

EVALUATING THE IMPACT OF REMOTE WORK ON EMPLOYEE PRODUCTIVITY USING PANEL DATA IN STATA

1. Background and Problem Statement:

A mid-sized software development firm implemented a hybrid work model after the COVID-19 pandemic. Management suspected that remote work affected employee productivity in varying ways depending on department and seniority. However, no formal analysis had been done. The organization collected monthly productivity scores (measured via performance appraisals and task completion rates) over 24 months for 120 employees across five departments. There was a need to rigorously evaluate whether remote work status had any significant effect on productivity while controlling for employee-level and time-fixed effects.

2. Objectives:

- To evaluate the causal impact of remote work status on monthly employee productivity scores
- To control for unobserved individual heterogeneity using fixed-effects models
- To compare fixed effects and random effects estimators for robustness
- To identify whether department or tenure moderates the relationship between remote work and productivity

3. Methodology:

3.1 Data Structure and Variables:

- Panel Data: Monthly observations from Jan 2021 to Dec 2022 (24 time periods)
- Units: 120 employees (balanced panel)
- Key Variables:
 - Dependent Variable: Productivity Score (continuous, range: 0 to 100)
 - Independent Variable: Remote Work (1 = remote, 0 = in-office)
 - Control Variables: Years of Experience, Department (5 dummies), Monthly Project Load
 - Panel ID: Employee_ID

- Time Variable: Month_ID

3.2 Stata Techniques Used:

- Data Preparation:
 - xtset Employee_ID Month_ID
 - Missing value imputation and consistency checks
- Model Estimation:
 - Pooled OLS: regress Productivity RemoteWork Experience ProjectLoad i.Department
 - Fixed Effects (FE): xtreg Productivity RemoteWork Experience ProjectLoad, fe
 - Random Effects (RE): xtreg Productivity RemoteWork Experience ProjectLoad, re
 - Hausman Test: hausman fe re
 - Interaction Terms: c.RemoteWork###i.Department to test moderation effects
- Diagnostics:
 - VIF for multicollinearity
 - Serial correlation test using Wooldridge test
 - Heteroskedasticity check with xttest3

4. Results and Interpretation:

- The fixed effects model was selected based on the Hausman test ($p < 0.05$), indicating correlation between individual effects and regressors.
- Remote work was associated with a statistically significant **increase** of 3.7 points in productivity ($p < 0.01$), controlling for experience and project load.
- Department-level interactions showed the productivity gains were most prominent in the IT and Data departments, but not significant in HR or Sales.
- Employees with more than 5 years of experience benefited more from remote work than those with under 2 years.
- Model R-squared (within) = 0.43, indicating moderate explanatory power.

5.Deliverables:

- .dta panel dataset prepared with all variables
- .do file with cleaned and annotated Stata commands
- Final regression output tables exported using esttab
- Visualizations showing productivity trends over time by remote status
- Summary report in .docx format with results interpretation and implications

6.Implications and Recommendations:

- Remote work has a positive productivity impact overall, particularly in knowledge-intensive departments.
- Junior employees may require mentoring structures to perform well remotely.
- HR should consider department-specific remote work policies rather than a one-size-fits-all model.
- Future evaluation should incorporate employee well-being and long-term retention metrics.

7.Stakeholder Relevance:

Academic:

- Suitable for econometrics coursework focusing on panel data modeling and fixed vs. random effects comparison
- Demonstrates application of interaction terms and model diagnostics in Stata

Corporate:

- Relevant for HR analytics teams assessing remote work effectiveness
- Offers a replicable framework for other firms with internal performance data