0019**<br>(0.0003) | 0.0167**<br>(0.0023)  |
|                                 | Prior Units (10,000s)        | -0.0018**<br>(0.0004) | 0.0123**<br>(0.0021)  |
|                                 | Average Selling Price (\$10) | -0.0002<br>(0.0002)   | 0.0001<br>(0.0011)    |
|                                 | % Sold in Retail Stores      | 0.0135<br>(0.0121)    | -0.0639<br>(0.0847)   |
|                                 | % Sold via Catalog           | 0.0546**<br>(0.0137)  | -0.2202*<br>(0.0940)  |
| <b>Reviewer Characteristics</b> | Number of Reviews            | 0.0003**<br>(0.0001)  | -0.0018**<br>(0.0003) |

|                                         |                       |                       |
|-----------------------------------------|-----------------------|-----------------------|
| Items Purchased (100s)                  | -0.0041**<br>(0.0003) | 0.0343**<br>(0.0011)  |
| Average Item Price (\$10)               | -0.0009<br>(0.0005)   | 0.0080**<br>(0.0018)  |
| Overall Discount Received               | 0.0243<br>(0.0176)    | -0.0306**<br>(0.0654) |
| Discount Frequency                      | -0.0112<br>(0.0077)   | 0.0128<br>(0.0295)    |
| Return Rate                             | 0.0031<br>(0.0032)    | -0.0449**<br>(0.0130) |
| Years Since First Order                 | 0.0075**<br>(0.0002)  | -0.0485**<br>(0.0005) |
| Number of Children                      | -0.0041**<br>(0.0006) | 0.0215**<br>(0.0026)  |
| Married                                 | 0.0028*<br>(0.0011)   | 0.0224**<br>(0.0052)  |
| Age (10s years)                         | 0.0052**<br>(0.0004)  | -0.0373**<br>(0.0020) |
| Est. Home Value (\$100,000s)            | 0.0002<br>(0.0002)    | 0.0065**<br>(0.0009)  |
| Est. Household Income<br>(\$100,000s)   | -0.0021*<br>(0.0008)  | 0.0102*<br>(0.0043)   |
| Graduate Degree                         | -0.0050**<br>(0.0010) | 0.0325**<br>(0.0051)  |
| R <sup>2</sup> or Pseudo R <sup>2</sup> | 0.0702                | 0.0773                |

Model 1 reports the marginal effects from a logistic model where the dependent variables is a binary variable indicating whether the review has a rating = 1. Model 2 reports coefficient from an OLS model where the dependent variable is the product rating. In both models the unit of analysis is a review and the sample size is 273,129 (the sample size reflects missing demographic variables). Both models include a constant, but this is omitted from the table. Standard errors clustered at the item level are reported in parentheses. <sup>†</sup>Significantly different from zero, p<0.10, \*significantly different from zero, p<0.05 and \*\*significantly different from zero, p<0.01.

### Product Rating: Fixed Effects Models

In the table below we report the No Confirmed Transaction coefficient from the following OLS fixed effects model where the dependent variable is the product rating on review  $i$ :

$$\text{Product Rating} = \beta \mathbf{X} + \beta_1 \text{No Confirmed Transaction} + \varepsilon.$$

In this model  $\mathbf{X}$  is the vector of fixed effects and *No Confirmed Transaction* is a binary variable identifying whether there the review did not have a confirmed transaction. The unit of analysis is a review and the sample size is The coefficient of interest is  $\beta_1$  and we estimate three separate models, with either reviewer fixed effects, item fixed effects or fixed effects for the date of the review. In all three models the unit of analysis is a review and the sample size is 325,869 (although the coefficient of interest is only affected by observations for which there is variation in the *No Confirmed Transaction* within a fixed effect). In all three models the standard errors are clustered at the item level and are reported in parentheses (clustering at the reviewer or review date level results in many clusters and therefore has little impact on the standard errors).

|                          | Reviewer<br>Fixed Effects | Item<br>Fixed Effects | Timing<br>Fixed Effects |
|--------------------------|---------------------------|-----------------------|-------------------------|
| No Confirmed Transaction | -0.1523**<br>(0.0304)     | -0.2720**<br>(0.0166) | -0.2157**<br>(0.0249)   |
| R <sup>2</sup>           | 0.2879                    | 0.0983                | 0.0128                  |

\*\*Significantly different from zero,  $p < 0.01$ .

### Fit and Feel Analysis at Each Review Rating Level

|                          |            | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference           |
|--------------------------|------------|---------------------------------------|------------------------------------|----------------------|
| <b>Any Fit Word</b>      | Rating = 1 | 41.25%                                | 49.89%                             | -8.64%**<br>(1.28%)  |
|                          | Rating = 2 | 51.27%                                | 58.46%                             | -7.19%**<br>(1.53%)  |
|                          | Rating = 3 | 49.60%                                | 60.90%                             | -11.29%**<br>(1.42%) |
|                          | Rating = 4 | 50.89%                                | 55.30%                             | -4.41%**<br>(1.09%)  |
|                          | Rating = 5 | 40.94%                                | 43.55%                             | -2.61%**<br>(0.528%) |
| <b>Any Feel Word</b>     | Rating = 1 | 30.60%                                | 32.03%                             | -1.43%<br>(1.19%)    |
|                          | Rating = 2 | 42.83%                                | 40.75%                             | -2.08%<br>(1.53%)    |
|                          | Rating = 3 | 42.63%                                | 44.44%                             | -1.81%<br>(1.44%)    |
|                          | Rating = 4 | 53.83%                                | 56.03%                             | -2.20%*<br>(1.09%)   |
|                          | Rating = 5 | 56.98%                                | 59.01%                             | -2.03%**<br>(0.52%)  |
| <b>Number of Reviews</b> | Rating = 1 | 1,680                                 | 16,363                             |                      |
|                          | Rating = 2 | 1,102                                 | 16,752                             |                      |
|                          | Rating = 3 | 1,262                                 | 20,077                             |                      |
|                          | Rating = 4 | 2,179                                 | 52,594                             |                      |
|                          | Rating = 5 | 9,536                                 | 204,324                            |                      |

The table reports averages for each measure separately according to the rating on the product review. Standard errors are in parentheses. \* Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

**Replicating the Fit and Feel Analysis  
Including Controls for Each of the Alternative Explanations**

|                |                                    | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>   |
|----------------|------------------------------------|------------------------------------------------|---------------------------------------------|---------------------|
| Any Fit Words  | Within Item Analysis               | 44.95%                                         | 45.93%                                      | -0.97%<br>(0.66%)   |
|                | Within Reviewer Analysis           | 45.19%                                         | 52.26%                                      | -7.07%**<br>(0.78%) |
|                | Matching at the Sub-Category Level | 44.63%                                         | 47.71%                                      | -3.07%**<br>(0.53%) |
|                | Excluding Store Purchases          | 45.24%                                         | 49.02%                                      | -3.78%**<br>(0.82%) |
|                | Items with Few Store Purchases     | 38.11%                                         | 38.30%                                      | -0.19%<br>(1.65%)   |
|                | Underwear Items                    | 56.25%                                         | 47.90%                                      | 8.35%<br>(4.81%)    |
| Any Feel Words | Within Item Analysis               | 52.30%                                         | 53.69%                                      | -1.39%*<br>(0.64%)  |
|                | Within Reviewer Analysis           | 52.60%                                         | 57.20%                                      | -4.59%**<br>(0.77%) |
|                | Matching at the Sub-Category Level | 51.72%                                         | 55.08%                                      | -3.36%**<br>(0.53%) |
|                | Excluding Store Purchases          | 50.41%                                         | 54.40%                                      | -4.00%**<br>(0.81%) |
|                | Items with Few Store Purchases     | 43.31%                                         | 40.59%                                      | 2.72%<br>(1.66%)    |
|                | Underwear Items                    | 73.21%                                         | 74.48%                                      | -1.27%<br>(4.20%)   |

The table reports averages for each measure separately for the samples of reviews with and without confirmed transactions. The sample sizes are reported in other tables. Standard errors are in parentheses.

<sup>†</sup>Significantly different from zero,  $p < 0.10$  and <sup>\*\*</sup>significantly different from zero,  $p < 0.01$ .

### Linguistic Deception Cues: Analysis at Each Review Rating Level

|                    |            | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference         |
|--------------------|------------|---------------------------------------|------------------------------------|--------------------|
| <b>Word Count</b>  | Rating = 1 | 71.40                                 | 61.67                              | 9.72**<br>(1.12)   |
|                    | Rating = 2 | 77.97                                 | 61.53                              | 16.44**<br>(1.36)  |
|                    | Rating = 3 | 73.95                                 | 62.00                              | 11.95**<br>(1.29)  |
|                    | Rating = 4 | 74.32                                 | 56.02                              | 18.30**<br>(0.96)  |
|                    | Rating = 5 | 67.53                                 | 48.43                              | 19.10**<br>(0.40)  |
| <b>Word Length</b> | Rating = 1 | 4.12                                  | 4.13                               | -0.01<br>(0.01)    |
|                    | Rating = 2 | 4.09                                  | 4.08                               | 0.004<br>(0.01)    |
|                    | Rating = 3 | 4.07                                  | 4.05                               | 0.02<br>(0.02)     |
|                    | Rating = 4 | 4.13                                  | 4.10                               | -0.03*<br>(0.01)   |
|                    | Rating = 5 | 4.11                                  | 4.18                               | -0.07**<br>(0.01)  |
| <b>Family</b>      | Rating = 1 | 15.42%                                | 12.63%                             | 2.79%**<br>(0.86%) |
|                    | Rating = 2 | 16.79%                                | 12.17%                             | 4.62%**<br>(1.03%) |
|                    | Rating = 3 | 16.32%                                | 13.62%                             | 2.70%**<br>(1.00%) |
|                    | Rating = 4 | 19.05%                                | 15.99%                             | 3.06%**<br>(0.80%) |
|                    | Rating = 5 | 23.10%                                | 21.00%                             | 2.10%**<br>(0.43%) |

|                          |            | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference         |
|--------------------------|------------|---------------------------------------|------------------------------------|--------------------|
| <b>Repeated !!</b>       | Rating = 1 | 8.21%                                 | 4.35%                              | 3.86%**<br>(0.54%) |
|                          | Rating = 2 | 4.63%                                 | 2.04%                              | 2.59%**<br>(0.46%) |
|                          | Rating = 3 | 3.49%                                 | 2.00%                              | 1.48%**<br>(0.42%) |
|                          | Rating = 4 | 4.36%                                 | 2.36%                              | 2.00%**<br>(0.34%) |
|                          | Rating = 5 | 7.98%                                 | 5.83%                              | 2.15%**<br>(0.25%) |
| <b>Number of Reviews</b> | Rating = 1 | 1,680                                 | 16,363                             |                    |
|                          | Rating = 2 | 1,102                                 | 16,752                             |                    |
|                          | Rating = 3 | 1,262                                 | 20,077                             |                    |
|                          | Rating = 4 | 2,179                                 | 52,594                             |                    |
|                          | Rating = 5 | 9,536                                 | 204,324                            |                    |

The table reports averages for each measure separately according to the rating on the product review. Standard errors are in parentheses. \* Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

**Replicating the Linguistic Deception Cues Analysis  
Including Controls for Each of the Alternative Explanations**

|             |                                    | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>            |
|-------------|------------------------------------|------------------------------------------------|---------------------------------------------|------------------------------|
| Word Count  | Within Item Analysis               | 70.12                                          | 58.08                                       | 12.04**<br>(0.73)            |
|             | Within Reviewer Analysis           | 69.86                                          | 67.52                                       | 2.34**<br>(0.62)             |
|             | Matching at the Sub-Category Level | 71.82                                          | 52.33                                       | 19.48**<br>(0.43)            |
|             | Excluding Store Purchases          | 70.56                                          | 52.04                                       | 18.52**<br>(0.67)            |
|             | Items with Few Store Purchases     | 65.26                                          | 50.51                                       | 14.75**<br>(1.33)            |
|             | Underwear Items                    | 66.97                                          | 48.54                                       | 18.44**<br>(3.63)            |
| Word Length | Within Item Analysis               | 4.11                                           | 4.15                                        | -0.04%**<br>(0.01%)          |
|             | Within Reviewer Analysis           | 4.10                                           | 4.11                                        | -0.01%<br>(0.01%)            |
|             | Matching at the Sub-Category Level | 4.10                                           | 4.15                                        | -0.05**<br>(0.01)            |
|             | Excluding Store Purchases          | 4.11                                           | 4.15                                        | -0.05**<br>(0.01)            |
|             | Items with Few Store Purchases     | 4.13                                           | 4.20                                        | -0.06**<br>(0.02)            |
|             | Underwear Items                    | 4.13                                           | 4.21                                        | -0.08 <sup>†</sup><br>(0.05) |

|             |                                    |        |        |                                |
|-------------|------------------------------------|--------|--------|--------------------------------|
| Family      | Within Item Analysis               | 19.72% | 20.13% | -0.004%<br>(0.005)             |
|             | Within Reviewer Analysis           | 19.94% | 20.03% | -0.09%<br>(0.62%)              |
|             | Matching at the Sub-Category Level | 20.47% | 18.80% | 1.67% <sup>**</sup><br>(0.42%) |
|             | Excluding Store Purchases          | 20.05% | 17.58% | 2.46% <sup>**</sup><br>(0.62%) |
|             | Items with Few Store Purchases     | 22.82% | 20.01% | 2.82% <sup>*</sup><br>(1.36%)  |
|             | Underwear Items                    | 12.50% | 19.85% | -7.35% <sup>†</sup><br>(3.82%) |
| Repeated !! | Within Item Analysis               | 5.91%  | 4.27%  | 1.65% <sup>**</sup><br>(0.31%) |
|             | Within Reviewer Analysis           | 6.91%  | 5.43%  | 2.65% <sup>**</sup><br>(0.52%) |
|             | Matching at the Sub-Category Level | 7.07%  | 4.76%  | 2.32% <sup>**</sup><br>(0.23%) |
|             | Excluding Store Purchases          | 5.55%  | 4.51%  | 1.05% <sup>**</sup><br>(0.34%) |
|             | Items with Few Store Purchases     | 7.32%  | 4.58%  | 2.75% <sup>**</sup><br>(0.72%) |
|             | Underwear Items                    | 7.14%  | 4.08%  | 3.06%<br>(1.93%)               |

The table reports averages for each measure separately for the samples of reviews with and without confirmed transactions. The sample sizes are reported in other tables. Standard errors are in parentheses.

<sup>\*</sup>Significantly different from zero,  $p < 0.05$  and <sup>\*\*</sup>significantly different from zero,  $p < 0.01$ .

### Replicating the Results for the 10 Largest Product Categories

| Product Category | Difference in Mean Rating | Difference in % of Ratings = 1 | Chi-Square test | KL Divergence | Number of Reviews Without Prior Trans | Number of Reviews With Prior Trans |
|------------------|---------------------------|--------------------------------|-----------------|---------------|---------------------------------------|------------------------------------|
| 1                | -0.45**<br>(0.04)         | 7.62**<br>(0.81)               | 134.98**        | 0.0554        | 814                                   | 31,251                             |
| 2                | -0.70**<br>(0.04)         | 15.13**<br>(0.89)              | 364.56**        | 0.1077        | 992                                   | 25,946                             |
| 3                | -0.52**<br>(0.06)         | 8.04**<br>(1.14)               | 99.26**         | 0.0754        | 421                                   | 16,470                             |
| 4                | -0.20**<br>(0.04)         | 3.23**<br>(0.83)               | 29.90**         | 0.0188        | 573                                   | 10,507                             |
| 5                | -0.27**<br>(0.06)         | 3.38**<br>(1.11)               | 31.77**         | 0.0356        | 317                                   | 10,504                             |
| 6                | -0.24**<br>(0.04)         | 4.73**<br>(0.89)               | 46.68**         | 0.0199        | 902                                   | 9,476                              |
| 7                | -0.31**<br>(0.08)         | 4.48**<br>(1.54)               | 19.50**         | 0.0342        | 217                                   | 9,879                              |
| 8                | -0.49**<br>(0.07)         | 6.03**<br>(1.30)               | 63.38**         | 0.0724        | 306                                   | 9,527                              |
| 9                | -0.19**<br>(0.05)         | 1.51 <sup>†</sup><br>(0.89)    | 18.71**         | 0.0157        | 482                                   | 9,094                              |
| 10               | -0.17**<br>(0.06)         | 5.56**<br>(1.23)               | 27.29**         | 0.0276        | 387                                   | 9,075                              |

The table reports each statistic for the products categories with the 10 largest sales volumes. Standard errors are in parentheses. \*\*Significantly different from zero,  $p < 0.01$ . <sup>†</sup>Significantly different from zero,  $p < 0.10$ .

### Replicating the Results for Items with Different Product Ages

| Product Age (Years) | Difference in Mean Rating | Difference in % of Ratings = 1 | Chi-Square test | KL Divergence | Number of Reviews Without Prior Trans | Number of Reviews With Prior Trans |
|---------------------|---------------------------|--------------------------------|-----------------|---------------|---------------------------------------|------------------------------------|
| Less than 1         | -0.30**<br>(0.02)         | 7.50**<br>(0.36)               | 544.64**        | 0.0346        | 5,232                                 | 82,041                             |
| 1 to 2              | -0.25**<br>(0.02)         | 4.35**<br>(0.46)               | 174.52**        | 0.0261        | 2,713                                 | 54,508                             |
| 2 to 4              | -0.21**<br>(0.02)         | 4.33**<br>(0.41)               | 176.08**        | 0.0214        | 2,989                                 | 55,863                             |
| 4 to 6              | -0.19**<br>(0.03)         | 3.96**<br>(0.55)               | 76.64**         | 0.0181        | 1,578                                 | 34,357                             |
| 6 to 10             | -0.27**<br>(0.03)         | 4.99**<br>(0.61)               | 93.09**         | 0.0255        | 1,229                                 | 33,137                             |
| Over 10             | -0.21**<br>(0.03)         | 3.58**<br>(0.50)               | 82.68**         | 0.0164        | 1,903                                 | 50,204                             |

The table reports each statistic when grouping the reviews according to the age of the item reviewed (at the date of the review). Standard errors are in parentheses. \*\* Significantly different from zero,  $p < 0.01$ .

### Replicating the Results for Items with Different Sales Volumes in the Previous 12 Months

| Sales Volume<br>(quartile) | Difference in<br>Mean Rating | Difference in %<br>of Ratings = 1 | Chi-Square<br>test | KL<br>Divergence | Number of<br>Reviews<br>Without<br>Prior Trans | Number of<br>Reviews<br>With Prior<br>Trans |
|----------------------------|------------------------------|-----------------------------------|--------------------|------------------|------------------------------------------------|---------------------------------------------|
| 1<br>(lowest)              | -0.16**<br>(0.02)            | 4.54**<br>(0.31)                  | 294.48**           | 0.0178           | 6,536                                          | 74,871                                      |
| 2                          | -0.26**<br>(0.02)            | 5.19**<br>(0.39)                  | 281.50**           | 0.0299           | 3,732                                          | 77,680                                      |
| 3                          | -0.29**<br>(0.02)            | 5.62**<br>(0.41)                  | 278.51**           | 0.0324           | 2,872                                          | 78,540                                      |
| 4<br>(highest)             | -0.31**<br>(0.02)            | 5.51**<br>(0.41)                  | 271.45**           | 0.0360           | 2,397                                          | 79,015                                      |

The table reports each statistic when grouping the reviews according to the sales volume of the item reviewed (in the year prior to the review date). \*\*Significantly different from zero,  $p < 0.01$ .

### Within-Item Analysis (Controlling for Item Differences)

|                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference          |
|-----------------|---------------------------------------|------------------------------------|---------------------|
| Average rating  | 4.01                                  | 4.23                               | -0.22**<br>(0.02)   |
| Rating = 1      | 10.85%                                | 6.72%                              | 4.13%**<br>(0.42%)  |
| Rating = 2      | 7.43%                                 | 5.92%                              | 1.50%**<br>(0.35%)  |
| Rating = 3      | 9.19%                                 | 7.16%                              | 2.03%**<br>(0.40%)  |
| Rating = 4      | 14.90%                                | 17.78%                             | -2.88%**<br>(0.50%) |
| Rating = 5      | 57.63%                                | 62.41%                             | -4.78%**<br>(0.67%) |
| Chi-Square test |                                       |                                    | 163.69**            |
| KL Divergence   |                                       |                                    | 0.0176              |

The table reports the average product ratings for reviews with and without a confirmed transaction. Reviews are first averaged at the item level and then averaged across items. The sample includes all of the 3,779 items for which we have review(s) with and without confirmed transactions. Standard errors are in parentheses. \*\*Significantly different from zero,  $p < 0.01$ .

- i. We identify the 3,779 items that have review(s) with prior transactions and review(s) without prior transactions.
- ii. For each product  $j$  in this set we calculate  $(\text{Rating\_1}_j^{\text{with}})$ : among item  $j$ 's reviews with prior transactions what proportion have a rating equal to 1? We then average  $\text{Rating\_1}_j^{\text{with}}$  across the 3,779 items and report this average (10.85%) above.
- iii. We also calculate  $\text{Rating\_1}_j^{\text{without}}$ : among item  $j$ 's reviews without prior transactions what proportion have a rating equal to 1? We average  $\text{Rating\_1}_j^{\text{without}}$  across the 3,779 items and also report this average (6.72%) above.
- iv. For each item  $j$  we also calculate  $\text{Difference\_1}_j = \text{Rating\_1}_j^{\text{without}} - \text{Rating\_1}_j^{\text{with}}$ . We average  $\text{Difference\_1}_j$  across the 3,779 items and report this average (4.13%) above.
- v. Notice that this difference calculation gives us the within item difference in the proportion of reviews that have a rating equal to 1 when the reviews do not have prior transactions compared to when they do. This explicitly controls for all item differences.
- vi. We then repeat this process for all 5 rating levels and also report both a Chi-Square test of the equivalence of the two distributions and the KL Divergence.

### Within-Reviewer Analysis (Controlling for Reviewer Differences)

|                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference          |
|-----------------|---------------------------------------|------------------------------------|---------------------|
| Average rating  | 4.08                                  | 4.27                               | -0.18**<br>(0.02)   |
| Rating = 1      | 9.62%                                 | 5.61%                              | 4.00%**<br>(0.43%)  |
| Rating = 2      | 7.62%                                 | 6.05%                              | 1.57%**<br>(0.42%)  |
| Rating = 3      | 8.39%                                 | 7.78%                              | 0.61%**<br>(0.45%)  |
| Rating = 4      | 13.71%                                | 17.15%                             | -3.43%**<br>(0.57%) |
| Rating = 5      | 60.67%                                | 63.41%                             | -2.74%**<br>(0.73%) |
| Chi-Square test |                                       |                                    | 216.16**            |
| KL Divergence   |                                       |                                    | 0.0163              |

The table reports the average product ratings for reviews with and without a confirmed transaction. Reviews are first averaged at the reviewer level and then averaged across reviewers. The sample includes all of the 5,234 reviewers for whom we have review(s) with and without confirmed transactions. Standard errors are in parentheses. \*\* Significantly different from zero,  $p < 0.01$ .

- i. We identify the 5,234 reviewers who have written a review(s) with prior transactions and review(s) without prior transactions.
- ii. For each reviewer  $i$  in this set we calculate  $(\text{Rating\_1}_i^{\text{with}})$ : among reviewer  $i$ 's reviews with prior transactions what proportion have a rating equal to 1? We then average  $\text{Rating\_1}_i^{\text{with}}$  across the 5,234 reviewers and report this average (6.49%) above.
- iii. We also calculate  $\text{Rating\_1}_i^{\text{without}}$ : among reviewer  $i$ 's reviews without prior transactions what proportion have a rating equal to 1? We average  $\text{Rating\_1}_i^{\text{without}}$  across the 5,234 reviewers and also report this average (3.14%) above.
- iv. For each reviewer  $i$  we also calculate  $\text{Difference\_1}_i = \text{Rating\_1}_i^{\text{without}} - \text{Rating\_1}_i^{\text{with}}$ . We average  $\text{Difference\_1}_i$  across the 5,234 reviewers and report this average (3.35%) above.
- v. Notice that this difference calculation gives us the within reviewer difference in the proportion of reviews that have a rating equal to 1 when the reviews do not have prior transactions compared to when they do. This explicitly controls for reviewer differences.
- vi. We repeat this process for all 5 rating levels and also report both a Chi-Square test of the equivalence of the two distributions and the KL Divergence.

**Within-Reviewer Analysis**  
**Reviewers With At Least 3 Reviews Without Confirmed Transactions**

|                 | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>   |
|-----------------|------------------------------------------------|---------------------------------------------|---------------------|
| Average rating  | 4.30                                           | 4.43                                        | -0.13**<br>(4.36)   |
| Rating = 1      | 6.49%                                          | 3.14%                                       | 3.35%**<br>(0.91%)  |
| Rating = 2      | 3.84%                                          | 4.56%                                       | -0.72%<br>(0.83%)   |
| Rating = 3      | 7.20%                                          | 7.51%                                       | -0.31%<br>(1.03%)   |
| Rating = 4      | 17.68%                                         | 15.32%                                      | 2.36%<br>(1.40%)    |
| Rating = 5      | 64.79%                                         | 69.47%                                      | -7.37%**<br>(1.77%) |
| Chi-Square test |                                                |                                             | 9.90*               |
| KL Divergence   |                                                |                                             | 0.0147              |

The table reports the average product ratings for reviews with and without a confirmed transaction. Reviews are first averaged at the reviewer level and then averaged across reviewers. The sample includes all of the 226 reviewers who have at least 3 reviews without a confirmed transaction and at least one review with a confirmed transaction. Standard errors are in parentheses. \* Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

### Restricting Attention to the Underwear Product Category

|                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference        |
|-----------------|---------------------------------------|------------------------------------|-------------------|
| Average rating  | 4.26                                  | 4.41                               | -0.15<br>(0.11)   |
| Rating = 1      | 9.82%                                 | 4.95%                              | 4.87%*<br>(2.12%) |
| Rating = 2      | 0.90%                                 | 4.27%                              | -3.38%<br>(1.92%) |
| Rating = 3      | 8.04%                                 | 5.31%                              | 2.72%<br>(0.45%)  |
| Rating = 4      | 16.07%                                | 16.00%                             | 0.07%<br>(2.18%)  |
| Rating = 5      | 65.18%                                | 69.46%                             | -4.28%<br>(4.44%) |
| Chi-Square test |                                       |                                    | 10.22*            |
| KI Divergence   |                                       |                                    | 0.0540            |

The table reports the average product ratings when we restrict attention to reviews of items in the underwear product category. The sample sizes are 112 (reviews without a confirmed transaction) and 3,088 (reviews with a confirmed transaction). Standard errors are in parentheses. \*Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

**Feedback about Customer Service or Shipping Policies**  
**Text Analysis of Customer Service or Shipping Policy Complaints**

|                                  |             | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>              |
|----------------------------------|-------------|------------------------------------------------|---------------------------------------------|--------------------------------|
| <b>Customer Service Feedback</b> | All Reviews | 1.69%<br>(0.10%)                               | 1.81%<br>(0.02%)                            | -0.12%<br>(0.11%)              |
|                                  | Rating = 1  | 3.45%<br>(0.10%)                               | 3.17%<br>(0.02%)                            | 0.28%<br>(0.45%)               |
|                                  | Rating = 2  | 1.81%<br>(0.40%)                               | 2.05%<br>(0.11%)                            | -0.23%<br>(0.44%)              |
|                                  | Rating = 3  | 1.58%<br>(0.35%)                               | 1.71%<br>(0.09%)                            | -0.12%<br>(0.38%)              |
|                                  | Rating = 4  | 1.33%<br>(0.25%)                               | 1.60%<br>(0.05%)                            | -0.27%<br>(0.27%)              |
|                                  | Rating = 5  | 1.46%<br>(0.12%)                               | 1.74%<br>(0.03%)                            | -0.28%*<br>(0.14%)             |
| <b>Shipping Policy Feedback</b>  | All Reviews | 0.62%<br>(0.06%)                               | 1.10%<br>(0.02%)                            | -0.47%**<br>(0.08%)            |
|                                  | Rating = 1  | 1.31%<br>(0.06%)                               | 3.12%<br>(0.02%)                            | -1.81%**<br>(0.43%)            |
|                                  | Rating = 2  | 0.91%<br>(0.29%)                               | 1.66%<br>(0.10%)                            | -0.75% <sup>†</sup><br>(0.39%) |
|                                  | Rating = 3  | 0.56%<br>(0.21%)                               | 1.40%<br>(0.08%)                            | -0.85%*<br>(0.34%)             |
|                                  | Rating = 4  | 0.64%<br>(0.17%)                               | 1.05%<br>(0.04%)                            | -0.40% <sup>†</sup><br>(0.22%) |
|                                  | Rating = 5  | 0.47%<br>(0.07%)                               | 0.87%<br>(0.02%)                            | -0.40%**<br>(0.10%)            |
| <b>Number of Reviews</b>         | All Reviews | 15,759                                         | 310,110                                     |                                |
|                                  | Rating = 1  | 1,680                                          | 16,363                                      |                                |
|                                  | Rating = 2  | 1,102                                          | 16,752                                      |                                |
|                                  | Rating = 3  | 1,262                                          | 20,077                                      |                                |
|                                  | Rating = 4  | 2,179                                          | 52,594                                      |                                |
|                                  | Rating = 5  | 9,536                                          | 204,324                                     |                                |

The unit of analysis is a review. Standard errors are in parentheses. <sup>†</sup>Significantly different from zero, p<0.10, \* significantly different from zero, p<0.05, and \*\*significantly different from zero, p<0.01.

**Feedback about Customer Service or Shipping Policies**  
**Within Item and Within Reviewer Analysis**

|                                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference          |
|---------------------------------|---------------------------------------|------------------------------------|---------------------|
| <b>Within Item Analysis</b>     |                                       |                                    |                     |
| Customer Service Feedback       | 1.46%<br>(0.15%)                      | 1.96%<br>(0.08%)                   | -0.49%**<br>(0.17%) |
| Shipping Policy Feedback        | 0.57%<br>(0.10%)                      | 1.26%<br>(0.09%)                   | -0.69%**<br>(0.12%) |
| Number of Items                 | 3,779                                 | 3,779                              |                     |
| <b>Within Reviewer Analysis</b> |                                       |                                    |                     |
| Customer Service Feedback       | 1.50%<br>(0.16%)                      | 1.66%<br>(0.15%)                   | -0.17%<br>(0.21%)   |
| Shipping Policy Feedback        | 0.57%<br>(0.10%)                      | 0.95%<br>(0.11%)                   | 0.38%**<br>(0.14%)  |
| Number of Reviewers             | 5,234                                 | 5,234                              |                     |

The unit of analysis is either an item or a reviewer. Standard errors are in parentheses.

\*\* Significantly different from zero,  $p < 0.01$ .

### Matching Reviews with Confirmed Transactions at the Sub-Category Level

|                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference          |
|-----------------|---------------------------------------|------------------------------------|---------------------|
| Average rating  | 4.04                                  | 4.32                               | -0.28**<br>(0.01)   |
| Rating = 1      | 11.06%                                | 5.38%                              | 5.68%**<br>(0.24%)  |
| Rating = 2      | 6.87%                                 | 5.44%                              | 1.44%**<br>(0.24%)  |
| Rating = 3      | 8.23%                                 | 6.50%                              | 1.73%**<br>(0.26%)  |
| Rating = 4      | 14.10%                                | 16.88%                             | -2.79%**<br>(0.40%) |
| Rating = 5      | 59.74%                                | 65.80%                             | -6.06%**<br>(0.50%) |
| Chi-Square test |                                       |                                    | 718.48**            |
| KL Divergence   |                                       |                                    | 0.0271              |

The table reports the average product ratings for reviews with and without a confirmed transaction when matching reviews with confirmed transactions at the sub-category level. The sample sizes are 9,150 (reviews without a confirmed transaction) and 316,604 (reviews with a confirmed transaction). Standard errors are in parentheses. \*\* Significantly different from zero  $p < 0.01$ .

### Distribution of Ratings by Ordering Channel

|                                 | Mail or<br>Telephone | Internet | Retail Stores |
|---------------------------------|----------------------|----------|---------------|
| Average rating                  | 4.31                 | 4.32     | 4.43          |
| Rating = 1                      | 6.04%                | 5.17%    | 4.37%         |
| Rating = 2                      | 5.42%                | 5.55%    | 4.27%         |
| Rating = 3                      | 6.36%                | 6.68%    | 4.53%         |
| Rating = 4                      | 16.14%               | 17.19%   | 17.43%        |
| Rating = 5                      | 66.04%               | 65.40%   | 69.39%        |
| Sample Size (number of reviews) | 39,551               | 225,370  | 5,623         |

The table reports the average product ratings (for reviews with confirmed transactions) according to the ordering channel in which the confirmed transaction was received. We omit reviews with confirmed transactions in multiple channels.

### Excluding Customers Who Purchase in the Firm's Retail Stores

|                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference          |
|-----------------|---------------------------------------|------------------------------------|---------------------|
| Average rating  | 4.09                                  | 4.33                               | -0.24**<br>(0.02)   |
| Rating = 1      | 10.67%                                | 5.31%                              | 5.37%**<br>(0.37%)  |
| Rating = 2      | 6.24%                                 | 5.39%                              | 0.85%*<br>(0.37%)   |
| Rating = 3      | 8.33%                                 | 6.50%                              | 1.82%**<br>(0.40%)  |
| Rating = 4      | 12.96%                                | 16.78%                             | -3.82%**<br>(0.61%) |
| Rating = 5      | 61.79%                                | 66.02%                             | -4.22%**<br>(0.77%) |
| Chi-Square test |                                       |                                    | 282.76**            |
| KL Divergence   |                                       |                                    | 0.0260              |

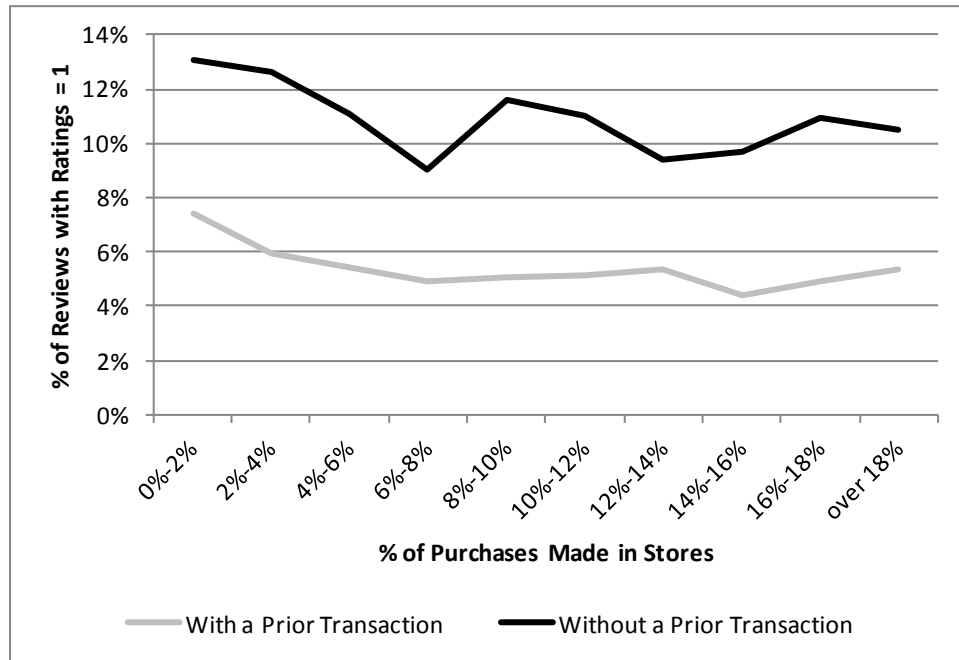
The table reports the average product ratings for reviews with and without a confirmed transaction. The sample excludes all customers who have purchased in one of the firm's retail stores and customers living within 400 miles of one of the firm's stores. Standard errors are in parentheses. The sample sizes are 3,926 (reviews without a confirmed transaction) and 89,876 (reviews with a confirmed transaction). Standard errors are in parentheses. \* Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

**Items Where Fewer than 2% of Purchases Occur in the Firm's Retail Stores**

|                 | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>  |
|-----------------|------------------------------------------------|---------------------------------------------|--------------------|
| Average rating  | 4.09                                           | 4.25                                        | -0.16**<br>(0.04)  |
| Rating = 1      | 11.78%                                         | 7.41%                                       | 4.37%**<br>(0.90%) |
| Rating = 2      | 6.69%                                          | 5.89%                                       | 0.79%<br>(0.80%)   |
| Rating = 3      | 5.63%                                          | 6.00%                                       | -0.38%<br>(0.80%)  |
| Rating = 4      | 12.85%                                         | 15.62%                                      | -2.78%*<br>(1.22%) |
| Rating = 5      | 63.069%                                        | 65.07%                                      | -2.01%<br>(1.62%)  |
| Chi-Square test |                                                |                                             | 30.78**            |
| KL Divergence   |                                                |                                             | 0.0128             |

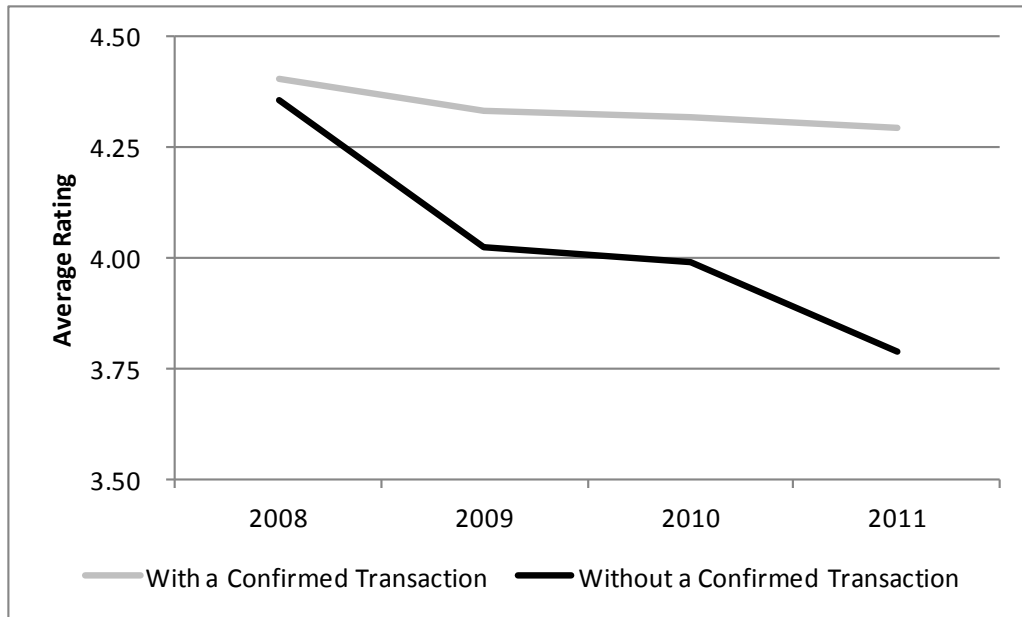
The table reports the average product ratings for reviews with and without a confirmed transaction. The sample excludes all items where more than 2% of all unit purchases occur in one of the firm's retail stores. Standard errors are in parentheses. The sample sizes are 942 (reviews without a confirmed transaction) and 11,842 (reviews with a confirmed transaction). Standard errors are in parentheses. \* Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

### Do Items That Have More Sales in Retail Stores Have Lower Product Ratings?



The figure reports the relationship between the proportion of an item's sales that occur in retail stores and the proportion of reviews that have ratings equal to 1. The unit of analysis is a review and the sample includes all 325,869 reviews.

**Average Rating by the Year the Review was Written**



The figure reports the average product ratings for reviews with and without a confirmed transaction, grouped according to the year that the review was written. The unit of analysis is a review and the sample includes all 325,869 reviews.

### Predicting Which Reviewers Will Write a Review Without a Confirmed Transaction

|                                    | Marginal Effects      |
|------------------------------------|-----------------------|
| Average Review Date                | -0.0162**<br>(0.0005) |
| Number of Reviews                  | 0.0117**<br>(0.0002)  |
| Items Purchased (100s)             | 0.0011**<br>(0.0002)  |
| Average Item Price (\$10)          | 0.0011**<br>(0.0003)  |
| Overall Discount Received          | -0.0176<br>(0.0149)   |
| Discount Frequency                 | 0.0309**<br>(0.0066)  |
| Return Rate                        | 0.0177**<br>(0.0026)  |
| Years Since First Order            | -0.0001<br>(0.0001)   |
| Number of Children                 | 0.0017**<br>(0.0005)  |
| Married                            | -0.0050**<br>(0.0012) |
| Age (10s years)                    | -0.0085**<br>(0.0004) |
| Est. Home Value (\$100,000s)       | 0.0001<br>(0.0002)    |
| Est. Household Income (\$100,000s) | 0.0002<br>(0.0010)    |
| Graduate Degree                    | 0.0008<br>(0.0011)    |
| Pseudo R <sup>2</sup>              | 0.0730                |

The table reports the marginal effects from a logistic model where the dependent variable is a binary variable indicating whether the reviewer has ever written a review without a confirmed transaction. The unit of analysis is a reviewer and the sample size is 178,772 (the sample size reflects missing demographic variables). The model includes a constant, but this is omitted from the table. Standard errors are in parentheses. \*\* Significantly different from zero,  $p < 0.01$ .

**Classification Table:**  
**Predicting Which Reviewers Will Write a Review Without a Confirmed Transaction**

|                             | Actual: True | Actual: False         | Total   |
|-----------------------------|--------------|-----------------------|---------|
| <b>Predicted: True</b>      | 363          | 220                   | 583     |
| <b>Predicted: False</b>     | 9,012        | 169,177               | 178,179 |
| <b>Total</b>                | 9,375        | 169,397               | 178,772 |
| <b>False Positive</b>       | 37.74%       | 220/583               |         |
| <b>False Negative</b>       | 5.06%        | 9,012/178,719         |         |
| <b>Correctly Classified</b> | 94.84%       | (363+169,177)/178,772 |         |
| <b>Benchmark</b>            | 94.76%       | 169,397/178,772       |         |

The table reports the classification table from the logistic model reported on the previous page. The benchmark prediction is that none of the reviewers write reviews without a confirmed transaction.

### Upset Customers: Text Analysis

|                                 | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference           |
|---------------------------------|---------------------------------------|------------------------------------|----------------------|
| <b>By Product Review Rating</b> |                                       |                                    |                      |
| Rating = 1                      | 1.37%                                 | 1.65%                              | -0.28%<br>(0.32%)    |
| Rating = 2                      | 1.18%                                 | 0.734%                             | -0.445%<br>(0.270%)  |
| Rating = 3                      | 0.872%                                | 0.608%                             | 0.264%<br>(0.228%)   |
| Rating = 4                      | 0.872%                                | 0.384%                             | 0.488%**<br>(0.139%) |
| Rating = 5                      | 0.912%                                | 0.479%                             | 0.434%**<br>(0.074%) |
| <b>Number of Reviews</b>        |                                       |                                    |                      |
| Rating = 1                      | 1,680                                 | 16,363                             |                      |
| Rating = 2                      | 1,102                                 | 16,752                             |                      |
| Rating = 3                      | 1,262                                 | 20,077                             |                      |
| Rating = 4                      | 2,179                                 | 52,594                             |                      |
| Rating = 5                      | 9,536                                 | 204,324                            |                      |

The table reports averages for each measure separately for the samples of reviews with and without confirmed transactions. For the within item analysis, reviews are first averaged at the item level and then averaged across items. For the within reviewer analysis, reviews are first averaged at the reviewer level and then averaged across reviewers. Standard errors are in parentheses. \*Significantly different from zero,  $p < 0.05$  and \*\*significantly different from zero,  $p < 0.01$ .

**Upset Customers: Analysis of Subsequent Orders  
All Reviews**

|                                            | <b>(Any) Review<br/>Without a<br/>Confirmed<br/>Transaction</b> | <b>Reviews<br/>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>    |
|--------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------|----------------------|
| <b>All Observations</b>                    |                                                                 |                                                         |                      |
| Years Until Next Order                     | 0.2603<br>(0.0042)                                              | 0.2681<br>(0.0008)                                      | -0.0078*<br>(0.0038) |
| Purchase Intervals Until Next Order        | 1.1137<br>(0.0510)                                              | 0.9276<br>(0.0060)                                      | 0.1861**<br>(0.0290) |
| No Subsequent Order                        | 12.38%<br>(0.29%)                                               | 17.08%<br>(0.07%)                                       | -4.70%**<br>(0.34%)  |
| No Order in Next Purchase Interval         | 32.12%<br>(0.45%)                                               | 34.10%<br>(0.10%)                                       | -1.97%**<br>(0.47%)  |
| No Order in Next Year                      | 13.13%<br>(0.35%)                                               | 15.39%<br>(0.09%)                                       | 2.26%**<br>(0.38%)   |
| More Orders in Next Year vs. Prior Year    | 37.21%<br>(0.46%)                                               | 29.03%<br>(0.11%)                                       | 8.19%**<br>(0.48%)   |
| More Orders in Next Year vs. Prior Average | 62.13%<br>(0.50%)                                               | 58.89%<br>(0.12%)                                       | 3.24%**<br>(0.52%)   |
| <b>Sample Sizes</b>                        |                                                                 |                                                         |                      |
| Years Until Next Order                     | 11,018                                                          | 219,019                                                 |                      |
| Purchase Intervals Until Next Order        | 11,018                                                          | 219,019                                                 |                      |
| No Subsequent Order                        | 12,575                                                          | 264,140                                                 |                      |
| No Order in Next Purchase Interval         | 10,613                                                          | 212,206                                                 |                      |
| No Order in Next Year                      | 9,416                                                           | 176,641                                                 |                      |
| More Orders in Next Year vs. Prior Year    | 9,416                                                           | 176,641                                                 |                      |
| More Orders in Next Year vs. Prior Average | 9,416                                                           | 176,641                                                 |                      |

The unit of analysis is a reviewer x review date. The sample size changes because we restrict attention to observations for which we observe a complete post period. The sample size is also smaller when measuring the time or interval until the next order as we only consider observations where there is a subsequent order. Standard errors are in parentheses.

\*Significantly different from zero,  $p < 0.05$  and \*\*significantly different from zero,  $p < 0.01$ .

**Upset Customers: More Orders in Next Year vs. Prior Year  
Adding an Interval Between Prior Period and Review Date**

|                                                | (Any) Review<br>Without a<br>Confirmed<br>Transaction | Reviews<br>With a<br>Confirmed<br>Transaction | Difference         |
|------------------------------------------------|-------------------------------------------------------|-----------------------------------------------|--------------------|
| <b>More Orders in Next Year vs. Prior Year</b> |                                                       |                                               |                    |
| No interval                                    | 34.25%<br>(1.44%)                                     | 25.96%<br>(0.43%)                             | 8.29%**<br>(1.41%) |
| 2-week interval                                | 36.19%<br>(1.46%)                                     | 28.93%<br>(0.45%)                             | 7.26%**<br>(1.45%) |
| 4-week interval                                | 37.20%<br>(1.47%)                                     | 34.94%<br>(0.47%)                             | 2.26%<br>(1.52%)   |
| 6-week interval                                | 37.48%<br>(1.47%)                                     | 36.05%<br>(0.47%)                             | 1.43%<br>(1.53%)   |
| 8-week interval                                | 38.03%<br>(1.47%)                                     | 36.72%<br>(0.47%)                             | 1.30%<br>(1.54%)   |
| <b>Sample Sizes</b>                            | 1,086                                                 | 10,350                                        |                    |

The table reports findings when we add an interval between the end of the pre-period and the review date. We continue to use 12-month pre-periods and post-periods. The unit of analysis is a reviewer x review date. We use observations that include at least one review with a rating equal to 1 and restrict attention to observations for which we observe a complete post period. Standard errors are in parentheses. \*\*Significantly different from zero,  $p < 0.01$ .

### Upset Customers: Multivariate Analysis Including Fixed Reviewer Effects

In the table below we report the *No Confirmed Transaction* coefficient from the following OLS fixed effects model:

$$Y = \beta X + \beta_1 \text{No Confirmed Transaction} + \beta_2 \text{Review Date} + \epsilon.$$

We use each of the seven post-review outcome measures. The **X** vector is a vector of fixed reviewer effects and *No Confirmed Transaction* is a binary variable identifying whether at least one of the reviews written by that reviewer on that review date did not have a confirmed transaction. The unit of analysis is a reviewer x review date and the sample sizes are indicated in the table below. The sample size changes because we restrict attention to observations for which we observe a complete post period. The sample size is also smaller when measuring the time or interval until the next order as we only consider observations where there is a subsequent order. We estimate two separate models: one using all of the observations, and the other only using observations where at least one of the reviews had a rating of 1. Note that because of the fixed reviewer effects, the coefficient of interest is only affected by observations for which there is variation in the *No Confirmed Transaction* variable within a reviewer). The standard errors are clustered at the reviewer level and are reported in parentheses.

|                                            | No Confirmed Transaction Coefficient ( $\beta_1$ ) |                           | Sample Size      |                           |
|--------------------------------------------|----------------------------------------------------|---------------------------|------------------|---------------------------|
|                                            | All Observations                                   | Reviews With a Rating = 1 | All Observations | Reviews With a Rating = 1 |
| Years Until Next Order                     | -0.0170**<br>(0.0064)                              | -0.0082<br>(0.0561)       | 230,037          | 13,879                    |
| Purchase Intervals Until Next Order        | 0.1349<br>(0.1014)                                 | -0.6492<br>(1.7031)       | 230,037          | 13,879                    |
| No Subsequent Order                        | 0.0055<br>(0.0062)                                 | 0.0067<br>(0.0745)        | 276,715          | 16,940                    |
| No Order in Next Purchase Interval         | 0.0138<br>(0.0140)                                 | 0.0043<br>(0.1869)        | 222,819          | 13,817                    |
| No Order in Next Year                      | -0.0033<br>(0.0059)                                | -0.0242<br>(0.0733)       | 186,057          | 11,436                    |
| More Orders in Next Year vs. Prior Year    | 0.0342 <sup>†</sup><br>(0.0189)                    | 0.0130<br>(0.1996)        | 186,057          | 11,436                    |
| More Orders in Next Year vs. Prior Average | 0.0198<br>(0.0131)                                 | 0.0755<br>(0.1788)        | 186,057          | 11,436                    |

Standard errors are in parentheses, clustered at the reviewer level. <sup>†</sup>Significantly different from zero,  $p < 0.10$ , and \*\*significantly different from zero,  $p < 0.01$ .

### Niche Products by Product Rating Level

|                          |            | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference                      |
|--------------------------|------------|---------------------------------------|------------------------------------|---------------------------------|
| <b>Prior Units Index</b> | Rating = 1 | 74.41                                 | 100.00                             | 25.59 <sup>**</sup><br>(3.65)   |
|                          | Rating = 2 | 77.51                                 | 100.00                             | 22.49 <sup>**</sup><br>(4.45)   |
|                          | Rating = 3 | 74.84                                 | 100.00                             | 25.16 <sup>**</sup><br>(4.19)   |
|                          | Rating = 4 | 73.57                                 | 100.00                             | 26.43 <sup>**</sup><br>(3.12)   |
|                          | Rating = 5 | 68.66                                 | 100.00                             | 31.34 <sup>**</sup><br>(1.43)   |
| <b>Niche Items</b>       | Rating = 1 | 22.32%                                | 11.85%                             | 10.47% <sup>**</sup><br>(0.85%) |
|                          | Rating = 2 | 20.96%                                | 10.59%                             | 10.37% <sup>**</sup><br>(0.98%) |
|                          | Rating = 3 | 22.03%                                | 10.33%                             | 11.70% <sup>**</sup><br>(0.91%) |
|                          | Rating = 4 | 25.88%                                | 10.70%                             | 15.19% <sup>**</sup><br>(0.69%) |
|                          | Rating = 5 | 25.21%                                | 8.47%                              | 16.73% <sup>**</sup><br>(0.30%) |
| <b>Very Niche Items</b>  | Rating = 1 | 5.36%                                 | 0.89%                              | 4.46% <sup>**</sup><br>(0.29%)  |
|                          | Rating = 2 | 4.54%                                 | 0.68%                              | 3.86% <sup>**</sup><br>(0.29%)  |
|                          | Rating = 3 | 5.55%                                 | 0.71%                              | 4.80% <sup>**</sup><br>(0.29%)  |
|                          | Rating = 4 | 8.81%                                 | 0.72%                              | 8.09% <sup>**</sup><br>(0.22%)  |
|                          | Rating = 5 | 9.94%                                 | 0.55%                              | 9.39% <sup>**</sup><br>(0.10%)  |

The unit of analysis is a review. The measures are all defined in the main body of the paper. Standard errors are in parentheses. The table uses all of the reviews (sample sizes are reported in other tables).

<sup>\*\*</sup> Significantly different from zero,  $p < 0.01$ .

### New Products by Product Rating Level

|                            |            | Without a<br>Confirmed<br>Transaction | With a<br>Confirmed<br>Transaction | Difference                      |
|----------------------------|------------|---------------------------------------|------------------------------------|---------------------------------|
| <b>Product Age (years)</b> | Rating = 1 | 3.17                                  | 4.21                               | -1.04 <sup>**</sup><br>(0.13)   |
|                            | Rating = 2 | 3.44                                  | 3.98                               | -0.55 <sup>**</sup><br>(0.15)   |
|                            | Rating = 3 | 3.43                                  | 4.07                               | -0.64 <sup>**</sup><br>(0.14)   |
|                            | Rating = 4 | 3.73                                  | 4.30                               | -0.57 <sup>**</sup><br>(0.11)   |
|                            | Rating = 5 | 4.12                                  | 5.03                               | -0.91 <sup>**</sup><br>(0.06)   |
| <b>New Item</b>            | Rating = 1 | 59.57%                                | 50.95%                             | 8.62% <sup>**</sup><br>(1.28%)  |
|                            | Rating = 2 | 57.83%                                | 51.87%                             | 5.96% <sup>**</sup><br>(1.56%)  |
|                            | Rating = 3 | 54.65%                                | 50.85%                             | 3.80% <sup>**</sup><br>(1.45%)  |
|                            | Rating = 4 | 51.76%                                | 47.71%                             | 4.05% <sup>**</sup><br>(1.10%)  |
|                            | Rating = 5 | 47.67%                                | 41.22%                             | 6.46% <sup>**</sup><br>(0.52%)  |
| <b>New Category</b>        | Rating = 1 | 1.67%                                 | 1.21%                              | 0.46%<br>(0.29%)                |
|                            | Rating = 2 | 1.73%                                 | 1.74%                              | -0.01% <sup>**</sup><br>(0.41%) |
|                            | Rating = 3 | 2.15%                                 | 1.88%                              | 0.27%<br>(0.40%)                |
|                            | Rating = 4 | 2.00%                                 | 1.53%                              | 0.46% <sup>†</sup><br>(0.27%)   |
|                            | Rating = 5 | 1.31%                                 | 0.92%                              | 0.39% <sup>**</sup><br>(0.10%)  |

The unit of analysis is a review. The measures are all defined in the main body of the paper. Standard errors are in parentheses. The table uses all of the reviews (sample sizes are reported in other tables).

<sup>†</sup>Significantly different from zero,  $p < 0.10$  and <sup>\*\*</sup> significantly different from zero,  $p < 0.01$ .

### Which Types of Products Have High or Low Ratings?

|                                    | Average<br>Rating | Rating = 1 | Rating =2 | Rating = 3 | Rating =4 | Rating = 5 | Sample<br>Size |
|------------------------------------|-------------------|------------|-----------|------------|-----------|------------|----------------|
| Not Niche Items                    | 4.33              | 5.36%      | 5.40%     | 6.47%      | 16.56%    | 66.19%     | 293,289        |
| Niche Items                        | 4.20              | 7.04%      | 6.20%     | 7.23%      | 18.69%    | 60.84%     | 37,141         |
| Very Niche Items                   | 4.24              | 6.89%      | 5.87%     | 6.98%      | 16.96%    | 63.30%     | 7,813          |
| <b>Sales Volume<br/>(Quartile)</b> |                   |            |           |            |           |            |                |
| 1 (lowest)                         | 4.22              | 6.61%      | 6.20%     | 7.29%      | 18.41%    | 61.49%     | 81,407         |
| 2                                  | 4.26              | 6.03%      | 6.04%     | 7.17%      | 17.76%    | 63.00%     | 81,412         |
| 3                                  | 4.34              | 5.12%      | 5.32%     | 6.32%      | 16.47%    | 66.76%     | 81,412         |
| 4 (highest)                        | 4.44              | 4.39%      | 4.36%     | 5.42%      | 14.59%    | 71.25%     | 81,412         |
| <b>Item Age</b>                    |                   |            |           |            |           |            |                |
| 1 year                             | 4.19              | 6.86%      | 6.76%     | 7.68%      | 18.21%    | 60.48%     | 87,273         |
| 1 to 2 years                       | 4.26              | 5.85%      | 5.99%     | 7.33%      | 18.02%    | 62.81%     | 57,221         |
| 2 to 4 years                       | 4.36              | 4.92%      | 5.19%     | 6.14%      | 16.80%    | 66.95%     | 58,852         |
| 4 to 6 years                       | 4.39              | 4.71%      | 4.57%     | 6.04%      | 16.11%    | 68.57%     | 35,935         |
| 6 to 10 years                      | 4.42              | 4.62%      | 4.48%     | 5.46%      | 15.25%    | 70.18%     | 34,366         |
| Over 10 years                      | 4.42              | 4.85%      | 4.39%     | 5.32%      | 14.63%    | 70.81%     | 52,107         |

The unit of analysis is a review.

**Directed to Other Customers vs. the Firm**  
**Analysis at Each Rating Level**

|                                                   |            | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>   |
|---------------------------------------------------|------------|------------------------------------------------|---------------------------------------------|---------------------|
| <b>Contain Requests Directed to the Firm</b>      | Rating = 1 | 16.01%                                         | 5.01%                                       | 11.00%**<br>(0.61%) |
|                                                   | Rating = 2 | 8.62%                                          | 3.47%                                       | 5.15%**<br>(0.59%)  |
|                                                   | Rating = 3 | 8.56%                                          | 2.86%                                       | 5.70%**<br>(0.51%)  |
|                                                   | Rating = 4 | 5.42%                                          | 1.47%                                       | 3.95%**<br>(0.28%)  |
|                                                   | Rating = 5 | 2.44%                                          | 1.21%                                       | 1.23%**<br>(0.12%)  |
| <b>Contain Advice Directed to Other Customers</b> | Rating = 1 | 1.37%                                          | 1.11%                                       | 0.26%<br>(0.27%)    |
|                                                   | Rating = 2 | 2.45%                                          | 1.53%                                       | 0.92%*<br>(0.39%)   |
|                                                   | Rating = 3 | 2.22%                                          | 1.90%                                       | 0.32%<br>(0.40%)    |
|                                                   | Rating = 4 | 2.07%                                          | 1.35%                                       | 0.71%**<br>(0.26%)  |
|                                                   | Rating = 5 | 1.51%                                          | 0.92%                                       | 0.59%**<br>(0.10%)  |
| <b>Number of Reviews</b>                          | Rating = 1 | 1,680                                          | 16,363                                      |                     |
|                                                   | Rating = 2 | 1,102                                          | 16,752                                      |                     |
|                                                   | Rating = 3 | 1,262                                          | 20,077                                      |                     |
|                                                   | Rating = 4 | 2,179                                          | 52,594                                      |                     |
|                                                   | Rating = 5 | 9,536                                          | 204,324                                     |                     |

The table reports averages for each measure separately according to the rating on the product review. Standard errors are in parentheses. \*Significantly different from zero,  $p < 0.05$  and \*\*significantly different from zero,  $p < 0.01$ .

**Directed to Other Customers vs. the Firm  
Controlling for Item and Reviewer Differences**

|                                    | <b>Without a<br/>Confirmed<br/>Transaction</b> | <b>With a<br/>Confirmed<br/>Transaction</b> | <b>Difference</b>  |
|------------------------------------|------------------------------------------------|---------------------------------------------|--------------------|
| <b>All Reviews</b>                 |                                                |                                             |                    |
| Requests Directed to the Firm      | 5.22%<br>(0.18%)                               | 1.68%<br>(0.02%)                            | 3.54%**<br>(0.11%) |
| Advice Directed to Other Customers | 1.69%<br>(0.10%)                               | 1.10%<br>(0.02%)                            | 0.60%**<br>(0.09%) |
| Number of Reviews                  | 15,759                                         | 310,110                                     |                    |
| <b>Within Item Analysis</b>        |                                                |                                             |                    |
| Requests Directed to the Firm      | 4.02%                                          | 1.44%                                       | 2.58%**<br>(0.25%) |
| Advice Directed to Other Customers | 1.93%                                          | 1.35%                                       | 0.58%**<br>(0.19%) |
| Number of Items                    | 3,779                                          | 3,779                                       |                    |
| <b>Within Reviewer Analysis</b>    |                                                |                                             |                    |
| Requests Directed to the Firm      | 5.00%                                          | 2.95%                                       | 2.04%**<br>(0.31%) |
| Advice Directed to Other Customers | 1.76%                                          | 1.73%                                       | 0.03%<br>(0.21%)   |
| Number of Reviewers                | 5,234                                          | 5,234                                       |                    |

The table reports averages for each measure separately for the samples of reviews with and without confirmed transactions. For the within item analysis, reviews are first averaged at the item level and then averaged across items. For the within reviewer analysis, reviews are first averaged at the reviewer level and then averaged across reviewers. Standard errors are in parentheses. \*\* Significantly different from zero,  $p < 0.01$ .

### Change in Revenue and Units: Year-After vs. Year-Before Review Date

| Product Rating | Change in Revenue    | Change in Units      | Sample Size |
|----------------|----------------------|----------------------|-------------|
| 1              | -16.73%**<br>(2.09%) | -14.63%**<br>(1.93%) | 647         |
| 2              | -15.12%**<br>(1.82%) | -12.39%**<br>(1.66%) | 805         |
| 3              | -13.06%**<br>(1.32%) | -12.06%**<br>(1.20%) | 1,517       |
| 4              | -9.72%**<br>(0.78%)  | -9.01%**<br>(0.71%)  | 4,207       |
| 5              | -8.94%**<br>(0.42%)  | -9.15%**<br>(0.39%)  | 12,651      |

The changes are calculated as a percentage of the midpoint of the pre period and post period outcomes (to ensure that we do not introduce any asymmetry in the magnitude of increases versus decreases). A negative value indicates that revenue (units) was lower in the post period. The unit of analysis is an item x review date. We restrict attention to reviews written at least 1-year after the item was introduced and at least 1-year before the end of the data period. To avoid outliers we also restrict attention to items with at least \$1,000 in annual revenue. When there are multiple reviews without confirmed transactions for the same item on the same day we use the average of their product ratings. Observations with a product rating equal to  $x$  include all reviewers where the average rating is equal to  $x$  plus or minus 0.5. Standard errors are in parentheses. \*\*Significantly different from zero,  $p < 0.01$ .

**Change in Revenue and Units: Year-After vs. Year-Before Review Date**  
**Weighted by Number of Reviews**

| Product Rating | Change in Revenue    | Change in Units      | Sample Size |
|----------------|----------------------|----------------------|-------------|
| 1              | -16.49%**<br>(2.12%) | -14.32%**<br>(1.95%) | 647         |
| 2              | -14.58%**<br>(1.81%) | -12.05%**<br>(1.65%) | 805         |
| 3              | -11.88%**<br>(1.34%) | -11.12%**<br>(1.23%) | 1,517       |
| 4              | -7.09%**<br>(0.76%)  | -6.72%**<br>(0.68%)  | 4,207       |
| 5              | -6.68%**<br>(0.41%)  | -7.29%**<br>(0.38%)  | 12,651      |

Observations are weighted by the number of reviews for that item on that date. The changes are calculated as a percentage of the midpoint of the pre period and post period outcomes (to ensure that we do not introduce any asymmetry in the magnitude of increases versus decreases). A negative value indicates that revenue (units) was lower in the post period. The unit of analysis is an item x review date. We restrict attention to reviews written at least 1-year after the item was introduced and at least 1-year before the end of the data period. To avoid outliers we also restrict attention to items with at least \$1,000 in annual revenue. When there are multiple reviews without confirmed transactions for the same item on the same day we use the average of their product ratings. Observations with a product rating equal to x include all reviewers where the average rating is equal to x plus or minus 0.5. Standard errors are in parentheses. <sup>†</sup>Significantly different from zero,  $p < 0.05$ , and <sup>\*\*</sup>significantly different from zero,  $p < 0.01$ .

### Change in Revenue: OLS Difference-in-Difference Models

|                                 | Model 1              | Model 2              | Model 3                       | Model 4              |
|---------------------------------|----------------------|----------------------|-------------------------------|----------------------|
| Post*Rating_1                   | -9.02%**<br>(3.38%)  | -11.07%**<br>(3.77%) | -9.01%**<br>(2.80%)           | -11.07%**<br>(3.74%) |
| Post*Rating_2                   |                      |                      | -6.71%*<br>(2.14%)            | -8.72%**<br>(3.18%)  |
| Post*Rating_3                   |                      |                      | -6.71%*<br>(2.80%)            | -5.67%*<br>(2.81%)   |
| Post*Rating_4                   |                      |                      | -1.22%<br>(1.42%)             | -0.57%<br>(2.10%)    |
| Rating_1                        | 4.94%**<br>(1.78%)   | 6.17%**<br>(2.12%)   | 5.14%**<br>(1.79%)            | 6.44%**<br>(2.14%)   |
| Rating_2                        |                      |                      | 4.34%**<br>(1.44%)            | 5.11%**<br>(1.58%)   |
| Rating_3                        |                      |                      | 2.02% <sup>†</sup><br>(1.05%) | 1.90%<br>(1.37%)     |
| Rating_4                        |                      |                      | 0.14%<br>(0.75%)              | -0.12%<br>(1.02%)    |
| Post                            | -11.43%**<br>(1.86%) | -8.95%**<br>(2.34%)  | -11.43%**<br>(1.85%)          | -8.95%**<br>(2.32%)  |
| Review Date                     | -2.56%<br>(1.69%)    | -0.64%<br>(1.68%)    | -11.65%**<br>(1.76%)          | -9.89%**<br>(1.78%)  |
| Number of Previous Reviews      | -11.43%**<br>(1.86%) | -8.95%**<br>(2.34%)  | 0.05%**<br>(0.01%)            | 0.04%**<br>(0.01%)   |
| Avg. Rating on Previous Reviews | -11.43%**<br>(1.86%) | -8.95%**<br>(2.34%)  | 7.62%<br>(4.47%)              | 8.15%<br>(4.97%)     |
| No Previous Reviews             | -2.56%<br>(1.69%)    | -0.64%<br>(1.68%)    | 32.42%<br>(21.65%)            | 36.04%<br>(22.95%)   |
| Weighting                       | No weights           | Nbr Reviews          | No weights                    | Nbr Reviews          |
| Adjusted R <sup>2</sup>         | 0.8923               | 0.8974               | 0.8889                        | 0.8939               |
| Sample size                     | 26,596               | 26,596               | 39,644                        | 39,654               |

The figure reports the coefficients from an OLS model where the dependent variable is:  $\ln(\text{Revenue})$ . A constant and fixed item effects were included in all of the models, but are omitted from the table. The unit of analysis is an item x review date in either the pre period or post period. We restrict attention to reviews written at least 12-months after the item was introduced and 12-months before the end of the data period. To avoid outliers we also restrict attention to items with at least \$1,000 in annual revenue. When there are multiple reviews without prior transactions for the same item on the same day we use the average of their product ratings. Observations with a product rating equal to x include all reviewers where the average rating is equal to x plus or minus 0.5. In Models 1 and 2 we restrict attention to observations with an average rating of 1 or 5. In Models 3 and 4 we include all observations. The observations in Models 2 and 4 are weighted using the number of reviews for that item that day. Standard errors are in parentheses, clustered at the item level. \* Significantly different from zero,  $p < 0.05$  and \*\* significantly different from zero,  $p < 0.01$ .

## Text Analysis: Recall and Precision Findings

We randomly selected 500 reviews and asked five coders (PhD students) who had not worked on the project to read 100 reviews each. For each review we asked the coders to indicate:<sup>1</sup>

- “Does the reviewer comment on the physical fit of the product?”
- “Does the reviewer comment on the physical feel of the product?”
- “Does the consumer mention that he/she purchased the item?”
- “Is the consumer so upset with the firm that he/she is unlikely to purchase again?”
- “Does the reviewer complain about service?”
- “Does the reviewer complain about shipping?”

In the table below we compare the coders’ responses with the results from the text analysis.

|                                   | Text Analysis: No | Text Analysis: Yes | Recall Score |
|-----------------------------------|-------------------|--------------------|--------------|
| <b>Fit Analysis</b>               |                   |                    |              |
| Coder: No                         | 203               | 33                 |              |
| Coder: Yes                        | 48                | 216                | 82%          |
| Precision Score                   |                   | 87%                |              |
| <b>Feel Analysis</b>              |                   |                    |              |
| Coder: No                         | 89                | 28                 |              |
| Coder: Yes                        | 31                | 352                | 92%          |
| Precision Score                   |                   | 93%                |              |
| <b>Self-Identified Purchasers</b> |                   |                    |              |
| Coder: No                         | 238               | 20                 |              |
| Coder: Yes                        | 41                | 201                | 83%          |
| Precision Score                   |                   | 91%                |              |
| <b>Upset Customers</b>            |                   |                    |              |
| Coder: No                         | 489               | 1                  |              |
| Coder: Yes                        | 2                 | 8                  | 80%          |
| Precision Score                   |                   | 89%                |              |
| <b>Shipping Feedback</b>          |                   |                    |              |
| Coder: No                         | 497               | 0                  |              |
| Coder: Yes                        | 0                 | 3                  | 100%         |
| Precision Score                   |                   | 100%               |              |
| <b>Service Feedback</b>           |                   |                    |              |
| Coder: No                         | 491               | 0                  |              |
| Coder: Yes                        | 0                 | 9                  | 100%         |
| Precision Score                   |                   | 100%               |              |

<sup>1</sup> Each coder answered questions (a) through (d) for one set of 100 reviews and questions (e) and (f) for another set of 100 reviews.

## Reviews Directed to the Firm or Other Customers

We randomly selected 100 reviews:

- a. 50 reviews were randomly selected from reviews that text analysis identified were directed at the firm; and
- b. 50 reviews were randomly selected from reviews that text analysis identified were directed at other customers.

For each review we asked a coder to indicate:

“Are the reviewers comments directed towards other customers or the firm? (Choose One)”

In the table below we compare the coder’s responses with the results from the text analysis.

|                        | <b>Text Analysis:<br/>Other Customers</b> | <b>Text Analysis:<br/>The Firm</b> | <b>Recall Score</b> |
|------------------------|-------------------------------------------|------------------------------------|---------------------|
| Coder: Other Customers | 42                                        | 0                                  | 100%                |
| Coder: The Firm        | 2                                         | 42                                 | 95%                 |
| Coder: Neither         | 6                                         | 8                                  |                     |
| <b>Precision Score</b> | 84%                                       | 84%                                |                     |