

Center for
New York City
Affairs

Technical appendix

"A U.S. Trade war is likely to harm New York City's recovering economy"

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Summary

This technical appendix provides a detailed overview of the econometric models, data sources, regression outputs, and statistical tests used to examine the impact of U.S. trade openness on New York City's unemployment and real GDP growth rates for the periods 1990-2024 and 2001-2022 respectively. Two Ordinary Least Squares (OLS) models were specified: Model 1 estimates the short-term relationship between trade openness and the unemployment rate using first-differenced variables, while Model 2 explores the effect of trade openness on real GDP growth, accounting for stationarity issues in the data series. The appendix outlines the sources and transformations of the data, including annualized unemployment rates and real GDP in 2017 chained dollars. Regression results and stationarity tests are presented, highlighting statistically significant findings in Model 1 and the limitations of Model 2 due to data constraints. This appendix is intended to support the analytical rigor and transparency of the main report.

Model Specification

To estimate the impact of U.S. trade openness on New York City. I use two models: Model 1 estimates the impact of U.S. trade openness on New York City's unemployment rate and Model 2 estimates the impact of U.S. trade openness on New York City's real GDP growth rate. In both cases, I apply the following simple Ordinary Least Square (OLS) model:

$$Y_t = \alpha + \beta_1 X_t + \varepsilon_t$$

Where Y_t is New York City's annual unemployment rate and real GDP growth, X_t is the U.S trade openness (%GDP), and ε_t is the error term.

Model 1

Because my series on unemployment and U.S trade openness are non-stationary, I transform both variables into their first order difference and obtain my first model:

$$Y_t - Y_{t-1} = \alpha + \beta_1 X_t - X_{t-1} + \varepsilon_t$$

Because of this transformation, my model estimates the short-term effects of the relationship between trade openness and New York City's unemployment rate. In consequence, the model's results cannot be generalized to the long-run relationship between the two variables.

Model 2

In the second model, my series on real GDP growth is stationary while the U.S trade openness series is non-stationary. As a result, I first run the model on the levels of both variables and run the following model to address the stationarity issue:

$$Y_t = \alpha + \beta_1 X_t - X_{t-1} + \varepsilon_t$$

Data

I used the World Bank World Development Indicators to extract the series on U.S. trade openness available here for the period 1990-2024[1] in Model 1 and 2001-2022 in Model 2. For the series on New York City's unemployment rate, I used the New York State Department of Labor's seasonally adjusted monthly unemployment rate. I then annualized that series for the period 1990-2024.

I used the Bureau of Economic Analysis GDP database to extract GDP data by county and aggregated the five counties of New York City to obtain city levels. GDP values are expressed in 2017 chained dollars. I then generated the annual growth rate.

Regression and Test Results

Heteroskedasticity was not detected in neither in Model 1or Model 2. In table 1, the regression results of Model 2 report the coefficient results when I run Model 2 on the levels of variables. As displayed in Table 1, trade openness in Model 2 is not statistically significant. This is probably due to the lack of longer time-series available at the city level for GDP growth. Further research needs to be done to consolidate the relationship between trade openness and New York City's GDP growth.

Table 1

Regression output results

Model	Variable	Coefficient	Std. Error	p-value	Notes	R^2	Adj. R^2
Unemployment rate	Intercept	0.051	0.312	0.87227	Not statistically significant	0.270	0.248
	ΔTrade Openness	−0.630	0.183	0.000162*	Significant at 5% level		
Real GDP growth	Intercept	−0.574	7.930	0.943	Not statistically significant	0.001	−0.055
	Trade Openness	0.106	0.292	0.719	Not statistically significant		

Source: CNYCA analysis of World Bank World Development Indicators, Bureau of Economic Analysis, and New York State Department of Labor data.

[1] For 2024 trade openness value, I calculated it using GDP data from the Bureau of Economic Analysis.

Table 2 reports the stationarity tests performed on the first order difference of all the variable used in my models. I applied the Phillips-Perron Unit Root Test (PP) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. Cointegration was not detected in any of the models.

Table 2

Stationarity test results

Variable	Test	Statistic	p-value	Conclusion
ΔUnemployment Rate	PP	−27.150	0.010	Stationary
	KPSS	0.053	0.100	Stationary
ΔTrade Openness (Model 1)	PP	−31.250	0.010	Stationary
	KPSS	0.264	0.100	Stationary
NYC Real GDP Growth	PP	−20.120	0.024	Stationary
ΔTrade Openness (Model 2)	PP	−19.310	0.032	Stationary