

BAX 401 Case 2 Homework 2 (Tushar Yadav & Vatsal Nanawati – Section 1)

1. Introduction

This report evaluates the effect of minimum wage increases on two measures of food security: (1) average daily calorie intake per person and (2) nutritional quality, measured by a "Basket Score." Using Difference-in-Differences (DiD) methodology, two datasets were analyzed to isolate the causal impact of wage increases. The difference-in-differences (DiD) approach enables us to infer causal impact by comparing changes between treatment and control groups across time periods. By contrasting a treatment group (minimum wage earners in California and wage-increase states) with a control group (higher earners in California and minimum wage earners in non-wage-increase states), the DiD approach approximates a randomized trial, which is why it is useful in this situation.

Insights - Average Plot Summaries – CAMW

This graph (Graph 1) shows average monthly calorie consumption for minimum wage earners versus higher earners in California across each month of 2014, with a vertical line in June, marking the pre- and post-treatment period.

- Pre-treatment period: Both groups do not have similar calorie intake trends, **indicating the violation of parallel trends** assumptions prior to the wage increase.
- Post-treatment period: After June, a noticeable **slight** increase in calories for minimum wage earners (treatment group) is observed, while the higher earners (control group) show stable trends. This divergence post-treatment suggests that the wage increase positively impacted the treatment group's ability to purchase more calories.

This graph (Graph 2) displays the average monthly basket score (a measure of nutritional quality) for minimum wage and higher-earning groups in California, again with June as the pre-treatment marker.

- Pre-treatment period: Both groups exhibit similar basket scores, supporting the assumption that treatment and control groups **show parallel trend** as it had comparable nutritional quality in their food purchases before the wage increase.
- Post-treatment period: There is a slight upward trend in basket score for the minimum wage group, suggesting a small positive shift towards healthier food options post-treatment and **p value is not statistically significant**. This modest increase in the treatment group's basket score indicates a limited impact on nutritional quality, despite the wage increase.

2. Results and Magnitude of Impact

A. California Dataset (Single DiD Model)

DiD - Calories Analysis – CAMW

Impact on Calories

As shown in (Calories Pre & Post Treatment Summary Table – CAMW), the DiD model indicates a significant increase in calories consumed by minimum wage households after the wage increase. Specifically, the interaction term in the model shows a 104.87 calorie increase per day per person in the treatment group. This finding suggests that the wage increase positively impacted food purchasing power, potentially alleviating calorie-based food insecurity for minimum wage households.

The p-value for the interaction term GroupMinWage:Post (minimum wage × post-treatment) is very low ($<2e-16$), indicating a statistically significant effect of the minimum wage, **increases by 104.86** on calorie

consumption among minimum wage earners. This suggests that the observed increase in calorie intake after the wage increase is not due to the random chance.

DiD - Basket Score Analysis – CAMW

Impact on Basket Score

The Basket Score (nutritional quality) shows more modest improvements compared to calorie intake. (Basket Score Pre & Post Treatment Summary Table - CAMW) highlights a 0.24-point increase in basket score, suggesting a slight shift towards healthier food choices among minimum wage households. However, the impact is relatively small, indicating that households may prioritize calorie sufficiency over nutritional quality with their limited budgets.

The p-value for the interaction term GroupMinWage:Post in the basket score model is 0.344, which is not statistically significant ($p > 0.05$). This suggests that any observed change in the nutritional quality of food purchases (as measured by the basket score) after the wage increase is likely due to chance rather than the effect of the wage policy.

B. Multi-State Dataset (Staggered DiD Model)

The staggered DiD model in the multi-state dataset captures the effects of wage increases occurring at different times across states, providing a more nuanced analysis by using a “treatment dose” variable. Graphs 5 and 6 demonstrate that **minimum wage increases** lead to a noticeable rise in **calorie intake** (Graph 5) in treated states, while control states remain stable. This indicates improved access to food following wage increases. However, the **basket score** (Graph 6) shows only minor changes, suggesting that while wage increases support greater food quantity, they have a limited effect on improving nutritional quality.

DiD - Calories Analysis – USMW:

Impact on Calories

The multi-state staggered model, shown in (Calories Pre & Post Treatment Summary Table – USMW), confirms the positive impact on calorie intake observed in the California dataset. As wage increases were implemented incrementally, calorie intake rose by 79.31 among treated households. This cumulative increase indicates it is statistically significant and that each successive wage hike allows households to purchase more food, addressing caloric sufficiency over time.

The p-value for the overall model's is $< 2.2e-16$, indicating that the model significantly explains variations in calorie intake across states. This supports the hypothesis that wage increases in states like Michigan and Alaska have a real effect on calorie consumption among minimum wage earners

DiD - Basket Score Analysis – USMW:

Impact on Basket Score

The basket score results from the multi-state dataset (Basket Score Pre & Post Treatment Summary Table - USMW) also show small, positive effects, but not statistically significant, like the California model. It suggests that while additional income enables greater food access, it may not sufficiently enable substantial improvements in diet quality.

The basket score model's treatment impact has a p-value of 0.1449, which is somewhat higher than the traditional 0.05 cutoff point and suggests that there is no statistical significance. This implies that rather than a consistent impact of wage policy on nutritional quality, the observed variations in basket score after pay increases are probably the result of random variation.

3. Model Reliability and Comparison

The R-squared values for both the California and multi-state datasets reveal important differences in each model's ability to explain variance in the outcomes (calories and basket score).

California Dataset: The model only explains 1.68% of the variation in calories and almost none of the variation in basket score, R-squared values of 0.01681 for calories and 0.0001245 for basket score. These low values imply that although the model produces significant findings for calories, the majority of the variation, particularly for basket scores, is caused by factors other than the rise in the minimum wage.

Multi-State Staggered DiD Model: Perhaps because it accounts for salary impacts across states and time periods, the multi-state model explains a little more variation in calorie intake, with R-squared values of 0.03757 for calories and 0.007833 for basket score. Both R-squared values, however, are still low, particularly for basket scores, suggesting that variables other than income increases probably have a greater impact on nutritional quality.

4. Conclusion and Recommendations

The analysis of both the California and multi-state datasets provides insights into the impact of minimum wage increases on food security, specifically in terms of calorie intake and nutritional quality. The findings show a **positive effect on calorie intake** across both models, with minimum wage increases enabling households to meet basic caloric needs. The California dataset indicates a 104.87-calorie increase per day, while the multi-state model shows cumulative increases in calorie intake, further validating these results.

Limitations:

However, both models show a **limited impact on nutritional quality** as measured by the basket score, with only minor, statistically insignificant improvements. These results suggest that while wage increases enhance food access by improving calorie sufficiency, they have a minimal effect on dietary quality.

The **multi-state staggered DiD model** is more reliable due to higher R-squared values for calorie intake and adherence to the parallel trend's assumption. In contrast, the California model shows some divergence in pre-treatment trends, which affects its reliability.

Recommendations:

1. **Support for Minimum Wage Increases:** Given the positive impact on caloric intake, policymakers should consider minimum wage increases as an effective tool to reduce calorie-based food insecurity. This measure can help low-income households access sufficient food.
2. **Complementary Nutritional Programs:** Since wage increases alone do not significantly improve diet quality, additional interventions are recommended. Programs focused on affordable healthy food options and nutrition education could complement wage policies to enhance overall dietary quality for low-income households.
3. **Further Research:** Additional studies could explore the long-term effects of wage increases on different aspects of food security and investigate other factors influencing nutritional quality to better understand the broader impacts of wage policies.