THE UNIVERSITY OF TENNESSEE KNOXVILLE

Pursuit - The Journal of Undergraduate Research at The University of Tennessee

Volume 5 | Issue 1 Article 14

June 2014

The Business of Coupons-Do coupons lead to repeat purchases?

Margaret P. Ross
University of Tennessee, mross18@utk.edu

The Business of Coupons-Do coupons lead to repeat purchases?

Cover Page Footnote

This research was supported by a grant from the Department of Undergraduate Research and the Chancellor's Honors Program at the University of Tennessee, Knoxville. This project was completed with the support of Dr. J. Scott Holladay, assistant professor in the Department of Economics at the University of Tennessee, Knoxville.

Pursuit: The Journal of Undergraduate Research at the University of Tennessee

trace.tennessee.edu/pursuit

PURSUIT

The Business of Coupons: Do coupons lead to repeat purchases?

MARGARET ROSS
Advisor: Dr. J. Scott Holladay

Economics, The University of Tennessee, Knoxville

In recent years, couponing has emerged as a pop culture phenomenon. Businesses of all types are taking advantage of this resource by revamping their out-dated programs and turning them into something fresh to excite customers. Many questions remain unanswered concerning the viability, profitability, and usefulness of coupons. This study is an analysis of the effectiveness of coupons in enticing return purchases in the soft-drink category and the effectiveness of price discriminating at this grocery store chain. The dataset is comprised of household level grocery store transactions compiled by dunnhumby USA for 2,500 households over a period of two years. An ordinary least squares regression technique is employed to analyze the dollar sales and unit sales in the soft drink category before, during, and after coupon usage. Analysis of this sample leads to the conclusion that coupons are not effective in creating repeat purchases. However, coupons do an adequate job of price-discriminating and allow retailers to reach consumers who otherwise may not have tried a certain product.

This research was supported by a grant from the Department of Undergraduate Research and the Chancellor's Honors Program at the University of Tennessee, Knoxville. This project was completed with the support of Dr. J. Scott Holladay, assistant professor in the Department of Economics at the University of Tennessee, Knoxville.

Introduction

Traditionally, couponing has been a way for companies to increase sales of a mature product or to introduce a new product into the market. However, during our recent economic downturn, couponing has emerged as a pop culture phenomenon. Through shows such as Extreme Couponing on TLC and blogs such as thekrazycouponlady.com, couponing has entered the lives of many. Businesses of all types are taking advantage of this resource by revamping their outdated programs and turning them into something fresh to excite customers. However, many questions remain unanswered concerning the viability, profitability, and usefulness of coupons.

This project seeks to determine if coupons are a useful mechanism for creating repeat purchases, specifically in a grocery store. It also analyzes the demographic characteristics of those households in the sample to determine if coupons are an effective way to price discriminate

Past research (described more in-depth in Section II) has concluded that promotions do not increase brand preference. In this project, I used an ordinary least squares regression technique to analyze the buying patterns of 2,500 households over a two-year period. For more information on the methods and sample, refer to Section III. Regression results from this sample indicate that coupons are not effective in creating repeat purchases; however, the demographic data shows that they are effective price discrimination tools. Detailed regression results and my conclusions from these results can be found in Sections IV and V respectively. Finally, this research brings up many interesting questions that could be explored in other projects, which is discussed more fully in Section VI.

Literature Review

This literature review focuses on previous research addressing brand switching and price consciousness. A paper titled, "Impact of Deals and Deal Retraction on Brand Switching," focused on the effect of a consumer deal on brand switching and the effect of deal retraction on subsequent loyalty to the dealt brand. This paper focused on these questions on an aggregate level, stating, "the major finding in the extant dealing literature is that dealing is related positively to brand switching." Dodson, Tybout and Sternthal similarly found that offering a deal enhanced brand switching. In, "Consumer Shopping Behavior: How Much Do Consumers Save?" Griffith, Leibtag, Leicester and Nevo analyze four types of purchasing behavior: purchasing on sale; buying in bulk; buying generic brands; and choosing outlets. They concluded that the "savings from bulk purchasing are the largest, followed by savings from sales, purchases of standard generics, economy generics (lower quality and price than standard), and shopping at an outlet."

In "The effect of sales promotion on post-promotion brand preference: A meta-analysis," DelVecchio, Henard and Freling, analyzed 51 studies to "provide insight on the effects of sales promotions on brand preference." They found that "both the value and type of sales promotion have a significant effect on post promotion brand preference." They determined that coupons (or premiums) relative to other types of promotions had the highest post-promotion preference and may even lead to post-promotion brand preference. They also found that "promotions have a more positive effect on brand preference when competing against a larger set of products." They concluded that, "on average, sales promotions do not statistically affect brand preference after the promotional period has ended."

"Sales Response to Promotions and Advertising" considered the effectiveness of allocating money to either advertising or promotion. Brown determined that purchasing patterns for brand buyers (defined as those who are not likely to react to a promotion) remained fairly stable. The repurchase rate for price buyers (those who buy on deals and generally are influenced by promotions) was about half that of brand buyers. He found that, "promotions yield faster responses in sales than advertising, promotions do not yield new, long-term buyers, brand buyers are not likely to respond to promotions, and advertising appears to be capable of increasing the "Prime Franchise" of a brand." He concluded that, "advertising and promotions appeal to different types of consumers (or different buying motives within the same consumer), and are likely to differ in both their expected short- and long-run effects on sales and profits." Also he found that, "money spent on promotions almost always yields higher immediate sales, but it is not likely to yield long-term results for a period extending beyond the length of the promotion."

The consensus from these articles is that promotion does not increase post-promotion brand preference. Through my other non-scholarly sources (such as episodes of *TLC*'s *Extreme Couponing*), I have also observed that promotion is not linked to brand preference.

Economic Theory

From my literature review, I determined the economic theory underlying my research question. The first is brand loyalty: when a person is not likely to react to a promotion (Brown, 1974). The second is price/deal conscious: a person who buys on deals and is generally influenced by promotions (Brown, 1974). The third, brand switching: when a person buys one product, then the next time they buy in that same category, they buy a different product. The fourth, sales promotions: temporary incentives that encourage the trial of a product or service (DelVecchio who attributed it to Kotler and Webster, 2006). The fifth, deal retraction: when a promotion is removed from the market (DelVecchio, 2006). The sixth, post-promotion brand preference: the product choice made after a deal is retracted (DelVecchio, 2006). And last is price discrimination: charging different prices for the same product or service (Baye, 2010).

Research Question

My primary research question will be to quantitatively estimate if a consumer who originally purchases a product with a coupon will return to buy that product again without the coupon.

H_0: A coupon does not affect a consumer's purchasing behavior.

H_A: A coupon has an effect on a consumer's purchasing behavior.

Results suggest that coupons have no long term benefits on consumers' purchasing behavior and brand loyalty. My secondary research question seeks to understand why retailers continue to use coupons. My analysis suggests that introducing a coupon into the market increases short-term profits through price discrimination.

Methods

Sample

The population of interest in this study is grocery store patrons. My sample comes from data collected by dunnhumby USA for the intent of academic research. Therefore, the sampling frame is grocery store patrons from a certain grocery store chain who use that chain's loyalty card. I am using a file called "Journey." It contains household level transactions, over a period of two years, for 2,500 households. For certain households, demographic information as well as direct marketing contact histories are included. Also, both manufactures' coupons and retail coupons are included in data. I chose to use both in the analysis because both signal a price change to the consumer and are understood as a "deal." For a comprehensive list of the variables contained in the sample, please refer to Table 1 in the Appendix.

I have obtained good external validity from my sample because the sample adequately represents the population's demographic characteristics. Testing was conducted for each demographic characteristic to compare the sample to the population. All demographic variables reflected the same characteristics in the sample as in the population.

However, my sample does face some threats to external validity. Some of which are that the sample only contains data from one grocery store chain and that the sample may contain some selection bias because all these customers chose to use the store's loyalty program and thus may have been pre-disposed to coupon usage. These threats make it difficult for me to generalize my conclusions to the entire population of grocery store patrons.

Design

My data allows for the establishment of temporal precedence because it is time-series data in which the time of transactions and use of coupons is recorded. The direction of cause-and-effect is what I am trying to prove through my research. There may also be other plausible alternative explanations, which is a weakness of my research.

A few other threats to the validity of my statistical analysis are selection bias, selection-history threat, and mortality bias. As I stated previously, my project is susceptible to selection bias because each household chose to participate in the loyalty program, which could mean they are particularly deal sensitive. My project is also vulnerable to selection-history threat because an event could have occurred between the first purchase of a product and the return purchase of that product or another product, which could have influenced the choice. Mortality bias could also be a problem for my project because a household may not always shop at the particular chain used in my sample, which could lead to results that are not consistent with its normal purchasing patterns.

The type of design consistent with my available sample is a factorial design. My factor will be the use of coupons. The different levels in my design will include the product, brand, and price. The composition of the data (transaction and demographic data) allows me to analyze the purchasing patterns of coupon and non-coupon users separately.

Procedures

The independent variable that I will be studying is the use of coupons. There are few if any ethical considerations concerning my project because dunnhumby USA, did not release any personal identifying information of the households who were sampled. I also signed a statement with dunnhumby USA, to not postulate about the name of the grocery store chain from which the data was collected.

Data Summary

My data came in a series of eight CSV files. I first analyzed the data to choose an appropriate sample. I chose soft drinks as my main category, and then 12/15 pack canned carbonated drinks as the sub-category because this category is fairly homogeneous in price and composition. This category and sub-category also provided a substantial number of transactions. The soft drink category makes up about 4% (117,532) of the transactions in the dataset. The 12/15 pack canned carbonated drinks sub-category makes up about 33% (39,316) of the transactions in the soft drink category. I dropped all of the data that did not fit into these categories, then merged the household demographic data with the transaction file to analyze the demographic characteristics of coupon users.

To separate coupon users from non-coupon users, I created a dummy variable called "coupon." If retail or manufacturers' coupons had been used in a transaction, the value of 1 was assigned to the coupon variable. Then, demographic data was merged with the transaction data to analyze the demographic characteristics of the households in the sample. For more specifics about the demographic characteristics of those in the sample, please refer to Tables 2 and 3 in the Appendix.

Table 4 in the Appendix is a tabulation of the dummy variable, coupon, showing that coupons were used in 75.63% of the transactions. On a household level, 14,498 (61.37%) of the 23,624 transactions that included demographic information used coupons. According to the existing literature, this level of coupon usage is high. Other studies observed coupon usage in around 10% of their transactions. However, none of the studies in my literature review considered the soft drink category or combined manufacturers' coupons and retail discounts in their analysis.

The next graph (Graph 1 in the Appendix) is a scatter plot matrix between sales value, quantity, and coupons. As one would expect, sales value and quantity are positively correlated. Consistent with theory, coupons were used in lower dollar sales. Also, this graph shows that coupons were used in transactions with a larger quantity of items. This indicates that when coupons are introduced, households are stocking up on that item by buying larger quantities when the price is "lower."

Refer to the Appendix, Table 5, for summaries of the data in terms of sales value and quantity for transactions where a coupon is (a) not used in the current transaction, but was used

in the previous transaction (post-coupon-usage), (b) currently used (current-coupon-usage), and (c) not used in the current transaction, but will be used in the following transaction (pre-coupon-usage). This table shows that when a coupon was used, the sales value per transaction decreased, but the quantity sold per transaction increased, as one would expect. However, it is also evident that the sales value and quantity did not increase after the use of a coupon, and returned to levels very close to that of pre-coupon-usage. This indicates that coupon usage is not causing people to return to buy a product after the deal has been retracted.

To further analyze this dataset, I collapsed the data by product id, household key, basket id, week, day, transaction time, and store for quantity and sales value. Then, I merged all of the collapsed data sets together by product id. The summaries for the collapsed data are in Table 6 of the Appendix. The final dataset included these transaction variables and the demographic variables available for certain households. Again, the sales value decreases while quantity increases in transactions where coupons are used. However, once the deal is retracted, both sales value and quantity return to their pre-coupon-usage level.

Analysis of data

Graph 2 in the Appendix is a matrix of sales value for transactions where a coupon is not currently used but will be used in the next transaction (pre), transactions where a coupon is used (current), and transactions where a coupon is not currently used but was used in the last transaction (post).

Table 7 in the Appendix shows the output from regressing pre-coupon-usage sales value and current-coupon-usage sales value on post-coupon-usage sales value.

The t statistic for pre coupon usage sales value is large, allowing us to reject the null hypothesis that there is not an effect from coupon usage on post deal purchasing behavior in terms of sales value. However, the t-statistic for current coupon usage sales value is small, so we fail to reject the null hypothesis. The value of the coefficient on current-coupon-usage sales value means that a $1 increase in current coupon usage sales value will increase post coupon usage sales value by $0.007. The value of the coefficient on pre-coupon-usage sales value means that a $1 increase in pre-coupon-usage sales value will increase post-coupon-usage sales value by $0.53.

I also regressed post-coupon-usage quantity on pre-coupon-usage quantity and current-coupon-usage quantity (Table 8 in Appendix).

The t statistic for current coupon usage quantity is small, so we fail to reject the null hypothesis that there is not an effect from coupon usage on post deal purchasing behavior in terms of quantity. However, the t-statistic for pre coupon usage quantity is large enough to reject the null hypothesis for this variable. The coefficient on current coupon usage quantity indicates that a one unit increase in post coupon usage quantity is associated with a 0.002 unit decrease in current coupon usage quantity. However, a one-unit increase in post coupon usage quantity is associated with a 0.05 unit increase in pre coupon usage quantity.

Demographic characteristics of coupon users and non-coupon users varied substantially in this sample. Households between the ages of 45 to 54 had the most transactions using coupons (18,240), but a larger percentage of households age 55-64 used coupons (86.17% versus 75.20%). In terms of household income, 99.46% of transactions from households making under $15,000 annually used coupons. Also, 99.51% of transactions from households making between $100,000 and $124,000 annually used coupons. Almost all transactions (99.93%) using coupons came from households that "probably" owned their home. Single males had the largest share of transactions that used coupons (61.87%), reflecting the similar data for household size and kid category.

Most non-coupon purchases (49.57%) also came from those 45-54 years in age, reflecting

the fact that they also had the most transactions of those in the sample. Just under half (49.55%) of transactions that did not use coupons came from married households. Non-coupon using households made between $35,000 and $49,000 or over $250,000 annually. They were also definite homeowners, whose households were made up of two adults and children. Interestingly those age 35-44, married, making over $250,000 annually, homeowners, and single females had the highest percentage of non-coupon using transactions (these are potentially mutually exclusive characteristics). For detailed information about the demographic characteristics of the households in the sample, refer to Tables 2 and 3 in the Appendix.

Analysis of Potential Problems:

To test for heteroskedasticity, I ran a white test. The critical chi-squared value from table B-8 in "Using Econometrics, A Practical Guide," (6th Edition, pg. 597) for 4 degrees of freedom is 13.28 for a level of significance of 1%. The results of the white test for the sales value regression can be found in Table 9 and the results of the white test for the quantity regression can be found in Table 10 in the Appendix.

The chi squared statistic for the quantity regression is 2.74 and the chi squared statistic for the sales value regression is 272.21. The chi squared statistics for sales value is greater than the critical chi squared statistic. Therefore, we can reject the null hypothesis of homoskedasticity and conclude that we do, indeed, have heteroskedasticity in the sales value regression. For the quantity regression, we cannot reject the null hypothesis of homoskedasticity because the chi squared statistic is less than the critical chi squared statistic.

To adjust for the possibility of heteroskedasticiy, I ran the regressions again using robust standard errors. Table 11 is the regression for pre-coupon-usage and current-coupon-usage sales value regressed on post-coupon-usage sales value. Table 12 is the regression for pre-coupon-usage and current-coupon-usage quantity regressed on post-coupon-usage quantity. Both tables can be found in the Appendix.

Comparing these regression results with the non-robust ones, the non-robust results are more statistically accurate. The confidence intervals are more narrow in the non-robust results than the robust results and the coefficients for both regressions are very similar. Therefore, the non-robust regressions are a better representation of the data.

I encountered difficulties when testing for serial correlation because there were repeated time values within my panel data. However, since the data is a time-series, serial correlation is most likely an issue. Again, omitted variables are probably causing the issue. However, since these variables are not available, I chose not to attempt to correct for serial correlation.

To test for multicollinearity between pre-coupon-usage sales value and post-coupon-usage sales value, I calculated the variance inflation factor after running each independent variable against the others. This test was repeated for current-coupon-usage sales value and post-coupon-usage sales value. The variance inflation factor for each regression was 1, which indicates that there is no multicollinearity. To test for multicollinearity between pre-coupon-usage quantity and post-coupon-usage quantity, I calculated the variance inflation factor, which again equaled 1. I repeated this test for current-coupon-usage quantity and post-coupon-usage quantity and attained the same results. Therefore, I rejected the possibility of multicollinearity in the quantity regression as well.

Conclusion

Although this dataset has many shortfalls, it has provided some interesting suggestions. First, Table B, the sales value regression, proposes that an increase in pre-coupon sales value by one dollar, ceteris paribus, increases post-coupon sales value by $0.53. It also suggests that an increase by one dollar, ceteris paribus, in current coupon sales value increases post-coupon dollar sales by $0.007. The R^2 for this regression was 0.26, which is higher than that of the quantity regression, meaning that 26% of the variation in post-coupon sales value was explained by pre-coupon and current coupon sales value.

Second, Table C, the quantity regression, suggests that an increase of one unit, ceteris parabis, in the purchase of a product pre-coupon use, increases post-coupon purchases of that product by 0.05 units. It also suggests that an increase of one unit, ceteris paribus, in the purchase of a product with a coupon, decreases post-coupon purchases by 0.002 units. However, the R^2 value for this regression was only 0.0016, meaning that only 0.16% of the variation in post-coupon purchasing behavior was explained by pre-coupon and current coupon purchasing behavior.

The demographic characteristics provided in this data set can help a firm decide if it is price discriminating correctly. For example, this grocery store chain is third degree price discriminating. By introducing a coupon in this category, they are reaching consumers (coupon users), whom they wouldn't normally attract to the product. This is evident by looking at the demographic characteristics of those households who are using coupons (those with less than $16,000 in annual income and single males) and the households of those who aren't using coupons (households with $250,000 in annual income). Therefore, the grocery store chain is having success price discriminating through the use of coupons, but those who are using the coupons are unlikely to return to purchase the product without the coupon.

These two analyses, particularly the sales value regression, have interesting implication for a business considering coupons in their marketing plan. If a company wants to look at how much of a coupon to give for a certain product, they could run a similar regression to see how much current spending using a coupon, affects post spending without the coupon. For example, from this regression, they could determine that a coupon would probably not be beneficial in increasing the sales value of each transaction in this category.

However, it must be remembered that this data probably contains some biases because it does not fully describe all of the potential variables causing purchasing decisions. This omitted variable bias (especially that caused by mortality bias) is probably causing the heteroskedasticity and serial correlation in the models. It also could lead to the coefficient estimates being biased and therefore, the hypothesis tests not being reliable. All of these factors must be regarded when considering the conclusions from this data.

Suggestions for future research

In future research, I would suggest the use of data from multiple store chains. This could help eliminate the mortality bias encountered throughout this project. This research could also be improved if more sample categories were tested. If similar results were found in more categories, the conclusion of this research would be more valid. It would also be interesting to extend this research to other types of deals like that on Groupon, which may inspire completely different behavior than coupons in a grocery store. Another test statistic that could be useful in a project such as this would be the Granger causality test. I would suggest working towards the use of that test to help determine which variables are most important in determining post-coupon purchasing behaviors.

Appendix

Table 1

Description of Variables contained in Sample Data

Variable	Description
HOUSEHOLD_KEY	Uniquely identifies each household
AGE_DESC	Estimated Age Range
MARITAL_STATUS_CODE	Marital Status (A-Married, B-Single, U-Unknown)
INCOME_DESC	Household income
HOMEOWNER_DESC	Homeowner, renter, etc.
HH_COMP_DESC	Household composition
HOUSEHOLD_SIZE_DESC	Size of household up to 5+
KID_CATEGORY_DESC	Number of children present up to 3+
BASKET_ID	Uniquely identifies a purchase occasion
DAY	Day when transaction occurred
PRODUCT_ID	Uniquely identifies each product
QUANTITY	Number of the products purchased during the trip
SALES_VALUE	Amount of dollars retailers receives from sale
STORE_ID	Identifies unique stores
COUPON_MATCH_DISC	Discount applied due to retailer's match of manufacturer coupon
COUPON_DISC	Discount applied due to manufacturer coupon
RETAIL_DISC	Discount applied due to retailer's loyalty card program
TRANS_TIME	Time of day when the transaction occurred
WEEK_NO	Week of the transaction. Ranges 1-102.
CAMPAIGN	Uniquely identifies each campaign. Ranges 1-30.
DESCRIPTION	Type of campaign (TypeA, TypeB, or TypeC)
START_DAY	Start date of campaign
END_DAY	End date of campaign
DEPARTMENT	Groups similar products together
COMMODITY_DESC	Groups similar products together at a lower level
SUB_COMMODITY_DESC	Groups similar products together at the lowest level
MANUFACTURER	Code that links products with same manufacturer together
BRAND	Indicates Private or National label brand
CURR_SIZE_OF_PRODUCT	Indicates package size (not available for all products)
COUPON_UPC	Uniquely identifies each coupon (unique to household and campaign)
DISPLAY	Display location
MAILER	Mailer location

Table 2

Demographic Characteristics of Sample (Frequency)

Variable		**Frequency (Sample)**	**Frequency (Coupon Users)**	**Frequency (Non Coupon Users)**
Age	19-24	85	66	19
	25-34	295	237	58
	35-44	4822	326	4496
	45-54	18,240	13,716	4524
	55-64	94	81	13
	65+	88	72	16
Marital Status	Married	9,440	4,918	4522
	Single	208	167	41
	Unknown	13,976	9,413	4563
Income Description	Under 15K	9,033	8,984	49
	16-24K	118	96	22
	25-34K	151	134	17
	35-49K	4714	245	4469
	50-74K	437	355	82
	75-99K	131	110	21
	100-124K	4,503	4,481	22
	125-149K	61	45	16
	150-174K	37	26	11
	175-199K	17	15	2
	250K+	4,422	7	4415
Homeowner Description	Homeowner	5,323	742	4581
	Probable Owner	4,425	4,422	3
	Probable Renter	13	7	6
	Renter	110	80	30
	Unknown	13,753	9,247	4506
Household Composition	1 Adult Kids	113	85	28
	2 Adults Kids	9,229	4,746	4483
	2 Adults No Kids	455	370	85
	Single Female	4,654	185	4469
	Single Male	8,998	8,970	28
	Unknown	175	142	33

Household Size	1	13,746	9,236	4510
	2	587	472	115
	3	9,019	4,569	4450
	4	141	112	29
	5+	131	109	22
Kid Category	1	9,055	4,604	4451
	2	157	122	35
	3+	139	114	25
	None/Unknown	14,273	9,658	4615
Total		23,624	14,498	9,126

Table 3

Demographic Characteristics of Sample (Percent)

Variable		**Percent of Total (Coupon Users)**	**Percent of Total (Non-Coupon Users)**
Age	19-24	77.65%	22.35%
	25-34	80.34%	19.66%
	35-44	6.76%	93.24%
	45-54	75.20%	24.80%
	55-64	86.17%	13.83%
	65+	81.82%	18.18%
Marital Status	Married	52.10%	47.90%
	Single	80.29%	19.71%
	Unknown	67.35%	32.65%
Income Description	Under 15K	99.46%	0.54%
	16-24K	81.36%	18.64%
	25-34K	88.74%	11.26%
	35-49K	5.20%	94.80%
	50-74K	81.24%	18.76%
	75-99K	83.97%	16.03%
	100-124K	99.51%	0.49%
	125-149K	73.77%	26.23%
	150-174K	70.27%	29.73%
	175-199K	88.24%	11.76%
	250K+	0.16%	99.84%
Homeowner Description	Homeowner	13.94%	86.06%
	Probable Owner	99.93%	0.07%

	Probable Renter	53.85%	46.15%
	Renter	72.73%	27.27%
	Unknown	67.24%	32.76%
Household Composition	1 Adult Kids	75.22%	24.78%
	2 Adults Kids	51.42%	48.58%
	2 Adults No Kids	81.32%	18.68%
	Single Female	3.98%	96.02%
	Single Male	99.69%	0.31%
	Unknown	81.14%	18.86%
Household Size	1	67.19%	32.81%
	2	80.41%	19.59%
	3	50.66%	49.34%
	4	79.43%	20.57%
	5+	83.21%	16.79%
Kid Category	1	50.84%	49.16%
	2	77.71%	22.29%
	3+	82.01%	17.99%
	None/Unknown	67.67%	32.33%
Total		61.37%	38.63%

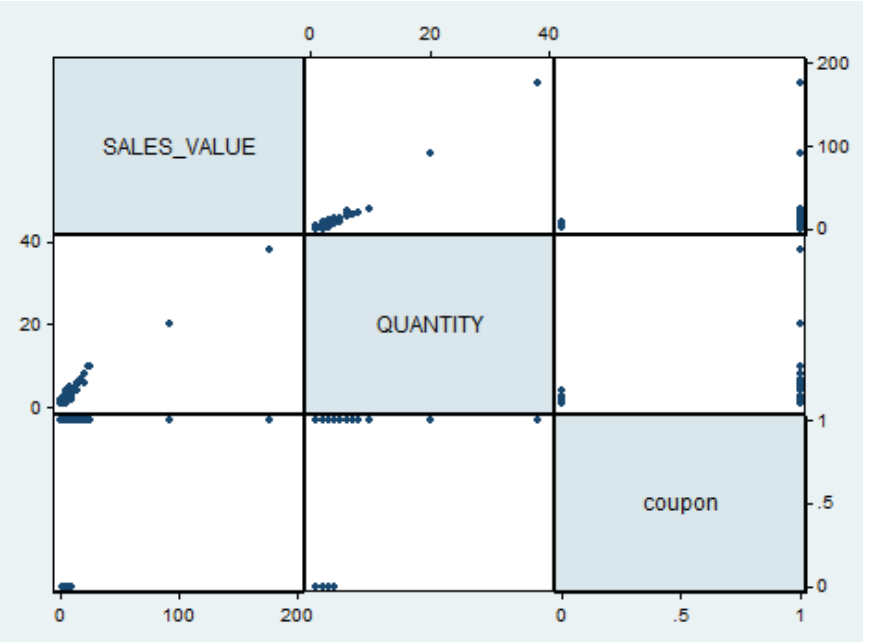
Table 4

Frequency of Coupon usage in Sample

coupon	Freq.	Percent	Cum.
0	9,449	24.37	24.37
1	29,321	75.63	100.00
Total	38,770	100.00	

Graph 1

Scatter Plot Matrix



Graph 2

Matrix of all dollar sales variables against one another

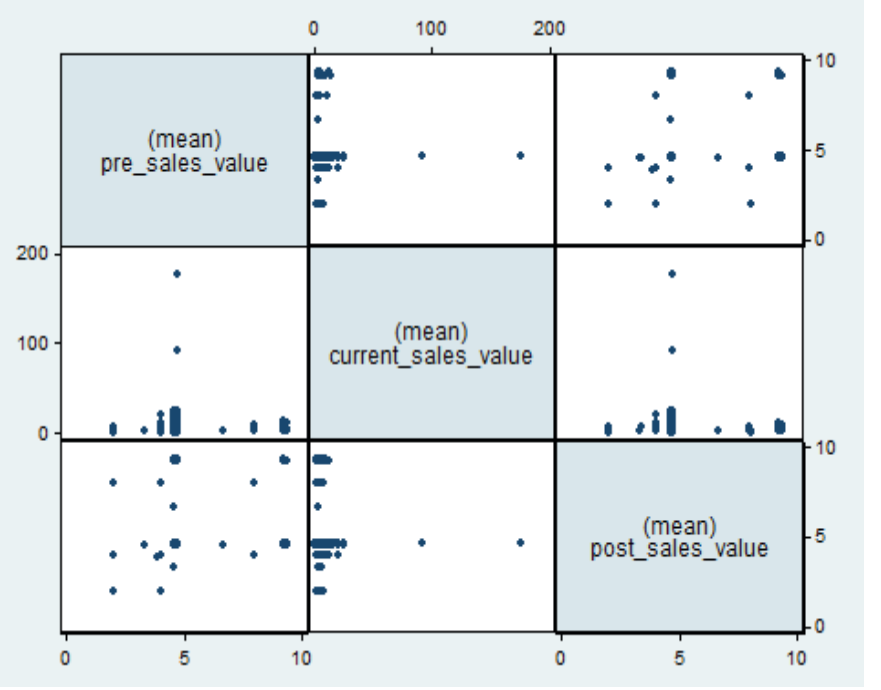


Table 5

Summary Data

Variable	Mean	Standard Deviation
Pre Sales Value	4.41411	1.179872
Current Sales Value	4.26303	2.49613
Post Sales Value	4.411142	1.179288
Pre Quantity	1.041825	0.2003163
Current Quantity	1.356229	0.8348274
Post Quantity	1.041878	0.2186304

Table 6

Summary Data after Collapse

Variable	Mean	Standard Deviation
Pre Sales Value	4.384025	1.101997
Current Sales Value	4.228708	4.709201
Post Sales Value	4.443172	1.170513
Pre Quantity	1.032296	0.1768204
Current Quantity	1.568277	1.39911
Regressed on Post Quantity	1.069658	0.2592164

Table 7

Source	SS	df	MS
Model	904.46883	2	452.234415
Residual	2574.59936	2531	1.01722614
Total	3479.06819	2533	1.37349711

Number of obs	= 2534
F(2, 2531)	= 444.58
Prob > F	= 0.0000
R-squared	= 0.2600
Adj R-squared	= 0.2594
Root MSE	= 1.0086

sales_value_post	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sales_value_pre	.5359946	.0183261	29.25	0.000	.500059	.5719303
sales_value_current	.0079346	.0040921	1.94	0.053	-.0000896	.0159588
_cons	2.05952	.0824518	24.98	0.000	1.897841	2.2212

Table 8

Source	SS	df	MS
Model	.277336926	2	.138668463
Residual	169.498512	2531	.066968989
Total	169.775848	2533	.067025601

Number of obs	2534
F(2, 2531)	2.07
Prob > F	0.1263
R-squared	0.0016
Adj R-squared	0.0008
Root MSE	.25878

quantity_post	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
quantity_pre	.0554748	.0292279	1.90	0.058	-.0018383	.1127879
quantity_current	-.0024917	.0035321	-0.71	0.481	-.0094178	.0044343
_cons	1.016199	.0311981	32.57	0.000	.9550222	1.077375

Table 9

White test for quantity regression

White's test for Ho: homoskedasticity
against Ha: unrestricted heteroskedasticity

chi2(5) = 272.21
Prob > chi2 = 0.0000

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	272.21	5	0.0000
Skewness	203.46	2	0.0000
Kurtosis	107.70	1	0.0000
Total	583.37	8	0.0000

Table 10:

White test for sales value regression

```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(4)      =      2.74
         Prob > chi2  =    0.6030

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	2.74	4	0.6030
Skewness	40.12	2	0.0000
Kurtosis	5.72	1	0.0167
Total	48.58	7	0.0000

Table 11

```
Linear regression                               Number of obs =    2534
                                                F(  2,  2531) =  108.33
                                                Prob > F      =  0.0000
                                                R-squared     =  0.2600
                                                Root MSE      =  1.0086
```

sales_value_post	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
sales_value_pre	.5359946	.0374641	14.31	0.000	.4625312	.6094581
sales_value_current	.0079346	.0041495	1.91	0.056	-.0002022	.0160714
_cons	2.05952	.1687565	12.20	0.000	1.728606	2.390435

Table 12

```
Linear regression                               Number of obs =    2534
                                                F(  2,  2531) =    1.60
                                                Prob > F      =  0.2024
                                                R-squared     =  0.0016
                                                Root MSE      =  .25878
```

quantity_post	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
quantity_pre	.0554748	.036913	1.50	0.133	-.016908	.1278576
quantity_current	-.0024917	.0025145	-0.99	0.322	-.0074224	.0024389
_cons	1.016199	.0381894	26.61	0.000	.941313	1.091084

References

1. Angeli, E., Wagner, J., Lawrick, E., Moore, K., Anderson, M., Soderlund, L., & Brizee, A. (2010, May 5). *General Format*. Retrieved from http://owl.english.purdue.edu/owl/resource/560/01/
2. Assmus, Gert, John U. Farley and Donald R. Lehmann (1984). "How Advertising Affects Sales: Meta-Analysis of Econometric Results." *Journal of Marketing Research*. 21, 65-74.
3. Baye, Michael R. (2010). "Managerial Economics and Business Strategy: Seventh Edition." Mc-Graw-Hill.
4. Boulding, William, Eunkyu Lee and Richard Staelin (1994). "Mastering the Mix: Do Advertising, Promotion, and Sales Force Activities Lead to Differentiation?" *Journal of Marketing Research*. 31, 159-172.
5. Brown, Robert George (1974). "Sales Response to Promotions and Advertising." *Journal of Advertising Research*. 14,33-39.
6. DelVecchio, David H. Henard and Traci H. Freling (2006). "The effect of sales promotion on post-promotion brand preference: A meta-analysis." *Journal of Retailing*. 82, 203-213.
7. Demer, Jodie and Wheeler, Heather. (2012) www.thekrazykouponlady.com
8. Dodson, JoeA., Alice M. Tybout and Brian Sternthal (1978). "Impact of Deals and Deal Retraction on Brand Switching." *Journal of Marketing Research*. 15, 72-81.
9. Griffith, Rachel, Leibtag, Ephrain, Andrew Leicester and Aviv Nevo (2009). "Consumer Shopping Behavior: How Much Do Consumers Save?" *Journal of Economic Perspectives*, 23, 99-120.
10. Scott, Carol A. (1976). "Effects of Trial and Incentives on Repeat Purchase Behavior." *Journal of Marketing Research*. 13, 263-369.
11. Studenmund, A. H. (2011). "Using Econometrics, A Practical Guide: Sixth Edition." Pearson.
12. The Discovery Channel. Extreme Couponing. (2012) http://tlc.howstuffworks.com/tv/extreme-