NATIONAL CENTER FOR POLICY ANALYSIS

Should Walmart Imitate Costco? The Variation in Retail Wages

Policy Report No. 381
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March 2016

There has been much debate over the past few years about raising the national minimum wage to $10 or even $15 an hour. In areas where the minimum wage is at or slightly above the federal level of $7.25, unions have complained that big box retailers and fast food restaurants do not pay "living" wages.

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Executive Summary

Living wage advocates often accuse Walmart of being the worst offender, and point to Costco as a model to follow because it allegedly pays higher wages. But is it realistic to expect all retailers to pay the same wage?

Retail Wages Vary by Store Type and Product Specialty. Average wages for various retail stores vary widely depending on the *type* of retail. According to the Bureau of Labor Statistics, if all the retail subsectors are combined, the average hourly earnings of retail nonsupervisory employees was $14.90 as of October 2015. Divided by retail store type, some have lower average hourly wages than others — ranging from $11.19 for gas station clerks to $22.12 for electronics and appliance store clerks.

Profit Margins in Retail Compared to Other Industries. If a large firm earned "record profits" last year, surely they have the money to boost the pay and benefits of their workers. However, profits as measured by dollars do not reveal much about a firm's expenditures. The question should be: What is the profit margin — the percentage of income earned on a dollar of expenditure? The retail industry has some of the lowest profit margins of all industries. After-tax operating margins (after-tax operating income divided by total revenues) in retail segments range from 2.23 percent to 4.38 percent.

Walmart Compared to Costco. In addition to differing types of retail stores with different profit margins and labor productivity, retailers have various *business models* — which include the products they sell, their customer base and their sources of potential revenue. Consider the two primary stores labor activists like to compare in terms of wages, Walmart versus Costco. The inherent difference between Costco and Walmart is their business model.

Walmart operates 5,300 stores (including the smaller Neighborhood Markets and Sam's Clubs) and tries to cater to the widest range of customers and provide quality and cost options that appeal to a range of lower to higher income shoppers.

Costco operates about 447 stores under a subscription business model,

charging customers for membership. It offers relatively fewer choices to customers compared to Walmart. Costco is geared toward a smaller, more selective clientele than Walmart. Costco stores tend to be located in more affluent neighborhoods and a higher percentage of Costco's customers are business buyers.

A Statistical Analysis of Walmart and Costco Locations. Given that Costco targets a higher income demographic than Walmart, one could surmise that both store chains would locate in areas that suit their desired income demographic. To test this hypothesis, we compiled a dataset of counties in Texas and Florida (states selected for their population size, relatively weak zoning laws, and presence of both Walmart and Costco) using five explanatory variables of interest: population, median household income in each county, number of Costco stores in each county and number of Walmart stores and Sam's Clubs in each county. The results indicate that Costco locations are largely dependent on income, while Walmart locations are not. Given two equally sized (500,000 residents) counties, if one is in the top 40 percent of median income it has a 76 percent probability of having a Costco; if it is in the bottom 60 percent, it has only a 20 percent probability.

Do Retailers Pass on Labor Costs to Their Customers? Several studies have found that "price sensitive" shoppers (those who are more likely to change their buying habits based on price changes) were more likely to have larger families, lower incomes and patronize more stores. Those who were less price sensitive were more likely to be older, of higher income and loyal to a particular store. If high-income consumers are less sensitive to price changes, as the research suggests, stores that cater to higher income shoppers could pass on the costs of higher wages to their consumers (to some degree) through increases in product prices. But a store that caters to price sensitive shoppers would more likely be unable to raise prices.

Researchers from Georgia State University measured the effect of the 2007 to 2009 incremental minimum wage increases (from $5.15 to $7.25 an hour) on 81 fast food restaurants in Georgia, including medium and large-sized cities and rural areas. They found that among adjustments in response to the wage hikes, there was a nearly 11 percent increase in the price of the combo meal.

Living wage advocates claim that putting more money in the pockets of low-wage workers boosts the economy by enabling them to buy more goods and services. But this argument ignores the potential increased price of products as a result of labor costs being passed on to consumers. If lower income earners are already as price-sensitive as the research suggests, making basic goods more expensive will not financially benefit them. There are better ways to help lower-income households than to mandate high minimum wages.

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Introduction

There has been much debate over the past few years about raising the national minimum wage to $10 or even $15 an hour. Indeed, some cities have already done so. In areas where the minimum wage is at or slightly above the federal level of $7.25, unions have taken to protesting outside of big box retailers and fast food restaurants for not paying "living" wages. Living wage advocates often accuse Walmart of being the worst offender, and point to Costco as a model to follow because it allegedly pays higher wages than other big-box retailers.[1] They ask why such a large and profitable retailer as Walmart cannot follow the Costco model. But is it realistic to expect all retailers to pay the same wage?

An analysis of the data suggests that retailers pay their employees based on the types of products being sold (hence, the experience and knowledge required) and the demographics of their shoppers. Furthermore, various retailers target different shoppers, some of whom are better able to absorb higher prices than others.

The Variation in Retail Wages by Store Type and Product Specialty

An important consideration appears to be missing from arguments that most retailers do not pay high enough hourly wages — where "high enough" is vaguely defined as sufficient for a household to meet basic necessities of living. There is no consensus on a "living wage," as it is often called, because the cost of living varies nationwide.[2] Average wages for various retail classifications vary widely depending on the *type* of retail, and there is likely good reason.

Pay in Retail Subsectors. The North American Industry Classification System (NAICS) lists 12 subsectors of retail trade, such as electronics and appliances stores, food and beverage stores, health and personal care, and general merchandise stores. The average hourly earnings of all retail nonsupervisory employees in these combined subsectors was $14.90 as of October 2015. Divided by retail sector, some have lower average wages than others.[3] But corporate greed is not likely the culprit. For example, as of September 2015:

- The lowest average hourly retail wage was $11.19 paid to gas station clerks.
- Department stores and general merchandise stores (such as the big-box retailers), paid nonsupervisory average hourly wages of $12.62.
- The average hourly earnings of all retail nonsupervisory employees in the food and beverage retail subsector were $12.88.
- The average wage for building material retail sales was $15.34 an hour.
- The highest average hourly wage of reported retail sectors was $22.12, paid to electronics and appliance store clerks.

Note that the less specialized the merchandise, the lower the average hourly wage. The variation in wages suggests that clerks are paid more in specialty stores where specific product knowledge and experience are helpful. This makes sense from a business perspective, as it would not be much help to a customer for a building materials store to hire an individual to sell plumbing products who has no knowledge or experience with plumbing products!

General Merchandise Stores. According to the NAICS code descriptions, general merchandise stores (coded as NAICS 452) sell "new general merchandise from fixed point-of-sale locations. Establishments in this subsector are unique in that they have the equipment and staff capable of retailing a large variety of goods from a single location."[4] Based on this description, it would appear that everything from discount big-box stores to high-end department stores would be included. But there are other subcategories listed under "452." [See the table.] Wage data available on these subcategories of General Retail are limited — there is no hourly report or differentiation between supervisory and nonsupervisory employees — but in 2014:[5]

- Average weekly wages for warehouse clubs were $488, higher than other types of general merchandise stores.
- "Other" general merchandise stores paid the lowest average weekly wage, at $338.

These "other" general merchandise stores are likely big-box types of stores that do not operate as warehouse clubs by selling in bulk and requiring an annual membership fee. But why would the average weekly wage vary between the two by more than $100? This question is addressed below.

Profit Margins in Retail Compared to Other Industries. When pundits or politicians vilify firms or industries as being "greedy," they often point to profitability. Thus, if a large firm earned "record profits" last year, surely they have the money to boost the pay and benefits of their workers. This may be true. However, profits as measured by dollars do not reveal much about a firm's expenditures. The question should be: What is the profit margin — the percentage of income earned on a dollar of expenditure?

General Retail Subcategories and Weekly Wages as of May 2014

NAICS Code	Subcategory	Sample Stores	Average Weekly Wages
452111	Department stores (except discount)	Kohls, JCPenney, Dillards, Belk	$389
452112	Discount department stores	Burlington Coat Factory, Walmart	$359
452910	Warehouse clubs and supercenters	Costco, Sam's Club	$488
452990	Other general merchandise stores	Dollar General, Dollar Tree	$338

Sources: NAICS codes obtained from each firm's profile at YCharts, available at https://ycharts.com/dashboard. However, some stores are classified differently (or cross-referenced) depending on the source. Wage data from Bureau of Labor Statistics, Quarterly Census of Employment and Wages, available at http://www.bls.gov/cew/.

The retail industry has some of the lowest profit margins of all industries. According to data from New York University's Stern Business School, the after-tax operating margins (after-tax operating income divided by total revenues) in retail segments range from 2.23 percent to 4.38 percent [see Figure I].[6]

Some industries' margins are even lower than retail, such as auto and truck manufacturing (2.21 percent) and coal (2.02 percent). But most other industries that manufacture products or provide services used by consumers have double-digit operating margins [see Figure II].[7]

Case Study in Business Models: Walmart and Costco

In addition to differing types of retail stores with different profit margins and labor productivity, retailers have various *business models* — which include the products they sell, their customer base and their sources of potential revenue. Consider the two primary stores labor activists like to compare in terms of wages: Walmart versus Costco. The inherent difference between Costco and Walmart is their business model.

Walmart. In 2014, Walmart earned nearly $480 billion and Costco earned only $112 billion, or less than a quarter of Walmart's revenues.[8] Walmart operates 5,300 stores (including the smaller Neighborhood Markets and Sam's Clubs) and tries to cater to the widest range of customers, supplying over 100,000 products, or stock-keeping units (SKUs).[9] Some department stores do not have the purchasing power required to buy directly from the manufacturers and resell to the public, but Walmart uses its economies of scale to negotiate with producers, bypassing distributors. This allows Walmart to provide quality and cost options that appeal to a range of lower to higher income shoppers.

According to a poll of 4,000 consumers conducted by consulting firm Kantar Retail, "the average Walmart shopper is a white, 50-year-old female, with an annual household income of $52,125." Catering to very different consumers than Costco, Walmart sells to the mass suburban, middle-class market. Sam's Club is Walmart's bid to enter the whole-seller, subscription market and to try to poach Costco's customers.[10] Sam's Club's attempts to stock higher quality merchandise from well-known manufacturers (like Ralph Lauren Polo) were met with skepticism from lower-income shoppers. Sam's could not break out of the value-store niche market into Costco's specialty sphere.[11]

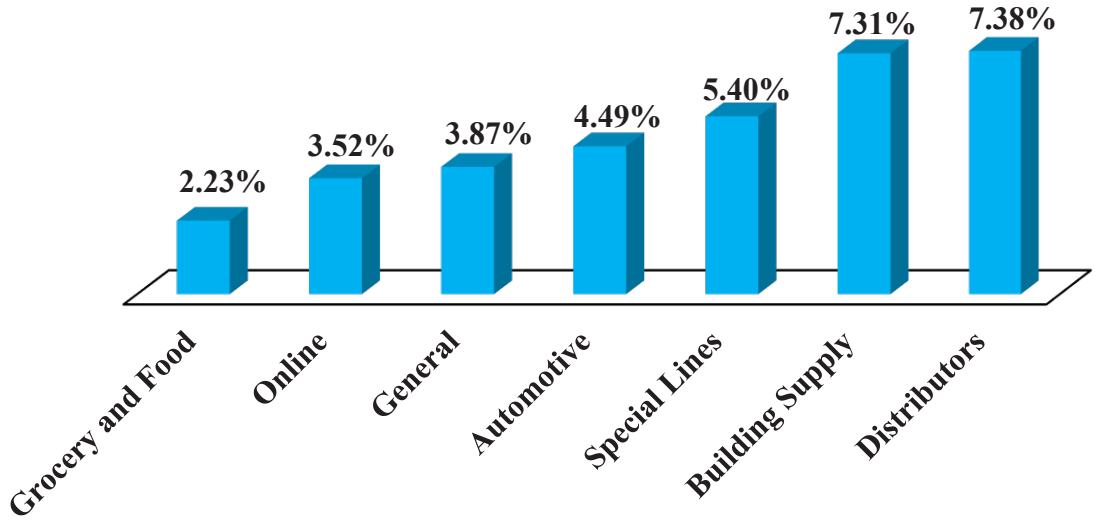
Costco. Costco operates about 447 stores under a subscription business model. By charging customers for membership, Costco is able to cap its margins, usually at about 11 percent above the price it pays for products.[12] In fact, Costco's membership fees account for about 75 percent of its earnings.[13] It offers relatively fewer choices to customers compared to Walmart. Costco supplies only 40,000 specialty SKUs; but stocking fewer items streamlines distribution and accelerates inventory turn-over, with less capital tying up potential investments.

On the individual store level, Costco is geared toward a smaller, more selective clientele than Walmart. Fewer registers, on average, remain open at Costco than Walmart, because Costco customers visit less frequently (8 to 11 times a year, on average) and buy

in bulk. This creates a slower, steadier flow of customers.[14]

Costco shoppers have an average income of $85,000 or more a year, because Costco stores tend to be located in more affluent neighborhoods and a higher percentage of Costco's customers are business buyers, purchasing either for resale, corporate events or employee consumption.[15] This figure can be further broken down: The most frequent shopper is a white woman from a large household, with $50,000+ in annual income. She is offset by Costco's target consumers — small business owners with $100,000+ incomes.[16]

Figure I
After-tax Unadjusted Operating Margin for Various Retail Segments



Source: "Margins by Sector," table, New York University, Stern School of Business.

Costco also partners with third parties to provide incentives to its customers. Its longstanding partnership with American Express (the only credit card accepted by Costco, although they now accept debit cards and also provide their own brand of cash cards/credit cards) was mutually beneficial — encouraging customers to buy into one type of credit card payments attracted countless new customers for American Express every year, while Costco members did not pay an annual card fee. Just as Costco profits from its subscription fees, American Express makes its profits from high annual fees and swipe charges levied on merchants, rather than from traditional interest charges.[17] (According to recent reports, Costco's partnership with American Express is set to expire in March 2016.)[18]

A Statistical Analysis of Walmart and Costco Locations

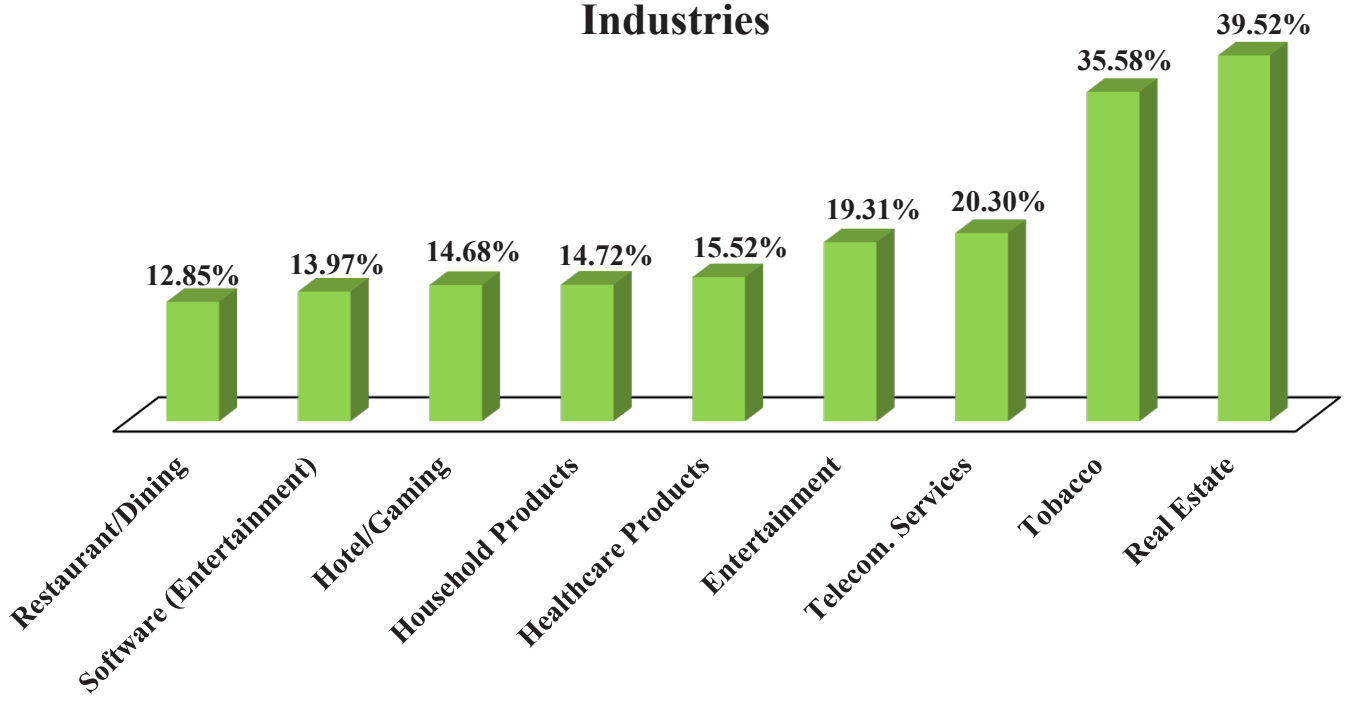
Given that Costco targets a higher income demographic than Walmart, one could surmise that both store chains would locate in areas that suit their desired income demographic. To test this hypothesis, we compiled a dataset of counties in Texas and Florida (states selected for their population size, relatively weak zoning laws, and presence of both Walmart and Costco). The dataset contains five explanatory variables of interest: population, median household income in each county, number of Costco stores in each county and number of Walmart stores and Sam's Clubs in each county.

Most of the analysis focuses on determining whether there is a noticeable difference in median income between counties with Costco stores and counties with Walmart stores. We do, however, control for one of the main drivers of store location: population. Population is almost always a robust predictor of store location, and it also helps control for other factors, such as business density and level of urbanization.

Results. Validity tests confirm that Costco locations are largely dependent on income, while Walmart locations are not. More precisely, Costco locations are almost entirely in higher income areas, while Walmart stores are everywhere, with a slight bias in favor of mid- to lower income counties. The Costco relationship is robust to almost every model specification, and it is robust even when controlling for population. Thus:

- Given two equally sized (500,000 residents) counties, if one is in the top 40 percent of median income it has a 76 percent probability of having a Costco.
- If it is in the bottom 60 percent, it has only a 20 percent probability [see Figure III].

Figure II
After-tax Unadjusted Operating Margin for Select Industries



Source: "Margins by Sector," table, New York University, Stern School of Business.

- Specifically, a county with a population of 100,000 has, on average, a 23 percent chance of having a Costco if it is in the upper 40 percent of median income.
- It has a 14.5 percent chance of having a Costco if it is in the bottom 60 percent income group.

Do Retailers Pass on Labor Costs to Their Customers?

In and of itself, the Costco and Walmart analysis does not tell us anything new except to validate the stores' intended demographic targets. However, when combined with empirical studies on shoppers' responses to price changes, it does indicate that higher income shoppers could tolerate price changes as a result of pass-through labor costs more than lower income shoppers.

Evidence of Price Sensitivity Among Various Groups of Shoppers. In 1993, researchers at the University of Wisconsin – Whitewater conducted a survey of shoppers in the Midwest on prices of specific grocery items (such as laundry detergent, soda, milk and hamburger).[19] Shoppers who responded to a 50-cent price increase in an item by stopping use of the product or switching to another product were considered "price sensitive." The study's author, Mete Sirvanci, reported:

- "Price sensitive" shoppers were more likely to have larger families, lower incomes and patronize more stores.
- Those who were less price sensitive were more likely to be older, of higher income and loyal to a particular store.

In a 1995 study from the University of Chicago, Stephen Hoch and his coauthors found similar results when examining determinants of store-level elasticity of demand (change in quantity demanded with respect to a change in the price of a product) on various grocery-type products:[20]

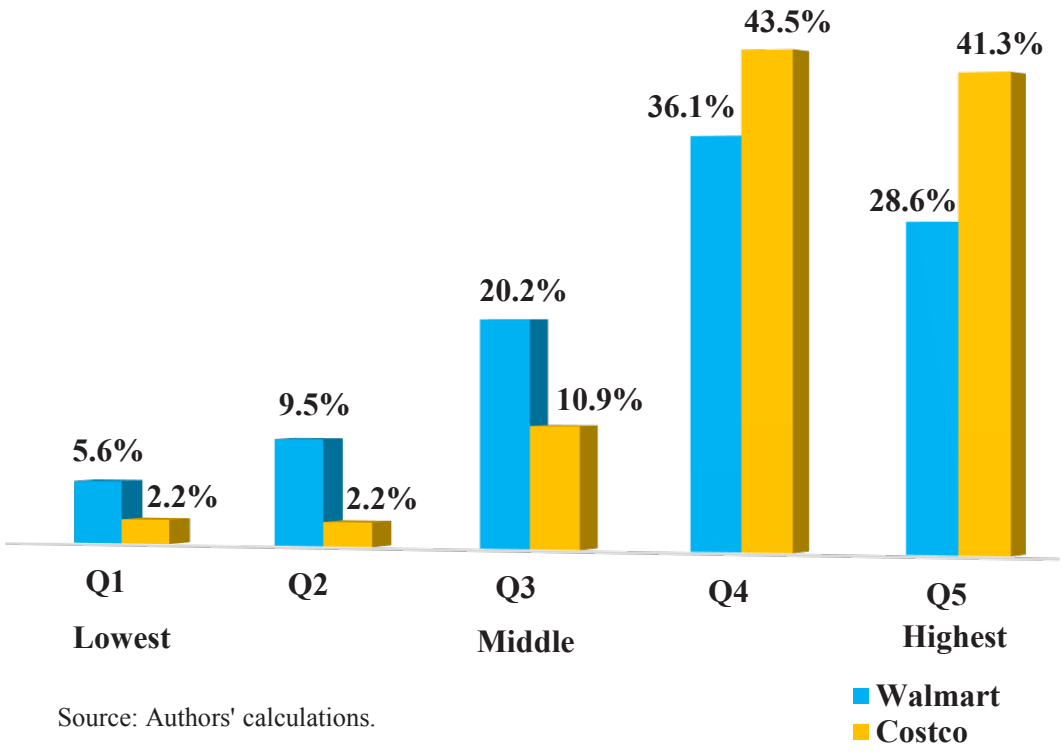
- Large families and minority families were more price sensitive.
- However, more educated consumers and households with more expensive homes tended to be less price sensitive.

Finally, researchers from Ohio State University examined the effect of demographics on price sensitivity in regard to breakfast cereals. They found that low income

consumers had a higher price elasticity of demand relative to high income consumers in four out of five cereal categories.[21]

But what does the price sensitivity of consumers have to do with retail wages? If high-income consumers are less sensitive to price changes, as the research suggests, stores that cater to higher income shoppers could pass on the costs of higher wages to their consumers (to some degree) through increases in product prices. But a store that caters to price sensitive shoppers would be more likely unable to raise prices.

Figure III
Proportion of Total Stores in Each County by Quintile of Median Income (Texas and Florida)



Source: Authors' calculations.

Effect of Minimum Wage Increases. Is there evidence to suggest that retailers pass labor costs on to consumers if they are faced with a hefty hike in the minimum wage? There are several academic studies that have examined the effect of minimum wages on employee benefits, work demands and training.[22] But one study in particular has examined the effect of minimum wage changes on fast food restaurant operations and product prices. Researchers from Georgia State University measured the effect of the 2007 to 2009 incremental minimum wage increases (from $5.15 to $7.25 an hour) on 81 fast food restaurants in Georgia, including medium and large-sized cities and rural areas. They found that the direct compliance cost for these restaurants in the first three years after the increase was 2.6 percent, 4.6 percent and 6.8 percent of total payroll, respectively. These costs covered just raising wages to the minimum, with no other pay increases. They also found that the increases had no statistically significant effect on the reduction of staff or hours worked.

However, they did find that the minimum wage increase caused compression of the internal wage structure; that is, managers would delay limit or pay raises and bonuses for more experienced employees. Furthermore, they found that managers were more interested in hiring older and more experienced employees and fewer teenagers. The researchers also looked at other channels of adjustment and found that for the most popular combo meal, two-thirds of the 15.4 percent total payroll cost increase over the three years was offset by a 10.9 percent price increase in the combo meal.[23]

Conclusion: Living Wage Advocates' Concerns Are Misplaced

While "living wage" advocates would prefer a national minimum wage that applies to all employers, regardless of industry, they often point specifically to the fast food industry and big-box retailers to showcase the plight of the low-wage worker. However, as we have found in

the retail sector, there are different business models and varying levels of employee productivity that warrant different wages.

Furthermore, this implies that an entry-level retail worker does not have to be "stuck" in a low-wage position forever, just because some retail positions fit the skill level of entry-level workers. There are others, however, that require more experience or product knowledge and likely pay more. Thus, for an employee, the key to higher wages is experience and training, or switching to an industry or specialty that generally pays higher wages. For this reason, an artificially high wage paid for a job that can be done by an already large supply of lower skilled workers does not make sense from a business standpoint, nor does it provide much incentive to a worker to gain additional education, knowledge and skills in order to earn higher wages in the future.

Productivity aside, living wage advocates also claim that putting more money in the pockets of low-wage workers boosts the economy by enabling them to buy more goods and services. But this argument ignores the potential increased price of products as a result of labor costs being passed on to consumers. If lower income earners are already as price-sensitive as the literature suggests, making basic goods more expensive for them is not going to financially benefit them, particularly if they have large families with several dependents who do not work. There are better ways to help out lower income households than to mandate high minimum wages in low- and moderate-income areas.

Appendix

Using CPS data, corporate information and other sources, we compiled a dataset where the unit of observation is the county. There are 321 observations representing all counties in Florida and Texas. The dataset contains five main data variables of interest: population, median income, number of Costco stores in the county and number of Walmart stores in the county. These variables are used to derive all the other variables used in the data analysis, including the store dummy variables, which are equal to 1 if there is at least one store of the given name in the county.

The Analysis. This analysis focuses on whether there is a statistically significant difference in the presence of Walmart and Costco stores in counties according to median household income. For all tests we use a 5 percent significance level.

Means Tests. The first set of tests determine whether there is any noticeable difference in the median incomes of counties with Walmart stores and counties with Costco stores:

H_o: Mean of the median incomes of counties with Costcos (μ_C) is the same as the mean of the general population (μ). (Implying that Costco stores are randomly located in regard to income) $\mu_C = \mu$.

Result: μ_C = 53675.2 SE = 2489.285, μ = 45031.09, SD = 10224.4

T-test: (μ_C - μ)/2044.88 = 4.227, p-value = 0.0001

Interpretation: Without controlling for population, Costco stores are located, on average, in higher income areas. The result is statistically significant at a 0.1 percent level.

H_o: Mean of the median incomes of counties with Walmart stores (μ_W) is the same as the mean of the general population (μ). (Implying that Walmart stores are randomly located regardless of county household income) $\mu_W = \mu$.

Result: μ_W = 46242.72 SE = 747.407 (of this sample not for the t-test), μ = 45031.09, SD=10224.4.

T-test: (μ_W - μ)/739.812 = 1.6378, p-value = 0.0516.

Interpretation: Without controlling for population, the presence of Walmart stores in higher-income counties is not statistically significant at a 5 percent level.

H_o: Mean of the median incomes of counties with Walmart stores (μ_W) is the same as the mean of median income of counties with Costco stores (μ_C). (Implying that Walmart stores and Costco stores are located in places with similar median incomes, or that they are all randomly distributed with respect to income level) $\mu_W = \mu_C$.

Result: μ_W = 46242.72 SE=747.407 (of this sample not for the t-test), μ_C = 53675.2, *SE* = 2489.285.

T-test using the larger of the sample standard deviations: (μ_C - μ_W)/2602.8988 = 2.85, *p-value* = 0.0044.

Interpretation: Without controlling for population, on average, counties that contain Costco stores have higher median incomes than counties that contain Walmart stores. This relationship is significant at a 1 percent level.

In order to control for population, we include the log of population as a control variable in all of the following regressions. This control displays a moderate amount of correlation with the log of median income (correlation = 0.24), but not indicative of multicollinearity.

Appendix Table I

Linear Probability Model-Costco

White's Robust errors	Description	Model 1	Model 2	Model 3
Log of Median Income	Log of the median income of the county according to CPS data.	0.3059419***	0.1449835*	x
		(0.0829433)	(0.0659229)	x
Log of Population	Log of the county population according to projections based off of 2010 Census.	--	0.0798504***	0.079335***
		--	(0.00115993)	(0.011293)
Constant	Constant generated as part of regression software.	-3.193208***	-2.289036**	-0.7675795***
		(0.8779445)	(0.7136875)	(0.109235)
Upper Indicator Variable	Indicator that =1 when the county is in the top 40% in terms of median income.	--	--	0.0845415**
		--	--	(0.0252091)
Predicts negative values?	Because negative probabilities are impossible, a lot of negative values is not good.	Yes, 28 observations are predicted as negative.	Yes, predicts 106 negative values for observations.	Yes, predicts 106 negative values for observations.
R^2	The fraction of the variation due not differences between conditional means.	0.0583	0.3216	0.3322
Adjusted R^2	Not a measure of fit. It shows the value added by an additional variable. Higher is better.	0.0554	0.3173	0.3280
AIC	Measures value added by an added variable. Lower is better.	50.26459	-52.99194	-58.05768
BIC	Measures value added by an added variable. Lower is better for specification.	57.807	-41.67762	-46.74336

*Significant at 5%.

**Significant at 1%.

***Significant at 0.1%

Interpretation: Model 1 is obviously not accurate, as it lacks a population control. Adding the population term greatly improves all measures of fit.

Model 2's main finding is that an approximate 1 percent increase in median income results on average all else constant in a 0.14% increase in the chance of a Walmart being located in an area.

Model 3, which according to the indicators is the best specified, can be interpreted as: on average, population held constant, if a county is in the top 40 percent of median income, it has an 8.5 percent percent higher chance of having a Costco than those counties which are not in the top 40 percent.

Specifically, a county with a population of 100,000 will on average have a 23 percent chance of having a Costco if it is in the upper 40 percent of median income, or 14.5 percent if it is not in the upper income group.

Appendix Table II

Linear Probability Model-Walmart

White's Robust errors	Description	Model 1	Model 2	Model 3
Log of Median Income	Log of the median income of the county according to CPS data.	0.3734856**	-0.0232864	x
		(0.1245783)	(0.0866213)	x
Log of Population	Log of the county population according to projections based off of 2010 Census.	--	0.0196836***	0.1981919***
		--	(0.0093529)	(0.0092351)
Constant	Constant generated as part of regression software.	-3.398242*	-1.169406	-1.417539***
		(1.334866)	(0.9177204)	(0.0964568)
Upper Indicator Variable	Indicator that =1 when the county is in the top 40% in terms of median income.	--	--	-0.0366056
		--	--	(0.0388568)
Predicts negative values?	Because negative probabilities are impossible, a lot of negative values is not good.	No negative values.	Yes, predicts 12 negative values for observations.	Yes, predicts 12 negative values for observations.
R^2	The fraction of the variation due not differences between conditional means.	0.0259	0.5027	0.5038
Adjusted R^2	Not a measure of fit. It shows the value added by an additional variable. Higher is better.	0.0229	0.4995	0.5007
AIC	Measures value added by an added variable. Lower is better.	449.7255	235.9397	235.1718
BIC	Measures value added by an added variable. Lower is better for specification.	457.2683	247.254	246.4862

Interpretation: Again, model 1 should not be interpreted as it is missing the very important population variable, and as a result the income coefficient is biased upward.

Model 2 can be interpreted as finding that on average, population held constant, there is a statistically insignificant negative effect of income level on the probability of a Walmart in the county. This is important because it implies that for the most part conditioned on population of a county, Walmart locations are randomly distributed.

Model 3 has the best fit and specification according to the metrics, but only marginally so. It can be interpreted as finding that if a county is in the upper 40th percentile of median income, and population is held constant, it has a slightly lower chance of having a Walmart than the lower income areas. But this effect is statistically insignificant.

So far both the means tests and the linear probability models support our hypothesis that Costco stores are located in higher income areas while Walmart stores are located generally everywhere.

This appears to be true even when controlling for population.

However, the linear probability model may not be the best model for this situation, as it results in negative predicted probabilities (which is impossible). A possibly better model is the logit model, which instead of a direct probability predicts logs of odd likelihoods. This means that the predictions are never zero and never greater than 1, which better models real life.

Appendix Table III

Costco Logistic Model

White's robust standard errors are used	Description	Model 1 (Coefficients)	Model 2
Upper Income Indicator Variable	Variable=1 when county is in the top 40% of median income (within Florida and Texas)	2.558545**	--
		(0.8492772)	--
Log of Median Income	Log of the County Median Income	--	3.093145
		--	(1.958018)
Log of Population	Log of county population	3.560268***	3.177382***
		(0.911421)	(0.6636516)
Constant	Constant	-48.1103***	-74.94935**
		(11.99502)	(25.44335)
Pseudo R^2		0.7797	0.7494
AIC		44.69195	50.02063
BIC		56.00628	61.33495

For model 1, which is the better specified model according to the measures of fit, the interpretation is that holding population constant, on average a county that is in the top 40 percent for median income will have a 12.917 times higher odds ratio than a county in the bottom income group.

The fact that the upper coefficient is larger than 1 is interpreted as meaning that being in the upper income range is a determinant for having a Costco.

This implies that for two counties each with 500,000 residents, if one county is in the bottom 60 percent (upper = 0) in terms of median income, then it has a 19 percent chance of having a Costco. If the other county is in the top 40 percent in terms of median income (upper=1) then it has a 76 percent of having a Costco.

Appendix Table IV

Walmart Logistic Model

White's robust standard errors are used	Description	Model 1 (Coefficients)	Model 2
Upper Income Indicator Variable	Variable=1 when county is in the top 40% of median income (within Florida and Texas)	-0.224196	--
		(0.3703255)	--
Log of Median Income	Log of the County Median Income	--	-0.2879188
		--	(0.9602244)
Log of Population	Log of county population	2.803457***	2.796719***
		(0.5501065)	(0.53984)
Constant	Constant	-27.12239***	-24.0614**
		(5318078)	(12.35059)
Pseudo R^2		0.6074	0.6069
AIC		176.1429	176.3467
BIC		187.4572	187.661

Interpretation: Once again the first model, which uses an upper income indicator variable, is the best fit per every indicator of fit. However, with Walmart, there appears to be no statistically significant relationship between the indicator variable and location of stores. The coefficient is also less than 1, implying that even if it was significant, the effect is more likely to be a protective factor. This is in line with all previous findings: being in the upper 40 percent of median income might have a slightly negative effect on the probability of having a Costco, holding population constant.

Thus, its lack of significance indicates that Walmart stores are indeed randomly located when controlling for population.

Notes

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