**OOS vs Conversion Analysis**

**Note 1:** some classes were removed from the analysis for two different reasons. The first reason is due to the query to get number of units ordered from the database order\_line\_measures resulted an empty set for the classes Digital Gift Cards and Promotional Cards. The second reason is due to the ongoing adjustment of the classes Virtual Bundle, Perishable and Personalized.

**Note 2:** not all categories have data back till 2018. So, the individual analysis is done considering the date when they were first introduced, and the combined analysis is done since 2018.

First, we investigate all categories combined and then move on to the summary of each of them separately. When we look at the comparison between the oos rate and conversion rate time series (Figure 1), we see a significant increase in the oos rate in the beginning of 2020. However, we do not observe as much of a steep drop in the conversion rate. This already shows some indication that the oos rate impact on conversion rate might not be high. We also observe from the figure a possible outlier in the conversion rate at 09/09/2019. A point in the oos rate series also stands out (12/31/2018), but not as by much from the other records as in the conversion rate case.

Chart, line chart

Description automatically generated

Figure - Conversion rate and oos rate throughout time for all classes

If we observe the relationship between conversion rate and oos rate a bit more closely (Figure 2), we see that when we remove the outlier, there is a negative relationship between the two variables. This negative relationship is also shown in the correlation matrix (Figure 3). The observed spearman correlation can be considerate medium to strong, which indicates we need to investigate this relationship more thorouglhy.

Chart, scatter chart

Description automatically generatedChart, scatter chart

Description automatically generated

Figure – Relationship between Conversion Rate and OOS rate with the outlier (a) and without the outlier (b)

Chart, bar chart

Description automatically generated

Figure – Correlation Matrix of All Variables

We run a simple OLS regression to check the possible effects of the oos rate in the conversion rate. However, we see a strong positive correlation between oos rate and total page views and total ordered quantity, which does not follow the expected assumption that it would be negatively correlated. We see from Table 1 and Figure 4 that, even though the R-squared is low, the oos rate presents a significant effect on the conversion rate values.

Table – OLS Regression Results

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Dep. Variable: conversion\_rate R-squared: 0.118

Model: OLS Adj. R-squared: 0.113

Method: Least Squares F-statistic: 20.55

Date: Wed, 07 Jul 2021 Prob (F-statistic): 1.16e-05

Time: 17:35:07 Log-Likelihood: 211.25

No. Observations: 155 AIC: -418.5

Df Residuals: 153 BIC: -412.4

Df Model: 1

Covariance Type: nonrobust

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coef std err t P>|t| [0.025 0.975]

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Intercept 0.4545 0.010 43.591 0.000 0.434 0.475

oos\_rate -0.7140 0.157 -4.533 0.000 -1.025 -0.403

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Omnibus: 42.712 Durbin-Watson: 0.960

Prob(Omnibus): 0.000 Jarque-Bera (JB): 266.407

Skew: -0.765 Prob(JB): 1.41e-58

Kurtosis: 9.238 Cond. No. 31.6

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Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Chart, scatter chart

Description automatically generated

Figure – Regression results plots

The same analysis was performed for each class separately. Table 2 shows the summary of these analyses. We see that most of the classes that present statistically significant effect of the oos rate on the conversion rate have relatively smaller except for Leashes, Collars & Bowls and Health & Wellness. However, they still have higher p-value, closer to the alpha value (0.05). One observation to be made is that the Over the Counter class had a steep increase in oos rate and decrease in conversion rate in the first months of the COVID-19 pandemic, and it continued with the same pattern (Figure 5). This might be due to some change in Chewy’s approach to the category.

Chart, line chart, histogram

Description automatically generated

Figure – Conversion Rate and OOS Rate for “Over the Counter” throughout time

Table – Summary of the Regression results for each class

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **mc2** | **# products** | **corr OOSxCONV** | **r\_sqr** | **intercept** | **coef** | **t\_oos** | **p\_oos** |
| Over the Counter | 1796 | -0.693 | 0.200 | -27.394 | -27.394 | -6.213 | 0.000 |
| Wild Bird | 2146 | -0.572 | 0.063 | -0.526 | -0.526 | -3.228 | 0.002 |
| Prescription Food & Treats | 1206 | -0.494 | 0.038 | -3.237 | -3.237 | -2.456 | 0.015 |
| Containment & Gear | 9409 | -0.411 | 0.099 | -0.051 | -0.051 | -2.740 | 0.008 |
| Equine | 15632 | -0.237 | 0.014 | -0.183 | -0.183 | -1.456 | 0.148 |
| Pet Bird | 3568 | -0.236 | 0.092 | -0.750 | -0.750 | -2.625 | 0.011 |
| Beds & Furniture | 15351 | -0.083 | 0.008 | -0.014 | -0.014 | -0.756 | 0.452 |
| Flea & Tick | 1981 | -0.057 | 0.011 | -0.671 | -0.671 | -1.304 | 0.194 |
| Core Treats | 23966 | -0.004 | 0.000 | 0.142 | 0.142 | 0.073 | 0.942 |
| Chicken & Farm | 2486 | 0.002 | 0.023 | -0.497 | -0.497 | -0.592 | 0.563 |
| Leashes, Collars & Bowls | 27583 | 0.030 | 0.063 | -0.117 | -0.117 | -2.139 | 0.036 |
| Toys | 22348 | 0.068 | 0.004 | 0.315 | 0.315 | 0.753 | 0.453 |
| Reptile & Amphibians | 3088 | 0.286 | 0.025 | 0.098 | 0.098 | 1.320 | 0.191 |
| Technology | 2343 | 0.318 | 0.019 | 0.107 | 0.107 | 1.716 | 0.088 |
| Litter | 2213 | 0.333 | 0.000 | 0.081 | 0.081 | 0.077 | 0.939 |
| Fish | 7646 | 0.345 | 0.021 | 0.445 | 0.445 | 1.454 | 0.149 |
| Premium | 6916 | 0.443 | 0.001 | 0.304 | 0.304 | 0.333 | 0.740 |
| Small Pet | 4595 | 0.444 | 0.007 | 0.346 | 0.346 | 1.048 | 0.296 |
| Core Food | 22968 | 0.470 | 0.010 | 1.911 | 1.911 | 1.229 | 0.221 |
| Apparel & People Products | 30768 | 0.500 | 0.014 | 0.083 | 0.083 | 1.464 | 0.145 |
| Health & Wellness | 8863 | 0.583 | 0.030 | 1.203 | 1.203 | 2.192 | 0.030 |
| Grooming & Waste Management | 16356 | 0.625 | 0.003 | 0.119 | 0.119 | 0.677 | 0.500 |