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Education, Infrastructure, and Border Economic Growth

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By

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Summary

Greater support for investments in education and public infrastructure at federal, state, and local levels of government is one means by which the Obama administration is attempting to improve U.S. economic performance. Texas includes numerous counties, including those on the border with Mexico, with fairly limited tax bases that will potentially benefit from these federal economic policies. While the new fiscal stimulus and economic recovery programs may help buttress education and infrastructure enhancement across Texas, there are relatively few reliable estimates of how such investments may improve, or fail to improve, regional income performance within its boundaries. Development of educational attainment, public infrastructure, and private capital stock estimates for all 254 counties in Texas is carried out first. Econometric analysis of the data follows. Results confirm the potential gains associated with greater educational attainment. Comprehensive public infrastructure data are not currently available for Texas counties, but results do point to positive contributions associated with regional airport facilities. Results also indicate that enhanced private capital stocks are also positively correlated with higher incomes. Policy implications of the empirical outcomes are also discussed.

Introduction

Central planks of the economic program being enacted by the Obama administration include investments in education and public infrastructure at federal, state, and local levels of government. Underlying these efforts are the basic assumptions that improved educational attainment and expansion of the public stock of physical capital will improve national, regional, and metropolitan productivity and economic performance. To examine this possibility at the regional level, including border counties of Texas, an empirical analysis of Texas personal income was completed. Texas includes numerous counties with fairly limited tax bases that will potentially benefit from the stimulus package. Those tax base limitations have caused education and infrastructure investment to historically represent difficult obstacles to economic progress in many counties in Texas, including those on the border with Mexico. While the new fiscal stimulus and economic recovery programs may help buttress education and infrastructure enhancement across Texas, there are relatively few reliable estimates of how such investments may improve, or fail to improve, regional income performance within its boundaries.

To carry out the project, development of educational attainment, public infrastructure, and private capital stock estimates for all 254 counties in Texas was required. Once that time-consuming step was completed, econometric analysis of the contributions of education and physical infrastructure to county per capita income performance was completed. The results will potentially indicate whether the basic assumptions of the Obama administration are accurate. They will also provide an estimate of how much achievements associated with the new program may improve long-run economic prospects for border metropolitan and non-metropolitan economies and whether a solid foundation for future growth is likely to result.

Subsequent sections of the report are as follows: A review of prior studies is provided next. Data and methodology are summarized in the third section. Estimation results follow. A subset of those outcomes is then utilized to simulate the potential gains that can result in Texas border counties as a consequence of the 2009 economic recovery program. Policy implications are also reviewed. The final section includes a summary of the results and implications for the regional effects of the recovery program. Data utilized, econometric equation estimates, and model simulation impacts for all 254 counties are listed in the appendix tables in a separate document, located at http://www.bakerinstitute.org/files/documents/LAI-pub-BorderEconFullertonAppendix-032410.pdf; further documentation will be provided by the author upon request.

Prior Research

A number of empirical studies document positive relationships between education and regional income performance (Rauch 1993). Several of these efforts have been conducted at the sub-state level for different regions of the United States. Rickman (1995) presents evidence of how high school non-completion generates both economic and social costs in counties located in southeastern Georgia. Similarly, Domanzlicky et al. (1996) use least squares regression analysis to help quantify the earning losses associated with high school drop out rates in southeastern Missouri. Statistical estimates in that study indicate that county per capita incomes decline by

$52 for every percentage point decline in secondary school graduation rates. Those results are consistent with those reported for Georgia in Rickman (1995) and with those obtained for southern Illinois by Sloboda (1999).

Several of the analyses on this topic focus on metropolitan economies where human capital premia are frequently very substantial. Glaeser, Scheinkman, and Shleifer (1995) report a positive relationship between human capital and per capita incomes. Simon (1998) documents faster rates of employment growth between 1940 and 1986 in cities with higher concentrations of educated individuals. Those impacts become more pronounced in the latter years of the data sample utilized. In some studies, greater impacts are also found to be associated with college education than with high school education (Simon 1998; Jones 2001).

Using 1990 census data for Texas, Fullerton (2001) documents a negative relationship between high school dropout rates and county per capita incomes. Positive impacts are estimated for increases in the numbers of both secondary and college graduates. That study also documents greater incomes in urban counties, potentially reflecting agglomeration externalities cited elsewhere (Ciccone and Hall 1996; Graham 2007). Statistically significant lower per capita incomes are also reported for counties located directly along the border with Mexico.

Gottlieb and Fogarty (2003) analyze the importance of tertiary educational achievement in metropolitan economies. For the 75 U.S. metropolitan areas in the sample, those with more educated workers experienced faster rates of real per capita income growth. Employment growth is also found to be higher in those markets.

Infrastructure development has also been found, along with education, to contribute to better regional productivity performance (Fan and Zhang 2004; Graham 2008). The results in these studies are by no means unanimous (Garcia-Mila, McGuire, and Porter 1996). In particular, there are important data constraints that prevent comprehensive analyses from being completed in many, if not most, regional economies. A growing body of evidence definitely points to potentially favorable impacts associated with public capital stocks (Bronzini and Piselli 2009).

Partridge and Rickman (2005) utilize logistic regression analysis as a means for examining the probability for counties to remain in poverty. Similar to Fullerton (2001), progressively higher levels of educational attainment are found to increase the likelihood of reducing regional impoverishment. Arellano and Fullerton (2005) report results along the same lines for regional per capita output using data from the 2000 census in Mexico. The latter study deploys population density as a proxy variable to capture the effects of agglomeration externalities and spillovers rather than dummy variables.

Education and public infrastructure must also be accompanied by increases in private capital stocks in order for economic growth to reach its full potential. Destefanis and Sena (2005) find that public capital exercises a significant impact on total factor productivity across different regions in Italy. Core infrastructure, defined as roads, airports, seaports, railroads, and water systems, is found to play a particularly helpful role in the enhancement of overall factor productivities.

Almada et al. (2006) attempt to utilize pooled cross section and time series data from 1990 and 2000 to analyze the relationship between educational attainment and income performance in Texas border counties. Parameter heterogeneity indicates that the data from different years should not be pooled, potentially due to structural economic change occurring within the Lone Star economy. Results obtained using county data from 2000 confirm significant and positive correlations between incomes and education across Texas. Model simulations indicate that border counties can experience large per capita and aggregate income gains by raising county graduation rates up to the state averages for the various categories examined.

This study attempts to assess the impacts of the 2009 economic recovery program on the Texas economy, with particular emphasis directed toward the counties that border Mexico. One step taken in this study that helps distinguish it from prior efforts includes testing with a continuous population variable as a potential improvement over discrete qualitative variables previously utilized for urban counties. Another is the inclusion of public infrastructure stock estimates that may help quantify the permanent impacts of regional recovery program investments. Along that same trajectory, at least one private capital stock estimate is also included to allow the equation specifications to reduce the risk of omitted variable specification bias. A third is the employment of alternative equation specifications that allow for potential diminishing returns associated with additions to any type of human and/or physical capital stocks in regional economies. Details on these steps and the empirical results associated with them are summarized below.

Data and Methodology

Socioeconomic data for all 254 counties in Texas are collected for 2000. Aggregate state and national information for Texas and the United States, respectively, are also collected for comparative purposes. All of the data utilized in the econometric analyses are listed in Appendix A.[1] All of the data collected reflect the executive branch objectives and assumptions regarding long-term regional economic performance. Table 1, below, provides a list of the variable names and descriptions.

Four categories of county educational attainment data for adults over the age of 25 are reported (Table A1). Those categories include the percentage in each county that failed to graduate from high school, the percentage that graduated from high school but did not go any further, the percentage that attended at least some college, and the percentage that successfully completed a four-year bachelor degree program.[2]

Five different demographic variables are included that also have been utilized in prior studies of regional economic performance (Table A3). They are the female labor force participation rate; the basic components for calculating the dependency ratio in each county, the percentage of the population age 18 or less, and the percentage of the population age 65 or younger; the percentage of the population in each county that speaks English only; and the percentage of monolingual Spanish speakers.

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[1] Appendixes and tables are available at (link).

[2] Two additional educational attainment variables are reported in Table A2. Column 2 contains the percentages of adults in each county with graduate or professional degrees. Column 3 includes the sum of the percentages with bachelor, graduate, or professional degrees in each county.

Table 1

Variable Names and Descriptions

Variable	Definition
HSDR25	Percentage of adults 25 and older who have dropped out of high school
HSGR25	Percentage of adults 25 and older who graduated high school
COLSOM25	Percentage of adults 25 and older who attended college partially
BACHGR25	Percentage of adults 25 and older who held a bachelor's degree
GRADGR25	Percentage of adults 25 and older who held graduate or professional degrees
COGR25	Percentage of adults 25 and older who held a bachelor's or professional degree
FLFPR	Female labor participation rate
POPLT18	Percentage of population age 18 or less
POPGT65	Percentage of population age 65 or more
PCTENGL	Percentage of individuals who speak English only
PCTSPNH	Percentage of individuals who speak Spanish only
PCTBLNG	Percentage of individuals who speak both English and Spanish
URBAN	Dummy Variable: equal to 1 if population is over 600,000, 0 otherwise
BORDER	Dummy Variable: equal to 1 if county is adjacent to the border, 0 otherwise
POP	County population
FRNBRN	Percentage of county population born overseas
DENSITY	Population density per square mile
DISTANCE	Distance to the nearest border crossing
AIRPORT	Commercial airport tower operations, total takeoffs and landings
AIRPC	Commercial airport takeoffs and landings per capita
AIRMILES	Miles to nearest commercial airport
CENMILES	Total highway miles owned by the state in each county
CENPC	Highway miles per capita owned by the state
LANEMILES	Total miles of highway lanes owned by the state
LANE	Per capita state highway lane miles
PROP	Private sector property tax valuation, market value
PROPC	Per capita private sector property tax valuation, market value
PCINC	County per capita income
EDUEXP	Total U.S. Department of Education expenditures in each county, instrument

Additionally, demographic and geographic data are included in Table A4: counties that have more than 600,000 inhabitants and/or are located directly adjacent to Mexico, populations for each county in the year 2000, percentage of foreign-born residents, population density per square mile, and percentage of the population that is bilingual in English and Spanish.

The inclusion of the population density and distance to nearest border crossing variables may help avoid two problems commonly associated with regional income studies. By using population density, potentially artificial designations of “urban” and “rural” county qualitative variables do not have to be made. Similarly, employment of the continuous distance variable circumvents the sometimes contentious problem of defining "border" and "non-border" counties (Peach and Adkisson 2000).

Data on public capital stocks in counties are difficult to obtain. Table A5 contains information regarding physical infrastructure for each of the 254 counties in Texas: distance to the nearest border crossing,[3] number of air tower operations, and the number of miles to the nearest airport.[4] Table A5 also includes highway data for each county: center line and total lane miles. Center line miles are the number of state highway miles in each county without taking into account the number of lanes on any of these roads. Total lane miles are the total number highway miles multiplied by the number of lanes available on each road. This variable is also included in the analysis because a 20-mile four-lane highway represents a greater investment in physical infrastructure than does a 20-mile two-lane road.

Air tower operations and highway lane miles are admittedly limited estimates of Texas county public capital stocks. Omitted from the sample are other important infrastructure such as harbors, railroads, water systems, government buildings, state and local education buildings, and public health care facilities. The reason such a small number of infrastructure estimates are utilized is the almost universal difficulty associated with obtaining sub-state regional capital stock estimates, especially for non-metropolitan counties (for discussion, see Haughwout 2002). Although the airport and highway variables are employed as limited and imperfect indicators of public infrastructure stocks across Texas, it was at least possible to obtain data for them for 254 counties.

As with public capital stocks, private capital stock measures for counties are fairly elusive. To minimize the risk of spurious correlation and misattributed returns to infrastructure investments, it is important to incorporate estimates of regional private capital in this type of analysis (see Sloboda and Yao 2008). Table A6 includes one such metric, plus county per capita personal income estimates, for the year 2000. Column 2 reports property tax valuations for residential,

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[3] Because some counties such as Culberson or Dimmit are very close to the international boundary without actually touching it, this information is presented in Column 2.

[4] Because not all counties have commercial airports but may, nevertheless, be located near one, Column 4 reports this data.

commercial, and industrial real estate across Texas for 2000. Column 3 lists per capita income, the dependent variable in the econometric equations, for all of the counties.

The basic functional relationship examined is as follows:

$$PCINC_i = b_0 + \sum_k b_k x_{ki} + e_i ,$$

where $i = 1, 2, 3, \ldots, 254$ for each of the counties in Texas; $k = 1, 2, 3, \ldots, K$ depending on the number of independent variables included; and the e_{it} error term is assumed to be homoscedastic.

The direction of causality is assumed to be from the explanatory variables to the dependent variable. While that assumption is frequently made in this type of study (Sloboda 1999; Almada et al. 2006), it may be erroneous. Because a cross-sectional data set is utilized, deployment of a time series based causality test such as those utilized in other regional studies is not feasible (Leichenko 2000). To examine the risk that endogeneity affects the consistency of the parameter estimates reported, a specification test involving auxiliary regressions is employed below (Davidson and MacKinnon 1989). The test is designed to examine potential endogeneity between education and incomes in the 254 counties across the state.

To analyze the data, three sets of equations are estimated. The first set of equations utilizes specifications based upon those in studies, such as Almada et al. (2006) and Domazlicky et al. (1996). As noted above, those studies have proven highly useful in the analysis of education and regional income linkages. Given that, they provide a logical point of departure for this effort that seeks to build upon the prior body of knowledge by adding capital stock measures for Texas counties.

A potential shortcoming exists with those models, particularly for simulation analytics that involve values that go substantially beyond the bounds of the sample data. Namely, the linear specifications do not allow for diminishing returns. To circumvent that potential drawback, the second set of specifications includes quadratic terms for a number of variables to allow for the possibility that increases in any of the explanatory variable values may eventually yield smaller returns. The third set of equation specifications also allows for potential diminishing returns. It does so by employing data that have been transformed using natural logarithms. Results from all three modeling approaches appear in the appendix materials at the end of the report and are discussed below.

One shortcoming of the models, and the simulations, that cannot be overcome is potential labor force migration to other counties or other states (Alm and Winters 2009). At least some empirical evidence indicates that more highly educated workers in border cities like El Paso are not any more likely to migrate than are less educated workers (Fernández, Howard, and Amastae 2003). Out-migration of educated workers from rural counties cannot, however, be ruled out and has been documented for other regions of the country (Mills and Hazarika 2001). A satisfactory answer to that question falls beyond the scope of this study.

Estimation Results

The first set of equations in Appendix B, Equations 1 through 7, is very similar to those shown in Fullerton (2001) and Almada et al. (2006). As in those earlier studies, key regressors in these equations are the educational attainment variables, HSGR25, COLSOM25, and COGR25. The coefficients for these variables are positive as hypothesized, but the HSGR25 parameters do not satisfy the 5-percent criterion. As in prior studies of the Texas and border economies, all of the estimation results for Equations 1 through 7, and Equations 14 through 21, are corrected for heteroscedasticity.

An important modification to the earlier research for Texas is also included in Equations 1 through 7. In Fullerton (2001) and Almada et al. (2006), dummy variables were employed for border adjacency and urban populations in excess of 600,000. To obtain more precise estimates of the border and agglomeration effects on incomes, Equations 1 through 7 use distance from the nearest border crossing (DISTANCE) and population density (DENSITY) for each county. Utilization of continuous variables as regressors frequently allows for more precise measurement in econometric analyses because they more closely match what the qualitative indicators attempt to reflect.

The parameter estimates for these variables are significant and, in line with studies for other regions, they exhibit the expected arithmetic signs. Worker productivity tends to be higher in metropolitan economies, leading to better income performances in counties with higher populations (Glaeser and Mare 2001). Counties located along the border with Mexico generally face higher rates of poverty and unemployment, along with numerous other economic difficulties (Betts, Slottje, and Vargas-Garcia 1994; Dávila, Mora, and Hales 2009). Those problems tend to be less pronounced in non-border regions.

Also included in Equations 1 through 7 are several variables that measure at least some aspects of the private capital stocks and public capital stocks in each county. Results for the two per capita highway mileage variables, LANE and CENPC, are puzzling. While generally significant at the 5-percent level, the coefficients for these two variables also exhibit counterintuitive signs. The per capita airport tower operations variable, AIRPC, obtains parameters that are greater than zero, but often do not satisfy the significance criterion. The per capita private capital stock variable, PROPPC, performs as anticipated.

Equations 8 through 14 in Appendix B include several different quadratic variables in their specifications. This is an intuitively attractive step to take because it allows for eventual diminishing returns from the different variables affecting regional income. As can be seen in the statistical output for these equations, however, the estimation results are mixed with several unexpected coefficient signs and/or statistically insignificant results. In spite of those outcomes, most of the primary results from the first set of equations are also supported by the second group of regression equations.

Equations 15 through 21 in Appendix B use logarithmic specifications that also allow for diminishing returns associated with the explanatory variables. Again, the results for this set of equations are broadly consistent with those in the first set. The education variables are found to reliably contribute to higher per capita incomes, while the parameter estimates for demographic and public infrastructure are more ambiguous.

As discussed above, the sample data for this project cannot be utilized for classical time series causality tests. Three sets of endogeneity tests are carried out, however, using an artificial regressions procedure involving an instrumental variable (Davidson and MacKinnon 1989). Such a test requires an instrumental variable that is exogenous to the sample. To satisfy that requirement, total U.S. Department of Education expenditures in each county are utilized as the instrument. The values of that variable for each county are reported in Column 4 of Table A6.

The consistency test is carried out for the high school graduate (HSGR25), partial college attendance (COLSOM25), and college graduate (COGR25) explanatory variables. The test is conducted for linear specification, linear specification with quadratic terms, and logarithmic specification versions of the basic per capita income equation. Results are shown for Equations 1, 8, and 15 in Appendix B. Rejection of the null hypothesis in favor of the endogeneity alternative occurs for the logarithmic specification, but not for the linear or linear with quadratic term specifications. On the basis of those outcomes, plus the estimation results, Equation 1 is employed for all of the income simulation exercises completed below.

Given the estimation results for the three sets of specifications, it is apparent that simulations using models that include the demographic and public infrastructure variables from this sample will not generate reliable impact estimates. That raises some uncertainty with respect to the Obama administration's assumptions regarding the regional benefits associated with greater investments in physical infrastructure. More confidence can be attached, however, to impact simulations that examine the consequences of greater educational attainment in each county.

Simulation Results

Table 2 reports the border county potential income gains associated with increasing high school graduation rates to the Texas state average. Also included in these calculations are three counties whose boundaries do not quite reach the border with Mexico, but come very close (Culberson, Dimmit, and Jim Hogg).[5]

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[5] Estimates of the impacts of matching the state high school graduation rate for all of the Texas counties are listed in Appendix C, Table C1, available upon request to the author.

Table 2

Border Income Gains from Increased High School Graduation Rates

County	Per Capita Impact	Aggregate Impact
Brewster	$154.99	$1,374,137
Cameron	$195.78	$65,629,458
El Paso	$93.81	$63,754,942
Hidalgo	$187.62	$106,841,981
Hudspeth	$175.38	$586,480
Jeff Davis	$240.64	$531,096
Kinney	NC	NC
Maverick	$248.80	$11,767,441
Presidio	$203.93	$1,489,530
Starr	$326.29	$17,488,359
Terrell	NC	NC
Val Verde	$4.08	$182,953
Webb	$281.43	$54,348,578
Zapata	NC	NC
Culberson	NC	NC
Dimmit	NC	NC
Jim Hogg	NC	NC

As shown in Table 2, the impacts of raising high school completion rates to the state average are fairly remarkable for several of the border counties. In per capita terms, the single biggest gain is calculated for Starr County in the Rio Grande Valley region of South Texas. Nearby Hidalgo County, home to Edinburg, McAllen, and Pharr, is where the largest total income gain is tallied, $106.8 million.

Table 3

Income Gains from Increased Limited College Attendance

County	Per Capita Impact	Aggregate Impact
Brewster	NC	NC
Cameron	$1,843.09	$617,855,085
El Paso	$268.78	$182,671,951
Hidalgo	$3,033.43	$1,727,424,204
Hudspeth	$3,571.00	$11,941,410
Jeff Davis	$2,419.06	$5,338,869
Kinney	$1,727.90	$5,838,578
Maverick	$4,415.75	$208,851,612
Presidio	$4,722.93	$34,496,281
Starr	$4,991.71	$267,540,929
Terrell	NC	NC
Val Verde	$2,342.27	$105,064,688
Webb	$2,457.46	$474,577,209
Zapata	$2,764.64	$33,678,868
Culberson	$3,954.97	$11,766,047
Dimmit	$2,995.03	$30,693,055
Jim Hogg	$1,919.89	$10,138,940

Estimates for the impacts of increasing partial college attendance in border counties to the Texas state average are shown in Table 3.[6] In per capita terms, the largest impact shown in Table 3 is also for Starr County, with similar gains estimated for Maverick and Presidio counties. The greatest potential increase in aggregate terms is again calculated for Hidalgo County, $1.727 billion.

Estimates of the impacts associated with raising border county college graduation rates to the state average appear in Table 4.[7] Starr County and Zapata County are where the biggest income improvements are calculated in per capita terms. Hidalgo County and El Paso County are both estimated to achieve total income gains in excess of $1.3 billion each.

The magnitudes of the estimates in Tables 2 through 4[8] highlight the critical role that education plays in the Texas state economy. They also illustrate the importance of school enrollment and labor force quality enhancement efforts in border regions of Texas. Although the models shown

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[6] The corresponding impacts for all counties in the state are reported in Appendix C, Table C2.

[7] The impacts of doing so in all Texas counties are detailed in Appendix C, Table C3.

[8] As well as those presented in Appendix C.

in Appendix B incorporate data not previously employed in prior studies of border economic performance, the empirical results obtained are similar to those reported in the earlier efforts. Once again, the magnitudes of the gains reported underscore the tangible improvements in personal income that are currently foregone due to shortfalls in educational attainment.

Table 4

Income Gains from Increased College Graduation Rates

County	Per Capita Impact	Aggregate Impact
Brewster	NC	NC
Cameron	$2,915.47	$977,344,844
El Paso	$1,963.48	$1,334,424,862
Hidalgo	$3,064.22	$1,744,960,083
Hudspeth	$4,016.21	$13,430,209
Jeff Davis	NC	NC
Kinney	$1,636.23	$5,528,835
Maverick	$4,194.71	$198,397,168
Presidio	$3,421.22	$24,988,568
Starr	$4,849.20	$259,902,733
Terrell	$1,249.49	$1,350,696
Val Verde	$2,707.22	$121,435,228
Webb	$2,766.72	$534,301,280
Zapata	$4,313.71	$52,549,593
Culberson	$2,766.72	$8,231,001
Dimmit	$3,897.21	$39,938,631
Jim Hogg	$4,075.71	$21,523,827

Policy Implications

High school drop out and non-completion rates tend to be relatively high in Texas border counties. As shown in Table 2, the gains from addressing this issue are substantial and will help strengthen local tax bases by fairly impressive amounts. When feasible, school districts should be provided with additional resources to reduce drop out rates, and some steps in that direction are being taken by congress and the Obama administration.

As illustrated by Tables 3 and 4, there are substantial income gains that result from increased enrollments in post-secondary educational programs, as well. To help capture those gains, recruitment efforts should be strengthened for technical schools, community colleges, and four-year traditional colleges and universities in border counties. Because income levels are below the state average, procurement of additional scholarship and grant monies may be particularly helpful for these areas of Texas.

Comprehensive infrastructure data are hard to come by at the county level. The two partial measures used above are imperfect. The equations do indicate, however, that increased commercial air activities are associated with higher incomes. Investments in maintenance and enhancements to those resources will likely generate positive returns to regional economies throughout the state. For highway lanes, the results are not so clear-cut, but it would be a mistake to interpret these results as a reason for neglecting roads and bridges in Texas.

The results also indicate that strong income performance is supported by the presence of a private capital stock in each county. To encourage private sector investment, border counties should look seriously at ways to streamline licensing and permitting procedures. They should also ensure that regulatory processes are clear and unambiguous. Incentive programs involving specialized infrastructure development or educational training programs are likely to be helpful.

Many regional governments throughout the nation have property tax abatement programs as part of their business recruitment arsenals. Historically, the track record of these programs at the local level is suspect. Empirical evidence for El Paso strongly suggests that cash-strapped border counties and municipalities with limited tax bases should avoid implementing these types of programs (Fullerton and Aragones-Zamudio 2006).

Conclusion

Material in this study extends earlier research regarding regional income performance in Texas border counties. Specific steps taken include utilization of border distance and county population density measures in place of qualitative dummy variables employed in prior efforts. Also included in the data sample are measures of the private capital stock and limited indicators of public infrastructure stocks across the state. Finally, different sets of econometric specifications that allow for diminishing returns are also estimated.

Results obtained corroborate some of the key findings in earlier research for Texas regional economic performance. The addition of the population density, distance to the border, and private capital stock variables to the empirical framework appears useful. Inclusion of the airport tower operations variable appears somewhat useful, but the per capita highway mileage outcomes are ambiguous. That may be because these variables omit other critical infrastructure components such as municipal water systems. Given the critical role of public capital stocks in regional economies, more analysis of this issue for Texas and its border counties would be helpful.

The empirical analysis completed in this study is for counties located on the north side of the Rio Grande only. Data constraints are more binding in Mexico, but an analysis of regional economic performance that makes use of the 2005 census data would be useful. Given the accelerated rates of tertiary sector development on both sides of the border, the premia to education documented in this study are likely to be relevant for many years to come.

Bidirectional causality between income and the various regressors cannot be ruled out and represents a potentially important issue to examine in future research regarding regional economic performance across Texas and the border counties. Because of that, income simulations related to greater educational attainment are conducted only with an equation that satisfies a parameter consistency condition. Future work in this area can potentially tackle the endogeneity issue by employing county-by-county time series approaches, multicounty panel data methods, or a structural equation modeling strategy. Data requirements for any of these alternative techniques will be fairly intense, but the results from such efforts may shed light on an important question regarding regional economic growth.

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