

“The Wal-Mart Effect”
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INTRODUCTION

The Wal-Mart Effect is a well documented topic, originally coined by Charles Fishman in his book titled unsurprisingly: “The Wal-Mart Effect”. The Wal-Mart Effect summarized discusses the effect Wal-Mart has had on American retail as a whole, and its impact on many aspects of the supply chain. Wal-Mart is a cost cutting company, capitalism taken to its extremes during the twentieth century and into the early twenty-first century. We decided to look into this topic as it interested us both and wanted to see if we could find similar findings to the many studies on the effect, putting our knowledge to the test, and also see just how much of a problem the Wal-Mart Effect really is. What we planned on finding was a negative impact on residents' employment rates, a decrease in overall income.

Max - For what I have contributed to the project, started as the research into the subject, finding articles and studies for us to base our project off of and find out more into the project, and subject surrounding the Wal-Mart effect. I then wrote the first proposal. Later into the project I worked on experimental data analysis, adding in a counterfactual to the Difference in Difference model Zack had implemented. I then furthered the Data retrieval and sorting to help organize and find all the data on walmarts and their location data in the United States, implementing the geopy library to help find the counties of every Wal-mart in the United States. We worked on the two project reports together and the presentation.

Zack - As a part of my contribution, I found our initial data and worked on the hypothesis for our project. I worked on data retrieval as well as the implementation of the data into our models. I first implemented the Difference-In-Difference Model, which proved to be inefficient for our task, and then later implemented the final Synthetic Control Method Model. Max and I collaborated on analyzing the results.

APPROACH

This report analyzes the effects of Walmart’s entry into 10 different U.S. counties between 1993 and 2010 using the synthetic control method. We examine four key retail market indicators: private retail employment, annual retail wages, retail’s share of private employment, and relative retail wages. Our findings reveal mixed effects across counties. We employ the synthetic control method (SCM), which provides advantages over traditional difference-in-differences (DiD) analysis by creating a more tailored comparison group for each treated county.

The report uses county-level data from the Bureau of Labor Statistics’ Quarterly Census of Employment and Wages (BLS QCEW). Our dataset includes quarterly observations aggregated to annual values for both treated counties (where Walmart entered) and potential control counties (without Walmart entry during the study period).

While the difference-in-differences approach was initially considered, we chose the synthetic control method for several reasons:

1. Individualized comparison: SCM creates a specific weighted combination of control counties tailored to each treated county, unlike DiD which uses a single control group for all treated units.
2. Pre-treatment match: SCM explicitly matches on pre-treatment outcome trajectories, addressing the parallel trends assumption that is often challenging to verify in DiD.
3. Transparency: The weights assigned to each control county provide a transparent measure of each control unit’s contribution to the counterfactual.
4. Treatment timing heterogeneity: SCM easily accommodates the staggered adoption of Walmart entry across different counties and years (1993-2010).

Our implementation of the synthetic control method follows these steps:

1. Pre-processing data:

- a. The dataset was scraped from the staggered BLS QCEW datasets.
 - b. Extreme outliers and null values were removed
 - c. Duplicate observations were removed to ensure data integrity
2. Constructing synthetic controls:
 - a. For each treated county, we identified the optimal weighted combination of control counties that best resembled the treated county's pre-Walmart characteristics
 - b. The optimization minimized the squared prediction error for the pre-treatment outcomes, using a quadratic loss function
 - c. Constraints ensured that weights were non-negative and summed to one
3. Predictor variables:
 - a. All outcome variables were used as predictors, creating a rich set of matching criteria
 - b. Predictors were standardized (z-scores) to ensure comparability across variables with different scales
 - c. The optimization algorithm was configured to find the combination of control counties that best matched the pre-treatment characteristics of the treated county
4. Calculating treatment effects:
 - a. For each treated county and outcome, we calculated the difference between observed values and synthetic control predictions
 - b. We computed both absolute effect and percentage effect relative to the synthetic control
 - c. Treatment effects were averaged over the 5-year post-treatment period to provide a summary measure of Walmart' impact
5. Statistical inference:
 - a. Placebo tests were conducted by applying the synthetic control method to control counties as if they had been treated
 - b. P-values were derived from the distribution of placebo effects, specifically from the ratio of post-treatment RMSPE (Root Mean Square Prediction Error) to pre-treatment RMSPE
 - c. This non-parametric approach to inference accounts for the limited number of treated units

Our synthetic control implementation was coded in Python using several libraries:

- NumPy and Pandas for data manipulation
- SciPy for optimization (SLSQP method)
- Matplotlib for visualization
- Statsmodels for statistical functions

The optimization algorithm that was used to minimize the objective function:

$$L(W) = \sum_{k=1}^K (X_{1k} - \sum_{j=2}^{J+1} w_j X_{jk})^2$$

Where:

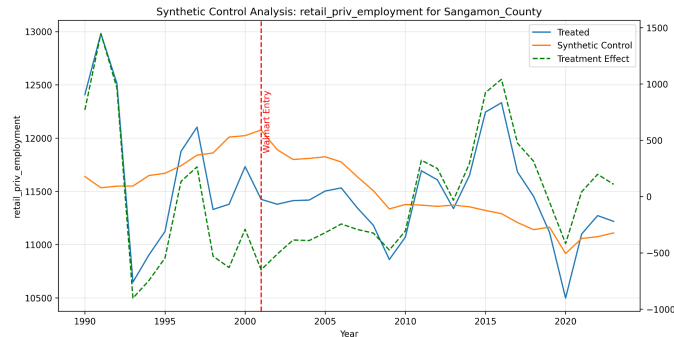
- X_{1k} is the value of predictor variable k for the treated unit
- X_{jk} is the value of predictor variable k for control unit j
- w_j is the weight assigned to control unit j
- Subject to constraints: $w_j \geq 0$ for all j and $\sum_{j=2}^{J+1} w_j = 1$

RESULTS

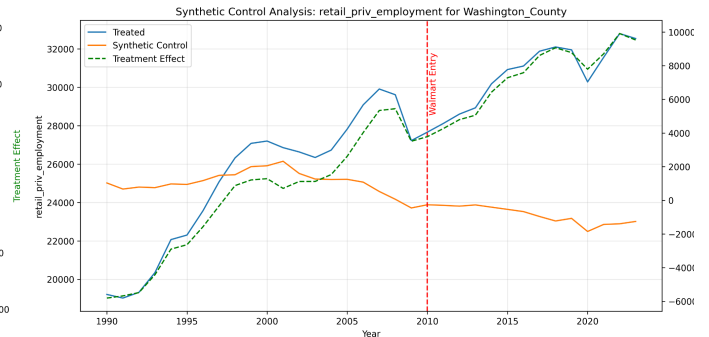
Retail Private Employment:

Walmart's entry appears to increase retail employment across most counties, with effects ranging from -3.51% to +24.07%. However, none of these effects reached statistical significance at conventional levels.

The largest observed increase was in Washington County (22.15%) and Hall County (24.07%), while only Sangamon County showed a decrease (-3.51%).



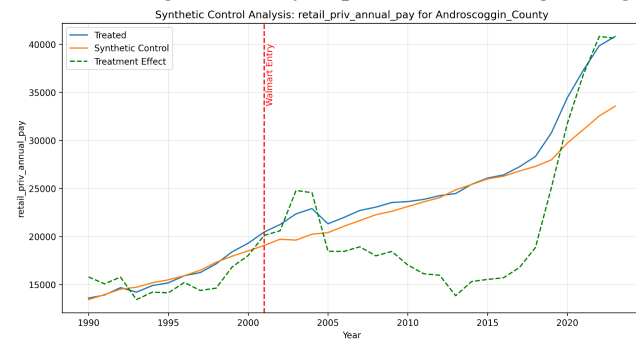
Synthetic Control Analysis for Sangamon County



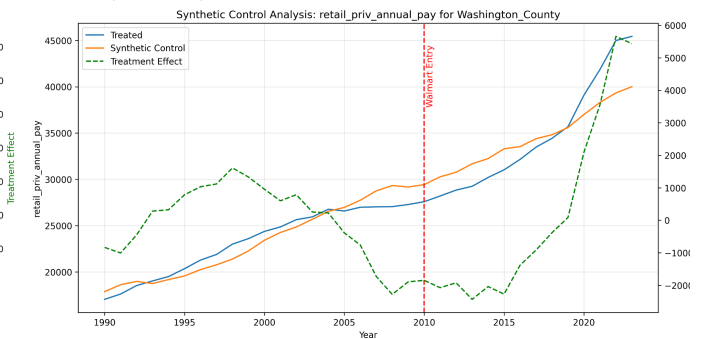
Synthetic Control Analysis for Washington County

Retail Private Annual Pay:

Six counties show statistically significant effects on annual retail pay, with three positive and three negative. The most substantial positive effect was observed in Androscoggin County (8.51% increase), while Washington County experienced the largest negative effect (-6.70%).



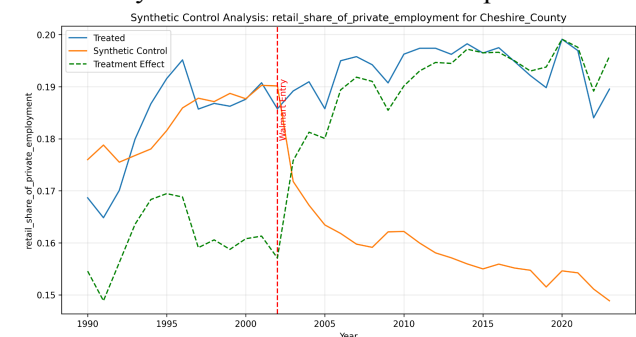
Synthetic Control Analysis for Androscoggin County



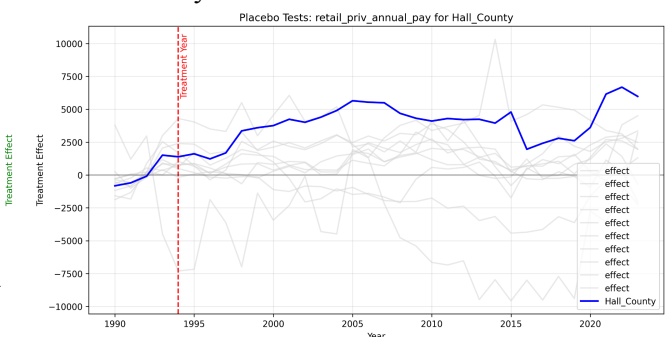
Synthetic Control Analysis for Washington County

Retail Share of Private Employment:

Four counties exhibited statistically significant changes in retail's share of private employment, all positive. Cheshire County saw the largest increase (13.12%), suggesting that Walmart's entry substantially increased the retail sector's prominence in the local economy.



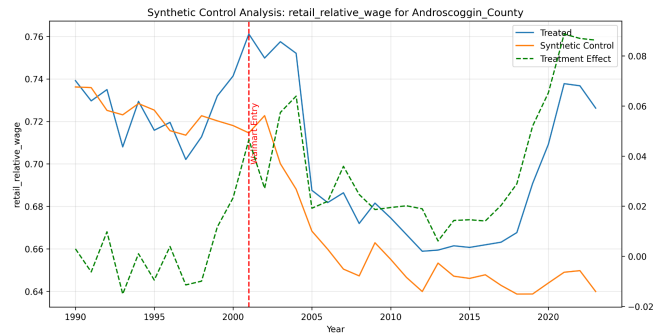
Synthetic Control Analysis for Cheshire County



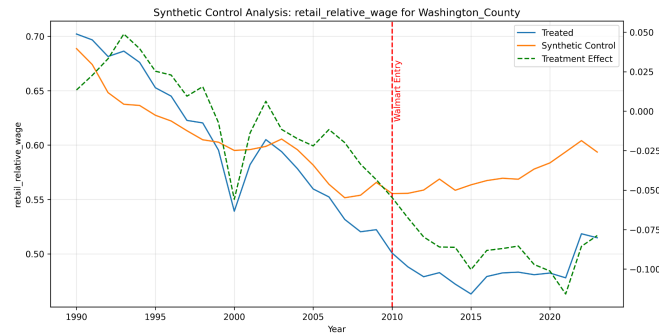
Placebo Tests for Cheshire County

Retail Relative Wage:

Four counties show statistically significant effects on relative retail wages, with two positive and two negative. Washington County experienced the most substantial decrease (-14.11%), while Androscoggin County saw the largest increase (5.66%).



Synthetic Control Analysis for Androscoggin County



Synthetic Control Analysis for Washington County

The results suggest that Walmart's effects may have evolved over time, with newer entries (particularly Washington County in 2010) showing more pronounced negative effects on wages compared to earlier entries.

Some Spatial Patterns Emerged:

New England Region (Androscoggin, Berkshire, Cheshire, Rutland): Generally positive effects on retail's share of employment, with mixed wage effects.

Midwest (Hall, Madison, Sangamon): Variable effects, with Madison showing significant positive effects on retail share.

West Coast (Solano, Washington): More pronounced wage effects, particularly the large negative effect in Washington County.

County	Treatment Year	Retail Priv Employment (Effect)	Significant?	Retail Annual Pay (Effect)	Significant?	Retail Share of Private Employment (Effect)	Significant?	Retail Relative Wage (Effect)	Significant?
ANDROSCOGGIN	2001	541.02	No	1693.92	Yes	0.0002	No	0.0394	Yes
BERKSHIRE	1995	549.69	No	-316.60	Yes	0.0058	Yes (10%)	-0.0046	Yes
CHESHIRE	2002	540.53	No	1328.51	No	0.0214	Yes	0.0071	No
HALL	1994	1227.64	No	2141.41	No	-0.0052	No	0.0787	No
JACKSON	2007	926.08	No	365.47	Yes (10%)	-0.0126	No	0.0511	No
MADISON	1998	2842.19	No	-191.36	Yes (10%)	0.0041	Yes	0.0174	No
RUTLAND	1997	427.16	No	198.17	Yes	0.0064	Yes (10%)	-0.0079	Yes
SANGAMON	2001	-417.44	No	-456.77	No	-0.0170	No	0.0199	No
SOLANO	1993	953.65	No	-451.47	No	-0.0026	No	0.0287	No
WASHINGTON	2010	5267.33	No	-2097.75	Yes (10%)	-0.0108	No	-0.0791	Yes

CONCLUSION

While Walmart's entry appears to increase retail employment in most counties, these effects are not statistically significant. This leads us to conclude that while Walmart may create jobs directly, these gains may be partially offset by job losses in competing retail establishments.

The significant wage effects observed in six counties present a mixed picture. Some counties experienced wage increases, while others saw decreases. This heterogeneity may reflect differences in local labor markets and competitive conditions.

The significant positive effects on retail's share of private employment in several counties lead us to conclude that Walmart's entry can shift local economic structure toward greater retail prominence. The significant effects on retail's relative wage position compared to other sectors indicate that Walmart can alter the wage structure of local economics, with both positive and negative effects observed.

ACKNOWLEDGEMENTS

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