# Is Shopping at Walmart an Inferior Good? Evidence from 1997-2010

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*We test the relative income elasticity of shopping at Walmart and Target using quarterly data from 1997-2010. We seek to isolate the effects of income changes by controlling for price level, retail space, and measures of time. Our findings indicate Walmart's income elasticity, while lower than Target's, is positive, indicating shopping at both stores is normal rather than inferior.*

## INTRODUCTION

Walmart is often described as performing well during recessions. The common narrative is Walmart offers a low-price shopping experience consumers value more during a recession than when their incomes are higher (Bustillo and Zimmerman, 2008 and Zwaniecki, 2008). This seems to be a textbook example of what economists call an inferior good. A good or service is 'inferior' in the economic sense if consumers buy more when their incomes fall, other things equal. Put another way, a good or service is inferior if its income elasticity of demand is less than zero.

This is different than simply analyzing financial performance during recessions. It would not be enough, for example, to note Walmart's earnings rise when incomes fall, as earnings could rise for many reasons. An ideal test would hold prices and supply factors constant to isolate the effect of income on demand. In this paper we construct such a test to determine the income elasticity of demand for shopping at Walmart and close competitor, Target.

## LITERATURE REVIEW

There are a number of studies which examine income elasticity of individual goods. Ito, Peterson, and Grant (1989) attempt to determine the income elasticity of rice in Asian countries. They compare percent changes in real GDP per capita to percent changes in rice consumption from 1971 to 1985 in fourteen Asian countries. They found negative income elasticity for rice in economically advanced Asian countries and positive income elasticity for rice in less advanced countries holding own and substitute prices constant. They suggest that rice becomes an inferior good as the living standards of Asian countries rise.

Garrett and Coughlin (2009) examine income elasticity for lottery tickets using county-level panel data for three states to determine the relationship between income elasticity and tax-burden. They found regressivity of lottery sales varied both over time and relative to income levels in different states.

Studies examining income elasticity for aggregated goods are less common. Freedman (2003) looks at changes in health care expenditures over time and compares them to changes in disposable personal income to determine income elasticity for health care. Using state level data to determine the relationship between disposable personal income and health care expenditures, they find health care has a positive income elasticity, implying health care is a normal good.

Lu, Thompson, and Tu (2010) analyzed the differences in income elasticities of computers and packaged software with respect to governments, businesses, and individual consumers. They found computers and packaged software were inferior goods to government agencies, necessary goods for firms, and luxury goods to households.

Our study has much in common with Basker (2011), who also sought to compare income elasticity for Walmart and Target. Using data from 1997-2006, Basker used the natural log of the real aggregate wage income as reported by QCEW and the natural log of real quarterly revenues per store for Target and Walmart as the measure of consumption changes.

We perform a similar test to estimate the income elasticities for shopping at Walmart and Target with several differences. First, we have identified the need to control for changes in relative store sizes. Without this control, expansions of retail space due to building larger stores during a recession could be mistaken for income inferiority. For example, Walmart and Target have introduced superstore versions of their previous retail outlets. If a regular store is converted to a supercenter, the number of stores does not change but retail space increases. Second, we exclude revenues from store credit cards from Target's quarterly revenue data, as they are not part of purchases, but rather are proceeds from interest charges and fees. Finally, we extend the timeframe of the study to include the most recent recession.

## DATA AND METHODOLOGY

We use quarterly sales revenue data from Q1 1997 through Q1 2010, giving us 53 quarters of data for both companies. Since Walmart and Target sell a variety of goods, quantity demanded cannot be defined as the number of units purchased. Instead, we use real quarterly revenues, measured in 2010 dollars. Since sales could increase (decrease) due to an increase (decrease) in either the number or size of stores, we use the percentage change in revenue per square foot. This way, we are measuring the effect of changes in consumer demand rather than changes in the scale of the company. All information about Walmart at Target's revenues and square footage was taken from quarterly and annual filings with the Securities and Exchange Commission. Prior to 2004, Walmart did not report square footage on a quarterly basis, only on an annual basis. They did report their stores by store type quarterly. To obtain square footage estimates an average square footage by store type for each year was applied to the number of stores in each quarter missing square footage data. Target reports actual information quarterly.

We also use a different measure of income: the natural log of quarterly real GDP per capita, from the Bureau of Economic Analysis. We include a regression using QCEW to recreate Basker's work. To obtain the ceteris paribus effect of income, we also include several controls. Including quarterly indicators to account for retail sales patterns is straightforward. Controlling for price, however, is not, as both Walmart and Target sell a wide variety of goods and services with presumably autonomous price changes. Since we are looking at goods and services in aggregate, we use the Consumer Price Index (Bureau of Labor Statistics) to adjust all dollar figures for inflation. We also include a time trend control. Table 1 provides summary statistics for each of these variables.

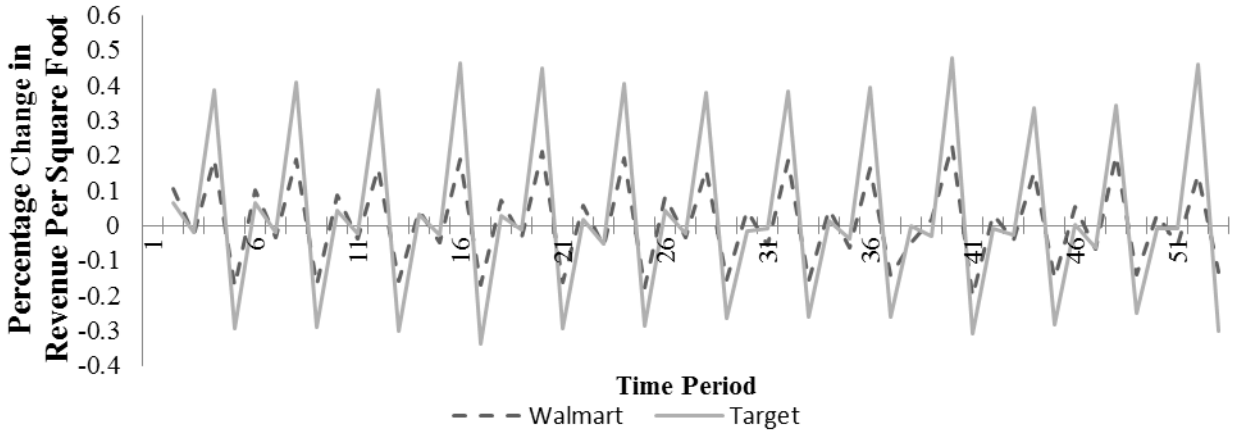
**TABLE 1**
**SUMMARY STATISTICS**

| Variable | Description | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Consumer Price Index | Bureau of Economic Analysis Consumer Price Index. Quarterly price index for all consumer goods. | 187.6 | 18.8 | 159.9 | 218.47 |
| Walmart: Revenue Per Store | Quarterly Revenue per Store in Millions | 14.19 | 3.11 | 7.88 | 19.58 |
| Walmart: Revenue Per Square Foot | Quarterly Revenue per Square Foot | 101.34 | 11.48 | 73.48 | 121.27 |
| Target: Revenue Per Store | Quarterly Revenue per Store in Millions | 8.46 | 1.76 | 5.66 | 12.95 |
| Target: Revenue Per Square Foot | Quarterly Revenue per Square Foot | 69 | 12.01 | 52.29 | 100.33 |
| Quarterly Census of Employment and Wages | Bureau of Labor Statistics quarterly count of employment and wages reported by employers in billions. | 1252.5 | 197.45 | 888.91 | 1605.85 |
| GDP | Bureau of Economic Analysis quarterly Gross Domestic Product Per Capita | 39429 | 5749.13 | 29947 | 47666 |
| Disposable Income | Bureau of Economic Analysis quarterly Disposable Income Per Capita | 29330.2 | 4493.04 | 21932 | 36022 |

n=53

Figure 1 shows our dependent variable over time. Both Walmart and Target show significant seasonality in revenue changes. We also see much more variation in percentage change in revenue per square foot for Target.

**FIGURE 1**
**PERCENTAGE CHANGE IN REVENUE PER SQUARE FOOT, 1999-2010**




The equations to be estimated take the following form:

$$\ln(revenue)_t = \beta_0 + \beta_1 \ln(income)_t + \beta_2 \ln(income)_t \cdot Walmart_t + \beta_3 Walmart_t + \beta_4 time_t + \beta_5 time_t \cdot Walmart_t + \beta_6 Q2_t + \beta_7 Q3_t + \beta_8 Q4_t + u_t \quad (1)$$

where t denotes quarters, *Walmart* is a dummy variable, ln(*income)* is the natural log of the income measure, ln(*income*)•*Walmart* is the interaction between income and Walmart, *time* is a simple time trend, (*time*)•*Walmart* is the interaction between time and Walmart, *Q2*, *Q3*, and *Q4* are quarter indicators, and *u* is the error term. The parameters of interest are $\beta_1$ and $\beta_2$ which, combined, are our estimate of the income elasticity for the retailer.

## RESULTS

The results of our estimations using the 1997-2006 data are shown in Table 2 displays the results of ordinary least squares regression of equation (1). The three specifications include different combinations of revenue and income noted in the table. Specifications (1) and (2) use Basker's definition of revenue as the dependent variable; (3) uses the log of real revenue per square foot. Specification (1) uses the aggregate quarterly wage as the income measure, while (2) and (3) use GDP per capita.

Walmart's income elasticity of demand during this period is consistently lower than or equal to Target's, and is consistently negative though not statistically significant. The negative coefficient on the $\ln(income)_t$*Walmart interaction is statistically significant, indicating a lower income elasticity for Walmart relative to Target. Finding Walmart is an inferior good during this time period is robust to changes in the measure of income. There does not appear to be any substantial change from omitting removing credit card revenue, nor from using revenue per square foot instead of revenue per store. Target is consistently found to be a normal good, though the magnitude varies, ranging from .960 to 2.054.

**TABLE 2**
**REGRESSION RESULTS USING ONLY DATA FROM 1997 Q1 to 2006 Q4**

| | (1) | (3) | (5) |
|---|---|---|---|
| ln (*income*) | 0.960*** | 1.529** | 2.054*** |
| | (0.231) | (.702) | (.698) |
| ln (*income*)**Walmart* | -1.238*** | -2.780** | -3.086*** |
| | (0.201) | (1.104) | (1.094) |
| *Walmart* | 34.890*** | 29.899** | 33.158*** |
| | (5.619) | (11.737) | (11.637) |
| *time* | 0.007* | -0.005* | -0.008*** |
| | (0.001) | (0.003) | (.003) |
| *time*Walmart* | 0.012*** | 0.017*** | 0.013*** |
| | (0.001) | (0.004) | (.004) |
| *Q2* | 0.056*** | 0.048*** | .048*** |
| | (0.014) | (0.013) | (.013) |
| *Q3* | 0.026** | 0.013 | 0.012 |
| | (0.013) | (0.011) | (.011) |
| *Q4* | 0.240*** | 0.260*** | 0.268*** |
| | (0.021) | (0.018) | (.018) |
| *Constant* | -25.002*** | -14.493* | -17.507** |
| | (6.429) | (7.461) | (7.414) |
| *Walmart income elasticity* | -0.279 | -1.250 | -1.032 |
| | (.240) | (.879) | (.867) |
| N | 80 | 80 | 80 |
| adj $R^2$ | 0.9848 | 0.9768 | .9557 |

Notes: Coefficient estimates from regression of the percentage change in revenue on the independent variables listed in the first column. Robust standard errors in *, *, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively

Table 3 shows the same three models found in Table 2, but includes the data from Q1 1997 to Q1 2010. With the inclusion of this extra data, Walmart is a normal good in all specifications (between 0.406 and 1.668), and is statistically significant. Target remains a normal good, with estimated elasticities between 1.397 and 2.259. Walmart has lower elasticity than Target, though the difference is only statistically significant in models (1) and (3).

**TABLE 3**
**REGRESSION RESULTS USING DATA FROM 1997 Q1 to 2010 Q1**

| | (1) | (3) | (5) |
|---|---|---|---|
| ln (*income*) | 1.397*** | 2.259*** | 1.942*** |
| | (0.190) | (0.392) | (0.388) |
| ln (*income*)**Walmart* | -0.991*** | -.590 | -1.195** |
| | (0.203) | (0.585) | (0.570) |
| *Walmart* | 28.014*** | 6.650 | 13.086** |
| | (5.666) | (6.224) | (6.070) |
| *time* | -0.004*** | 0.002 | -0.008*** |
| | (0.001) | (0.001) | (0.001) |
| *time*Walmart* | 0.009*** | 0.007*** | 0.005** |
| | (0.001) | (0.002) | (.002) |
| *Q2* | 0.077*** | 0.051*** | 0.045*** |
| | (0.015) | (0.013) | (0.012) |
| *Q3* | 0.055*** | 0.015 | 0.010 |
| | (0.015) | (0.011) | (0.010) |
| *Q4* | 0.207*** | 0.245*** | 0.257*** |
| | (.021) | (0.019) | (0.017) |
| *Constant* | -37.185*** | -22.223*** | -16.311*** |
| | (5.298) | (4.171) | (4.129) |
| *Walmart income elasticity* | 0.406** | 1.668*** | 0.747* |
| | (.201) | (.450) | (.432) |
| N | 106 | 106 | 106 |
| $R^2$ | 0.9740 | 0.9718 | 0.9493 |

Notes: Coefficient estimates from regression of the percentage change in revenue on the independent variables listed in the first column. Robust standard errors in *, *, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively

## CONCLUSION

The "recession-proof" Walmart touted in the mainstream media during the recent recession, does not hold in our findings as Walmart has a positive income elasticity of demand when including income data from a recession. It does appear, however, that Target's revenues are more sensitive to changes in income levels than Walmart's as demonstrated by our estimated income elasiticities. In fact, our findings indicate shopping at Target is a luxury, while shopping at Walmart is closer to a necessity. This was not overly surprising given the image and branding both Walmart and Target strive to uphold; however, it was very interesting to prove these strategies appear to be effective. Walmart's strategy is very beneficial in recessionary times as they experience relatively less negative effect on revenues. The downside of this is Walmart's revenues will not benefit as much from economic booms. Target's revenues, on the other hand, will suffer relatively more during recessionary times but will also profit from economic expansions relatively more than their relatively 'inferior' competition.

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