Text 1 Supplement

# Capital Stock Calculation

Following Winston and Langer (2006) and Chen (2017), the formula for calculating capital stock for a given year is as follows:

$LnCapitalStock\_{it}= Log(\sum\_{0}^{10}(\left(Capital Outlay\right)\_{t-\left(T-i\right)} ×\left(1-d\right)^{T-i}))$

where T is the time period. The default T value is 10. When T is equal to 10, capital stock is calculated as depreciated capital spending in the current year (t) and 9 immediately preceding years. The depreciation rate (d) for state and local capital investment is assumed to be 2.02 percent based on the U.S. Bureau of Economic Analysis (2004).[[1]](#footnote-1) We lag the capital stock variable for one year in order to avoid the simultaneity issue.

# Econometric Model

The econometric model is written as follows:

$City Capital Investment\_{it}=β\_{0}+β\_{1}\left(Capital Stock\right)\_{it}+β\_{2}\left(Economic Condition\right)\_{it}+β\_{3}\left(Fiscal Capacity\right)\_{it}+β\_{4}\left(Socio\\_Demographic\right)\_{it}+β\_{5}\left(Political\\_Fiscal Institution\right)\_{it}+γθ\_{i}+ψω\_{t}+ε\_{it}$

where $City Capital Investment\_{it}$ is the observed aggregate and disaggregate capital expenditures in city *i* during year *t*. $Capital Stock\_{it}$ is a variable of measuring existing value of capital assets. $Economic Condition\_{it}$ is a vector of variables capturing a city’s macroeconomic environment. $Fiscal Capacity\_{it} $represents a set of city fiscal resource capacity to finance capital investment. $Socio\\_Demographic\_{it}$ is a set of socio-demographic variables to measure citizen demands and preferences for capital investment. $Political\\_Fiscal Institutions\_{it}$ is a vector of variables capturing city variation in political and fiscal institutions. $θ\_{i}$ is the city fixed effect to control unobservable city attributes such as the forms of city governments, weather, and topography. $ω\_{t}$ is the time-specific effect to control changes in the business cycle. $ε\_{it}$ is the random error term.

# Estimation Methods

Due to the panel data structure, the study employs a two-way panel estimator with city and year dummies to control both city and year-invariant unobserved heterogeneity. The variance inflation factor (VIF) test found that the mean value of the VIF test is 2.94. VIFs for all variables are less than 5. So, we suggest that multicollinearity may not be a problem for this study. A series of panel unit root tests suggested the dependent variables are panel stationary, and thus fixed-effect or random effect models are applicable.[[2]](#footnote-2) The Hausman tests are performed to test the specification of fixed-effect versus random-effect model. The null hypothesis, which states that the difference of the coefficients estimated by the two specifications is not systematic, is rejected, thus indicating the choice of a fixed-effect model. Initial diagnostic tests were used before running the regression. First, the Breusch-Pagan/Cook-Weisberg test confirms that the estimated residuals are heteroskedastic. Second, the Wooldridge test confirms the existence of serial correlation in error terms. Third, the Pesaran’s cross-sectional dependence (CD) test confirms the existence of cross-sectional dependence. Heteroskedasticity, serial correlation, and cross-sectional dependence will yield biased standard errors of estimated coefficients. To correct the above issues, the study uses the Driscoll and Kraay standard errors (Driscoll and Kraay 1998).

# Reference

Chen, Can. 2017. Does money matter for infrastructure outcomes? The effects of public infrastructure finance on state infrastructure quality. *Journal of Public Budgeting, Accounting and Financial Management* 29 (3): 375–408.

Driscoll, John C., and Aart C. Kraay. 1998. Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics* 80 (4): 549–60.

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Winston, Clifford, and Ashley Langer. 2006. The effect of government highway spending on road users’ congestion costs. *Journal of Urban Economics* 60 (3): 463–83.

1. As a robustness check, we set T at 20 years and d (the depreciation rate) at 4 percent. Then, we calculated capital stock for cities from 1998 to 2012. The panel regression results using new capital stock measures remain largely unchanged. [↑](#footnote-ref-1)
2. Panel unit root tests are performed to test the stationary of the dependent variables of aggregate and disaggregate city capital investment. If the panel is stationary, then a static panel data method should be applied; otherwise, a dynamic specification should be used. Two kinds of tests are conducted— Augmented Dickey-Fuller approach and Phillips-Perron approach, with different specifications on lags, a linear trend, or a drift for all three dependent variables. All specifications reject the null hypothesis of unit root. [↑](#footnote-ref-2)