Assignment 3

Andreas F. | Marc S. | Andreas L.

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(a)

Calculate the average starting wage (`wage_st`*) separately for restaurants in NJ and in PA, both for each interview wave.*

Table 1: Average starting wages by state and interview wave

	Wave 1 (w_1)	Wave 2 (w_2)
NJ	4.62	5.08
PA	4.66	4.62

New Jersey restaurants show a clear increase in starting wages between waves, whereas wages in Pennsylvania remain essentially unchanged.

(i)

Calculate the difference in the average wages between the second and first interviews.

Table 2: Time differences: Δw_s

State	Δw_s
NJ	0.4692
PA	-0.0348

Thus, New Jersey experienced a substantial increase in starting wages between waves, while Pennsylvania shows a slightly negative change.

(ii)

Now calculate the difference between NJ and PA of the time differences just obtained.

The difference-in-differences estimator is therefore

$$\text{DID}(w) = \Delta w_{NJ} - \Delta w_{PA} = 0.4692 - (-0.0348) = \mathbf{0.504}.$$

This implies that starting wages increased by roughly 50 cents more in New Jersey than in Pennsylvania following the minimum wage increase.

(iii)

What is the interpretation of such a difference-in-differences estimate of the wage effect? Under what conditions does this provide a valid estimate of the minimumwage increase on wages in the fast food industry?

The DID estimate measures the (causal) effect of the minimum wage increase on starting wages, provided that NJ and PA would have followed parallel wage trends in the absence of the policy change.

(iv)

Interpret your finding.

The results show a clear wage increase in New Jersey relative to Pennsylvania, indicating that the minimum wage reform effectively raised starting wages in NJ fast-food restaurants. This confirms that the policy was binding for a substantial share of NJ restaurants. The small negative change in PA wages further supports that the control group did not experience similar shocks. So, the evidence is fully consistent with the intended effect of the minimum wage reform on pay levels.

(b)

Repeat the same exercise as in (a) for full time equivalent employment. What is the impact of the minimum wage increase on relative employment in NJ restaurants?

Table 3: Average employment by state and interview wave

State	fte_1	fte_2	Δfte
NJ	17.3	17.6	0.287
PA	20.1	18.1	−2.020
Difference (NJ − PA)			**2.30**

The time difference in NJ is small and positive, while employment in PA declines notably. Thus, the DID estimate for employment is:

$$\text{DID}(fte) = 0.287 - (-2.020) = \mathbf{2.30}.$$

This indicates that employment in New Jersey increased by about 2.3 full-time equivalent workers relative to Pennsylvania. Although NJ employment rises only slightly in absolute terms, PA exhibits a sizable decline, so the relative effect is positive. Overall, we find no evidence of a negative employment impact from the minimum wage increase; if anything, NJ restaurants performed better than their PA counterparts.

(c)

We estimate:

$$Y_{ist} = \beta\,\mathrm{TREAT}_{is} + \gamma\,\mathrm{POST}_t + \delta_{rDD}(\mathrm{TREAT}_{is} \cdot \mathrm{POST}_t) + e_{ist}$$

(i)

Write the equation separately for March and Nov/Dec and show that the DD model for two periods (t = 1,2) can be estimated as $Y_{is2} - Y_{is1} = \gamma + \delta_{rDD} \cdot TREAT_{is} + (e_{is2} - e_{is1})$.

Starting from the DID model

$$Y_{ist} = \beta\,\mathrm{TREAT}_{is} + \gamma\,\mathrm{POST}_t + \delta_{rDD}(\mathrm{TREAT}_{is} \cdot \mathrm{POST}_t) + e_{ist},$$

we write the two period-specific equations.

March (t = 1):

$$Y_{is1} = \beta\,\mathrm{TREAT}_{is} + e_{is1},$$

since $\mathrm{POST}_1 = 0$.

Nov/Dec (t = 2):

$$Y_{is2} = \beta\,\mathrm{TREAT}_{is} + \gamma + \delta_{rDD}\,\mathrm{TREAT}_{is} + e_{is2},$$

since $\mathrm{POST}_2 = 1$.

Subtracting the two yields:

$$Y_{is2} - Y_{is1} = \gamma + \delta_{rDD}\,\mathrm{TREAT}_{is} + (e_{is2} - e_{is1}),$$

which is the two-period DID regression used in this analysis.

(ii)

What are the regression DD estimates on wages and employment using this regression? How do they compare to the results you found in (a) and (b)?

For wages, the regression yields a treatment effect of

$$\hat{\delta}_w = 0.504 \quad (\mathrm{SE} = 0.048,\ p < 0.001),$$

indicating that starting wages in New Jersey rose by about 50 cents more than in Pennsylvania. This estimate matches exactly the DID result from part (a), where we also obtained a difference of 0.504.

For employment, the regression produces

$$\hat{\delta}_{fte} = 2.302 \quad (\text{SE} = 1.167,\ p = 0.049),$$

which is again identical to the DID estimate of 2.30 computed in part (b). Employment increased slightly in NJ relative to PA, and the regression confirms this positive, though imprecisely estimated, effect.

Overall, the regression-based DID results reproduce the manual DID calculations from parts (a) and (b) exactly, as expected from the algebraic equivalence shown in (c)(i).

(iii)

The regression allows you to control for other factors. Repeat the regressions, entering a dummy variable for whether the restaurant is company owned (`co_owned`*, as compared to franchised) and three dummy variables for three of the four chains in the dataset (Burger King, KFC, Roy Rogers, and Wendy's; you will have to construct the dummies from the variable* `chain` *or use* `factor(chain)`*.*

Adding ownership status and chain indicators has little influence on the estimated NJ effect in either regression. For wages, the treatment coefficient remains virtually unchanged at

$$\hat{\delta}_{w} = 0.504 \ (\text{SE} = 0.047),$$

confirming that the minimum wage increase drives the observed wage differences. The employment regression similarly shows only a small adjustment in magnitude, with

$$\hat{\delta}_{fte} = 2.30 \ (\text{SE} = 1.17).$$

Overall, the inclusion of covariates mainly affects the precision of some coefficients but does not alter the core treatment effect.

(iv)

Do your results change when you enter restaurant specific covariates? Would you have expected the results to change? Explain why or why not.

The treatment coefficients remain stable after adding covariates, and this is exactly what we would expect. Because the minimum wage reform was

externally imposed and unrelated to restaurant characteristics, factors such as chain affiliation or ownership structure are not confounders of the policy's effect. As a result, controlling for these variables does not change the estimated impact of the minimum wage on wages or employment, but merely adjusts for minor background variation.

(d)

(i)

Would you expect the DD assumptions to be satisfied more easily for the within NJ comparison than for the NJ - PA comparison?

Yes. Comparing only NJ restaurants is more likely to satisfy the parallel trends assumption because all units face the same regional labor market, economic environment, and seasonal patterns. In contrast, NJ and PA may differ in unobserved state-level factors that could affect employment trends even without the policy change. Restricting the comparison to high- and low-wage restaurants within NJ therefore reduces cross-state heterogeneity and makes the identifying assumptions more credible.

(ii)

Construct a variable for those restaurants paying starting wages of less than \$5.00 before the minimum wage increase. Use the regression to obtain a DD estimate of the employment and wage effects of the minimum wage increase. What is the relative impact of the minimu mwage on starting wages and employment within NJ?

For wages, the treatment effect is

$$\hat{\delta}_w = 0.616 \quad (\text{SE} = 0.030,\ p < 0.001),$$

implying that low-wage restaurants experienced an increase in starting wages of about 62 cents more than high-wage restaurants. This confirms that the minimum wage was binding for the low-wage group.

For employment, we obtain

$$\hat{\delta}_{fte} = 3.30 \quad (\text{SE} = 1.08,\ p = 0.002),$$

suggesting a modest relative increase in employment at low-wage restaurants. Although the effect is smaller and less precisely estimated than the wage effect, it shows no evidence of a negative employment response.

Summing up, the within-NJ comparison reinforces the main finding: the minimum wage substantially increased starting wages but did not reduce employment among the restaurants most affected by the policy.

(iii)

How do your within NJ estimates compare to those obtained in part (c) for the NJ - PA comparison?

The within-NJ estimates closely mirror the NJ–PA results. In both approaches, the minimum wage leads to a substantial increase in starting wages, and neither specification shows evidence of an employment decline. The magnitude of the wage effect is slightly larger within NJ, reflecting that low-wage restaurants were directly bound by the new minimum. Both strategies point to the same conclusion: the reform raised wages without reducing employment.

(e)

(i)

Now run a regression of changes in employment and wages just for PA using this new variable for low paying restaurants in PA. How do your results differ from those just for NJ?

For Pennsylvania, the coefficient on `low_wage` in the wage regression is

$$\hat{\delta}_w^{PA} = 0.354 \quad (\text{SE} = 0.091,\ p < 0.001),$$

indicating that low-wage PA restaurants also experienced higher wage growth between waves. However, unlike in NJ, this increase cannot be attributed to the minimum wage, since PA did not change its policy.

For employment, the effect in PA is small and statistically insignificant:

$$\hat{\delta}_{fte}^{PA} = 2.81 \quad (\text{SE} = 2.90,\ p = 0.336).$$

This contrasts with the NJ results, where low-wage restaurants showed a significant positive change in employment.

The PA estimates suggest that low-wage restaurants in the control state exhibit some natural wage growth but no systematic employment response. The much larger wage effect and clearer employment pattern in NJ therefore reflect the impact of the minimum wage increase rather than background trends.

(ii)

Carry out a statistical test of the hypothesis that the coefficient on the low wage dummy is the same in NJ and in PA.

To test whether the effect of being a low-wage restaurant differs between NJ and PA, we estimate the interaction model

$$dw_i = \beta_0 + \beta_1\, NJ_i + \beta_2\, low\_wage_i + \beta_3\, (NJ_i \times low\_wage_i) + u_i.$$

The coefficient β_3 measures the difference in the low-wage effect between the two states.

For wages, the interaction term is

$$\hat{\beta}_3 = 0.262 \quad (\text{SE} = 0.073,\ p < 0.001),$$

which is statistically significant. This rejects the null hypothesis that the low-wage effect is the same in NJ and PA. The minimum wage increase therefore creates a substantially larger wage response for low-wage restaurants in NJ.

For employment, the interaction effect is

$$\hat{\beta}_3 = 0.488 \quad (\text{SE} = 2.487,\ p = 0.844),$$

indicating no meaningful difference between the two states. This is consistent with earlier results showing no negative employment effect in NJ relative to PA.

Overall, the wage response differs sharply between NJ and PA, while the employment response does not.

(iii)

Why is this a check on how well the methodology is doing in uncovering effects of the minimum wage increase? What do you conclude?

This comparison serves as a placebo test: PA restaurants were not affected by the minimum wage reform, so any "effect'' of the low-wage dummy in PA must reflect normal wage movements rather than policy-driven changes. If the DiD framework is valid, we should see strong wage effects for low-wage restaurants in NJ but only small or insignificant effects in PA.

Our results fit this pattern. The wage response is much larger in NJ than in PA, and the interaction test confirms that the difference is statistically significant. At the same time, employment effects remain small and statistically indistinguishable across states. Taken together, this strengthens confidence that the methodology correctly isolates a relevant part of the causal impact of the minimum wage increase.