ESTIMATING THE FISCAL IMPACT OF REMOTE WORK ON MUNICIPAL BUDGETS

1. Objective

This project aimed to estimate how the shift toward remote work affected municipal revenue streams in major U.S. cities. The primary focus was on modeling changes in commercial property tax collection, transit fare revenue, and local sales tax intake as a function of remote work intensity, using panel data regression techniques in MATLAB.

2. Client and Use Case

Client:
A regional economic development council advising city governments on post-pandemic fiscal policy.

Use Case:
The client sought empirical evidence to support budget forecasting and develop alternative revenue models in response to declining downtown commercial activity due to remote work.

3. Dataset Overview

Time Period:
Q1 2019 – Q4 2023 (pre- and post-pandemic)

Cities Included:
30 metropolitan cities across the U.S. (New York, Chicago, Seattle, Denver, etc.)

Variables Collected:

- **Dependent Variables:**

    o   Commercial Property Tax Revenue

    o   Sales Tax Revenue

    o   Public Transit Fare Income

- **Key Independent Variables:**

    o   % of workforce working remotely (sourced from U.S. Census CPS & Kastle Back-to-Work Index)

    o   City-level unemployment rate

- o Office occupancy rate

- o Downtown foot traffic index (via Placer.ai)

Data Sources:

- U.S. Census Bureau

- Federal Reserve FRED API

- City revenue reports

- Third-party mobility datasets

4. Methodology

4.1 Data Preprocessing

- Handled missing quarterly data with linear interpolation.

- Used MATLAB's table structure for city-quarter level data merging.

- Log-transformed all revenue variables to handle skewness and allow elasticity interpretation.

4.2 Econometric Model in MATLAB

Model 1: Fixed Effects Panel Regression

$$\log(Y_{it}) = \beta_0 + \beta_1 \cdot \text{RemoteWork}_{it} + \beta_2 \cdot \text{OccupancyRate}_{it} + \gamma_i + \delta_t + \varepsilon_{it}$$

Where:

- Y_{it} = revenue variable for city i at quarter t

- γ_i = city fixed effects

- δ_t = time fixed effects (quarter dummies)

- Robust standard errors clustered at the city level

Model 2: Dynamic Panel Regression with 1-quarter lag

- Included lagged dependent variable to control for persistence in revenue trends

Software Tools:
MATLAB's fitlme, custom functions for demeaning data and computing clustered SEs

5. Key Findings

- **Remote Work Coefficient (on Commercial Property Tax):**
  -0.031 (p < 0.01), indicating a 3.1% drop in tax revenue for every 10% increase in remote work rate.

- **Public Transit Fare Income:**
  Decreased by 6.8% (p < 0.01) per 10% remote work increase.

- **Heterogeneity by City:**
  Impact significantly higher in high-density cities (e.g., NYC, SF).

- **Lag Effects:**
  Revenue declines persist up to two quarters post spike in remote work share.

6. Visualizations and Output

- **Coefficient Plot with 95% CIs** using MATLAB's errorbar

- **Interactive dashboard** built in MATLAB App Designer for client use

- **Trend Charts** for each city's revenue trajectory with annotated policy events (e.g., lockdowns, return-to-office mandates)

7. Deliverables

- 30-page technical report with full regression outputs

- Summary brief for policymakers (non-technical)

- MATLAB codebase for reuse with new quarterly data

- Interactive tool to simulate tax scenarios based on future remote work projections

8. Strategic Outcomes

- Helped cities re-evaluate their reliance on office-related tax streams

- Informed debate on commercial zoning changes and urban decentralization

- Led to pilot programs for downtown revitalization in 4 cities using these findings

9. Tools and Environment

- MATLAB R2023a

- Statistics and Machine Learning Toolbox

- FRED API connection script (custom)

- Version-controlled repository for reproducibility