PUBLIC INVESTMENT AND ECONOMIC GROWTH IN EL PASO

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Dedication

This research is dedicated to my parents, Rodolfo and Azucena González, because through their commitment to my education and development I was able to find my path in life. They showed me to love God, to love humanity, and to love education. It is secondly dedicated to my siblings, Isabel Jazmín and Rodolfo Ignacio González, these two people are my sunshine.

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Abstract

This research focuses on the impact from public capital stock on economic growth in El Paso, Texas. A time series analysis is used to gauge the dynamic relationship between public infrastructure and the productivity of this city's economy. An Error Correction model and a Vector Error Correction model are utilized to discover short-run and long-run impacts from public capital stock on the growth of this particular economy. The Vector Autoregressive model is used to determine causality amongst the variables and to determine the structure of this economy. This research finds that public infrastructure growth actually follows economic growth and private infrastructure growth. Two of the public capital stock components, highways and water and sewer mains, do have an impact on Gross Metropolitan Product. Neither the aggregate public capital stock nor any of its components cause changes in private capital stock growth. It is more apparent that private capital stock has an impact on economic growth in El Paso, rather than public capital stock.

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Section 1: Introduction

Public infrastructure plays an important part within municipal, state, and federal levels of government, Cunningham (2008), indicates that "tragedy of the commons" occurs when road capacity is treated as a free commodity and causes the loss of substantial amounts of time to commuting. Congestion pricing or high-occupancy tolls are suggested as means to alleviate the excess road demand that currently exists.

Smith (2008) states that physical infrastructure that is well maintained creates a foundation for continued economic growth and productivity. Further, it is pointed out that the infrastructure of a region reinforces the development of commerce and generates spillover effects for a community. Additionally, the highway component permits for a smoother transaction from the supplier to the buyer of goods and services. In 2007, the Texas Transportation Institute calculated that the deterioration of the infrastructure system causes bottlenecks that engender $78 billion per year in time and fuel costs.

Eberts (1986) performs a study at the metropolitan level for 38 cities using public capital stock data made up of roads and highways and water supply and treatment. A positive and significant elasticity for economic growth is documented with respect to public investment. García-Mila and McGuire (1992) utilize a highway and education series within the production function framework and find a significant impact on economic growth from the public capital variables.

Garcia-Mila et al. (1996) utilize a disaggregated public capital stock series that includes (a) highways, (b) water and sewer, and (c) all other public investment for a state level sample of 48 entities. Through the use of three specifications, the coefficients for the highway and water and sewer variables are positive and significant. The third component has a negative sign in two of the

specifications, and is statistically insignificant when state-effects are not incorporated. Public capital is not found, in this case, to enhance regional economic growth.

The current study intends to emulate García-Mila et al. (1996) by specifying a production function for El Paso, Texas, in isolation, within a time series framework. The objective is to estimate the effects of private and public investment on economic growth in El Paso. Several studies (Deno, 1986; Eberts, 1986; Eberts, 1987) examine metropolitan growth, but rely on panel data sets that involve multiple municipalities.

The content of this research will include the following sections. Chapter 2 reviews prior studies on public infrastructure. Chapter 3 includes an overview of the data and the theoretical framework for this study. Chapter 4 describes the empirical results and analysis. Lastly, the conclusion in Chapter 5 restates the objective of the research and summarizes the findings.

Section 2: Literature Review

Deno (1986) estimates the short-run relationship between public capital and other production inputs, while holding private output constant. This is accomplished using a public intermediate good model with data for 35 standard metropolitan statistical areas (SMSAs) over an 8-year span. Private net investment is found to have a greater impact on public capital outlays than public capital outlays on private industry. The general conclusion of this study implies that declining public investment impacts private output only slightly in the short run.

Eberts (1986) uses a public capital stock series to estimate the production function for 38 metropolitan statistical areas (MSA). This paper inputs public capital into the production function and finds it to have a positive and statistically significant impact on manufacturing output. When public good characteristics, like non-rivalry and non-excludability, are not taken into account, public capital provides a much smaller impact relative to private capital and labor. A complementary relationship is found between public capital and labor, as opposed to the substitutive relationships shared by private and public capital, and private capital and labor.

Eberts and Fogarty (1987) focus on the migration of manufacturing facilities out of the northern states into the southern and western regions of the United States. A sample of 40 SMSAs for the period 1904 to 1978 is utilized to test the exogeneity of public investment with respect to private investment. The results point to strong causal linkages from public investment to private investment. Additionally, private investment has a greater influence on public investment for cities located in southern states, relative to the rest of the country.

Costa et al. (1987) incorporate a public capital measure into a translog production function with the objective of estimating the elasticities amongst the inputs and the output variable. Sample data are collected for 48 states for the period between 1937 and 1972. A perpetual inventory method with a straight-line depreciation path is used to construct the public and private capital

variables from the gross investment values for both capital types. Labor and public capital are found to be complements, along with a positive relationship between the private and public capital inputs, with public capital exhibiting diminishing marginal returns. In the case of public and private capital, the relationship is not found to be statistically significant at conventional levels.

Aschauer (1989) examines the productivity of public expenditures with respect to aggregate demand and the long-term effects of this key variable on economic growth for the United States. It employs real aggregate output of goods and services of the private sector as the dependent variable and regresses it against aggregate employment, the aggregate stock of nonresidential capital, and a public capital measure based on the flow of government services. The public capital stock series is depreciated using a straight-line methodology, concentrating specifically on "core" infrastructure, which is made up of streets and highways, airports, electrical and gas facilities, mass transit, water systems, and sewers. This public capital stock measure is found to be statistically significant.

Duffy-Deno and Eberts (1991) use two-staged least squares (2SLS) to attempt to deal with the potential bias that may arise due to simultaneity between metropolitan personal income and pubic investment when using ordinary least squares (OLS). For the period between 1980 and 1984, a sample of 28 SMSAs is utilized to estimate the effect of public capital investment on per capita personal income for metropolitan areas. These public capital stock estimates are constructed using a traditional perpetual inventory method. One equation regresses personal income against explanatory variables for public capital stock and public investment, and the second equation specifies public investment as a function of personal income. The empirical results indicate that public capital stock has a positive and statistically significant effect on per capita personal income.

Tatom (1991) outlines the flaws that hinder proper estimates of public capital within a traditional production function. Previous studies not taking into account the relative price of energy within the framework, those that exclude time trends, and those that include non-stationary

variables may end up with a correlation between output and public capital that is not authentic. The specification within this study takes a first difference to deal with the non-stationary variables, includes the omitted energy price, and also incorporates a time trend in the specification. Results indicate that the public capital hypothesis cannot be supported because the public sector variable is not statistically significant once the aforementioned corrections are made.

In Garcia-Mila and McGuire (1992), public capital is represented by highway capital and publicly provided education, where they are both used in the traditional production function. A Cobb-Douglas specification is developed with the constant term used as a shift factor to account for state-specific and time effects within the data set. A one-year lag for each of the regressors is used in order to reflect the availability of inputs at the start of the year for the production of output. Positive and statistically significant coefficients are estimated for the public inputs, where education plays a larger role, relative to highway infrastructure, on gross state product. Again, publicly provided inputs are found to stimulate economic growth via public infrastructure investment.

Holtz-Eakin (1994) argues that previous work on the issue of public capital being productive overlooks state-specific and time effects. Using panel data for 48 states between 1969 and 1986, a production function is estimated under generalized least squares (GLS) and instrumental variables. The OLS regression for the aggregate state production function estimates a large coefficient for the public capital stock variable, 0.203, but once the model is re-estimated to account for fixed state-specific effects, the elasticity changes sign, and is statistically significant. Estimation with instrumental variables yields a negative sign for the public sector variable and is statistically insignificant. Region-level estimates arrive at the same conclusion, so the author suggest that previous work finding a statistically significant and positive coefficient for the public sector results from mis-specified shock term structures.

Garcia-Mila et al. (1996) use public infrastructure broken into highways, water and sewer, and all other public capital. The sample includes annual frequency data for 13 years across 48 states. The coefficients on the disaggregated public infrastructure variables differ as a consequence of controlling for fixed time effects, versus controlling for fixed or random state effects. Among the multiple specifications deployed, coefficients for the public capital variables are frequently either negative or insignificant. Public infrastructure is not found to contribute reliably to regional economic growth.

Okubo (2008) utilizes regional data in Japan to examine this question. The sample is made up of 46 prefectures over 25 years. A dynamic ordinary least square (DOLS) regression, including leads and lags of the change in a variable, plus an error term that takes into account both fixed region effects and time effects is employed. The first equation to be estimated imposes no restrictions on the coefficients, and the elasticity for public capital is positive and significant. Once constant returns to scale is imposed, $a_G + a_K + a_N = 1$, and time-effects are incorporated, a positive and significant elasticity for public capital results, but is small in magnitude.

Research of this nature has not previously been completed for El Paso. Carrying out this type of analysis may help quantify the benefits of infrastructure investment in this border economy. An annual gross investment series for highways, water and sewer, streets, and airport, will be transformed to into a stock variable through the perpetual inventory method, which will be outlined in the next chapter. The disaggregation of this public infrastructure variable into its primary component parts and placement within a Cobb-Douglas production function will facilitate the clarification of public capital's productivity within economic growth.