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DO PUBLIC SUBSIDIES FOR HIGHER EDUCATION AFFECT REGIONAL ECONOMIC DEVELOPMENT?

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INTRODUCTION

In fiscal year 2006 state and local governments contributed nearly $77.7 billion to higher education across the United States, of which 91 percent was from state funding sources (SHEEO 2007, 15). The vast majority – 78.9 percent – of this state/local government spending contributes to the general operating expenses of public higher education institutions, while 12.3 percent is allocated for research purposes, medical education, or agricultural extension (SHEEO 2007, 16). In terms of state and local tax revenues that were devoted specifically to public higher education, the average across the United States from 1994 to 2004 fluctuated around a mean of 7.1 percent (standard deviation of 0.33) (SHEEO 2007, 45).

What do state and local policymakers expect from their fiscal devotion to public higher education? Labor economists have devoted a significant amount of attention to the important role that human capital formation, such as attaining a college education, plays in an individual's labor market success. Of course, more productive citizens contribute intellectual capital to an economy, as well as future tax revenue. On the other hand, some proponents of publicly-supported higher education tout its effect on the real economy. For example, the Texas Comptroller of Public Accounts (2005) claimed that "Higher education has a significant impact on the Texas economy, fueling the Texas economic engine with $33.2 billion a year. Considering that the system receives approximately $6 billion annually in state general revenue and local property taxes, every dollar invested in the state's higher education system eventually returns $5.50 to the Texas economy." Similarly, the authors' institution, the University of California, Merced, opened to its first class of undergraduates in 2005. UC Merced is the tenth campus of the behemoth University of California system, yet has struggled for budgetary survival since the campus' creation was first announced in 1998. One of the central arguments that campus proponents rely on in their on-going political lobbying is the link between the university's success and the region's economic growth. In press releases UC Merced "has been heralded as the key driver for economic development in the San Joaquin Valley, providing jobs on the campus, and spurring economic development nearby. With technology as a focus in the classroom and improved technological infrastructure a goal for the region, UC Merced is expected to bring to the Central Valley some of the growth experienced in the rest of the state, particularly in Silicon Valley and the Bay Area."[1] Despite the importance that policymakers and local boosters of public higher education institutions place on the economic impact of the institutions, very little is understood about how the higher education industry affects the real economy. Therefore, the goal of this paper is to begin to fill the gap in our understanding of how state spending on public higher education affects local economic growth. The paper represents a starting point in a longer-term project that will analyze the interaction between the economic and political forces that have shaped the course of higher education in the United States since World War II.

State policymakers tend not to couch their fiscal support for higher education simply in terms of stimulating local economies, but in the broader context of encouraging or motivating the development of high-technology in the state or training a workforce that can compete in an increasingly global economy based on knowledge and information. Despite the oft-cited argument that public investment in higher education is central to a region's or state's economic progress, the small amount of research on this idea is decidedly mixed. Beeson and Montgomery

[1] http://www.pgecorp.com/news/press_releases/Release_Archive2000/033100press_release.shtml. See also Siegfried, Sanderson, and McHenry (2007) for a compilation of similar sentiments from across the country that extol the purported economic virtues of universities on local economies.

(1993) find that the quality of a university has a positive impact on regional employment growth rates and on the percentage of the labor force employed as scientists and engineers. Their analysis, however, could not reject the hypothesis that university quality had no impact on regional income, employment, net migration, or the share of employment in high-tech industries. Bania, Eberts, and Fogarty (1993) analyzed the relationship between university spending on research and new business start-ups in 87 high-tech manufacturing industries. They found that the university-research/new-business linkage only existed for 19 industries in the general area of electrical and electronic equipment (SIC 36). In the general industry classification Instruments and Related Products (SIC 38), no linkage between university research and business startups were found. Alternatively, Anselin, Varga, and Acs (2000) focused on the relationship between university research spending and reported new business innovations. They found strong research spillovers in both the equipment and instruments industries, but no statistical connection in the drugs and chemicals industry category (SIC 28) or in the machinery sectors (SIC 35). Finally, looking at the change in average earnings as their outcome variable, Goldstein and Renault (2004) conclude that university research and technology spending had a statistically significant impact on regional economic development, yet the economic effect was quite modest. Moreover, Goldstein and Drucker (2006) focus on average earnings in Metropolitan Statistical Areas (MSAs) and find that university research and development expenditures strongly affected earnings in a statistical sense, but again the economic effect was small. They further found that a greater number of science degrees tended to depress earnings, while graduate degrees was associated with higher earnings. While flooding a local economy with a supply of graduates can lower earnings, as a supply/demand model would suggest, generating highly-trained graduate-level workers had the opposite effect. The authors found no evidence that university patenting activity had any impact on earnings. Goldstein and Drucker (2006, 36) conclude that their findings offer "at least a partial validation of state and local policies designed to improve economic circumstances by creating or bolstering the economic development function as well as the more traditional research and human capital creation activities of regional universities."

In terms of tackling the fundamental research question regarding the link between higher education and regional economic development, Goldstein and Renault (2004, 734) clearly articulate a set of questions that scholars have largely ignored: "To what extent do institutions of higher education, and research universities specifically, generate regional economic development outcomes that would otherwise not occur? Which university-based activities, e.g. teaching, basic research, extension and public service, technology transfer, technology development, businesses spinning off from university research, etc., are most responsible for any net regional economic development impacts from the presence of universities? Through what mechanisms or channels does knowledge production (broadly considered) within universities lead to economic development outcomes in the surrounding region?"

Using previously unexplored data on each public institution's own reporting on their various revenues and expenditures, the overarching research project will explore how these expenditures have affected various measures of economic development. The research will be both temporally and spatially broad, at first spanning a time period from 1968 to present, but the ultimate goal is to consider the higher industry sector from the World War II era. Further, the spatial scope of

the project will be broad, spanning the hundreds of specific communities in which a public institution of higher education resides.

ANALYTICAL FRAMEWORK

As Siegfried et. al. (2007) point out, properly measuring the economic impact of public higher education institutions depends on one's definition of the "local area" and the research question at hand. In this particular paper and phase of the research, our focus is state-level expenditures and its impact on the state economy. In future work we plan to explore the impact of public higher education expenditures at the local level, such as the county or MSA. But given the dearth of economic research into the question generally, our goal in this phase of the work is to begin at the state level so that we can first better understand the political economy and economic impact of states' investments in their public universities.

Measuring the impact of public university expenditures on local economic growth is complicated by the fact that spending is not purely exogenous and omitted variables are a concern. For example, as university regions developed, along with the prospective increase in economic activity, this broader base may have contributed to more effective political lobbying on behalf of the university. Or as income increased, perhaps as a result of an investment in a state's universities, politicians and their constituents may have been more willing to devote resources to their higher education institutions (i.e., education is a normal good). Thus, university expenditures might have been positively influenced by measures of economic activity, which would tend to bias OLS estimates upward. Yet, an argument could be made that OLS estimates could be biased downward as well. For instance, in an empirical specification that controlled for state and year fixed effects, it would be unrealistic to expect that annual fluctuations in spending would have a large, immediate impact on real economic outcomes. Thus, without understanding the proper lagged relationship between higher education spending in one year and future economic growth, the OLS estimate of the relationship would be biased downward. The direction of the bias becomes an empirical question that we are able to explore in our estimations.

Given the simultaneity and endogeneity biases, we adopt an instrumental variables (IV) approach. The basic equation that we estimate can be expressed as:

$$O_{it} = \beta_0 + \beta_1 \ln E_{it} + \gamma_t T + \lambda_i S + \varepsilon_{it} \quad (1),$$

where O_{it} is the specific economic outcome variable under consideration in state i in year t, $\ln E_{it}$ is per capita state spending on higher education institutions, T represents a vector of year fixed effects to capture any shocks that were experienced by all states in a specific year, and S is a vector of state fixed effects that control for unobservable factors that did not vary over time, but varied across the states. We consider two economic outcomes in this paper: the natural log of per capita income and an index of housing prices from the OFHEO. The time period considered in our analyses is 1970-1996 for per capita income and 1975 to 1996 for house prices.

After controlling for the state and year fixed effects in the analysis, the instrument that we use must be correlated with higher education spending but uncorrelated with the estimated error term of the economic outcome regression. Because of the state and year fixed effects, our instrument needs to vary over time as well as across states. To achieve this end, we rely on two

variables that help to explain the political environment in which higher education spending was determined across states and time. The first variable takes the value of 1 if the state had in place policies that restricted the fiscal freedom that the legislative and executive branches faced in year t, and 0 otherwise. These policies presumably restricted state politicians' abilities to raise tax revenue, which no doubt served to restrain state spending on all budget items, including education. Thus, we would expect a negative coefficient in the first-stage regression. We also include this variable in the second-stage regression, as diminished taxing ability no doubt helped determine the level of economic activity in a state. The second variable we develop, which is our identifying instrument because it is excluded from the second-stage analysis, is an interaction between the aforementioned dummy variable and a second dummy variable taking the value 1 if the state's higher education institutions submitted a consolidated budget request to the legislature, and 0 otherwise. The idea is that in states that might have enacted policies that limited the discretion that politicians had over budget matters, if the state's various universities lobbied together they were likely to fair better than in states where each campus attempted to strike its own budget deal. The interaction of the two variables provides the variation across time and state, as different states adopted budget limitations at different times and al states had separate, unrelated policies governing the submission of the state's higher education budget(s).

RESULTS

The per capita income and house price index regression results are reported in Tables 1 and 2, respectively. Column (1) of both tables reports a baseline OLS estimation, while column (2) adds the state and year fixed effects in the OLS setting. A couple of changes from columns (1) to (2) are worth noting. First, the R^2 jumps radically when the fixed effects are added. Indeed, almost all of the variation in per capita income or house prices can be explained simply with a state and/or year dummy variable. The chance that another factor, such as higher education spending within the state, would have a large impact on these economic outcomes is rather low. Second, the OLS estimate of higher education's impact on per capita income falls when the fixed effects are added, yet it is statistically significant and very small. The OLS estimate in the house price regression also falls in absolute value and is insignificantly different from zero. The relatively small coefficients of the higher education variable seems to provide evidence that once state and year structural trends are considered, the year-to-year fluctuations in higher education spending have little impact on the real economy. This finding lends support for our IV approach.

TABLE 1: THE EFFECT OF STATE APPROPRIATION HIGHER EDUCATION SPENDING ON PER CAPITA INCOME 1970-1996

DEPENDENT VARIABLE = LOG (PER CAPITA INCOME) (1996 $)

	Baseline	State & Year Fixed-Effects	IV: State & Year Fixed-Effects	
			Second Stage	First Stage
	(1)	(2)	(3a)	(3b)
Log (State Appropriation Revenue Per Capita) (1996 $)	0.043*** (0.020)	0.019** (0.006)	0.276*** (0.080)	–
State Revenue Limit	–	–	0.050*** (0.017)	-0.252*** (0.049)
State Revenue Limit x Consolidated Higher Education Budget	–	–	–	0.336*** (0.080)
First-Stage Excluded Instrument F-Statistic	–	–	–	17.76 [0.0000]
Year Fixed-Effects	NO	YES	YES	YES
State Fixed-Effects	NO	YES	YES	YES
State Linear Trends				
	NO	NO	NO	YES
Adjusted R2	0.01	0.99	0.99	0.97
Number of Observations	1242	1242	1242	1242

Notes: Source: Author's Calculations using IPEDS/HEGIS and Bureau of Economic Analysis data. Each column in the table reports the results from one specification. The main entries are coefficient estimates, the entries in parentheses are standard errors and the entries in square brackets are p-values. The models in columns (1) to (4) contain no other controls than those listed. The model in (5) contains a dummy variable indicating that the state has an active revenue limit in that year. The instrumental variable in (5) is the interaction of the presence of an active revenue limit and whether higher education institutions prepare a consolidated budget for the state system. * indicates significantly different from zero at the 10% level of significance; ** indicates significantly different from zero at the 5% level of significance; *** indicates significantly different from zero at 1% level of significance.

TABLE 2: THE EFFECT OF STATE APPROPRIATION HIGHER EDUCATION SPENDING ON HOUSE PRICES 1975-1996

DEPENDENT VARIABLE = HOUSE PRICE INDEX

	Baseline	State & Year Fixed-Effects	IV: State & Year Fixed-Effects	
			Second Stage	First Stage
	(1)	(2)	(3a)	(3b)
Log (State Appropriation Revenue Per Capita) (1996 $)	-7.25*** (1.96)	-8.80 (5.48)	301.42*** (95.87)	–
State Revenue Limit	–	–	59.73*** (13.73)	-0.182*** (0.042)
State Revenue Limit x Consolidated Higher Education Budget	–	–	–	0.225*** (0.062)
First-Stage Excluded Instrument F-Statistic	–	–	–	13.15 [0.0000]
Year Fixed-Effects	NO	YES	YES	YES
State Fixed-Effects	NO	YES	YES	YES
State Linear Trends	NO	NO	NO	YES
Adjusted R2	0.01	0.80	0.99	0.97
Number of Observations	1012	1012	1012	1012

Notes: Source: Author's Calculations using IPEDS/HEGIS and OFEO House Price Index data. Each column in the table reports the results from one specification. The main entries are coefficient estimates, the entries in parentheses are standard errors and the entries in square brackets are p-values. The models in columns (1) to (4) contain no other controls than those listed. The model in (5) contains a dummy variable indicating that the state has an active revenue limit in that year. The instrumental variable in (5) is the interaction of the presence of an active revenue limit and whether higher education institutions prepare a consolidated budget for the state system. * indicates significantly different from zero at the 10% level of significance; ** indicates significantly different from zero at the 5% level of significance; *** indicates significantly different from zero at 1% level of significance.

The last column in each table shows the first-stage results. As expected, state revenue limits restricted a state's expenditures for higher education. If a state had such a policy in place, all else equal, higher education spending was between 18 and 25 less than it otherwise would have been. The coefficients in both first-stage regressions are statistically significant at the 1 percent level. Interestingly, however, if a state's higher education institutions submitted a consolidated budget to the state legislature and lobbied as a unit, they were able to offset the negative impact of the revenue limiting policy. Universities submitting a consolidated budget in revenue restricted states saw their budgets enhanced on the order of 23 to 34 percent, more than offsetting the original negative impact from the revenue limiting policy. It is important to note that the coefficients of the interaction instrument are highly statistically significant in both first-stage regressions and the F-test that the set of instruments are jointly zero can be rejected at high confidence levels.

Column (3a) in each table reports the second-stage results and in both cases the higher education variable is much larger than the OLS coefficient and the IV coefficients are both statistically

significant at the 1 percent level. The coefficient in Table 1 suggests that a 1 percent increase in per capital higher education expenditures increased a state's per capita income by .28 percent. The coefficient in Table 2 suggests that a 1 percent increase in higher education funding increased housing process by about 3 percentage points (301 basis points).

The question naturally arises why the IV results show such a strong impact of higher education, even after including state and year fixed effects. Given that we have virtually eliminated the average level of spending in each state and controlled for idiosyncratic budgetary effects common to all states (such as recessions), it is remarkable that any annual fluctuations in higher education spending could impact per capita income. However, we believe that the construction of our instrument suggests that we have identified a structural break in the data that was caused by the introduction of the budget limit policies across the U.S in the modern era. The fact that states with and with budget limiting policies and with and without consolidated budgeting took different paths in funding their universities has provided us with a "natural experiment" to understand the impact of higher education funding on real economic outcomes.

CONCLUDING REMARKS

Despite the importance that state and local policymakers and economic boosters place on public support of higher education as a source of economic growth, surprisingly little economic research has explored the connection between the two. This report represents the starting point in a long-term project that will explore the political economy of higher education in the United States since World War II. Public higher education experienced a dramatic shock as a result of the GI Bill and American preeminence in higher education since then has contributed greatly to the United States's lead in research, development, and technology. Gaining a better understanding of the public's support for higher education institutions will offer new insights into the economic growth of the United States over the course of the last century.

The specific goal of this paper has been to analyze modern, state-level data on public expenditures for higher education and its impact on per capita income and house prices. We have constructed a new panel data set based on data from the U.S. Department of Education that reports institution-level revenues and expenditures. The analysis in this paper has aggregated the individual data up to the state level. Our empirical results indicate that controlling for spending within each state and within each year across states explain almost all of the variation in per capita income and house prices. These variables are very stable, so finding an effect from higher education spending would be challenging. The OLS estimate indeed indicates a very small higher education effect on per capita income or house prices. Yet when we re-estimated the equation using an IV approach, we were able to detect a much larger impact. Controlling for the downward bias of the OLS estimate turns out to be critical in understanding how public support for higher education impacts the real economy. Our results indicate that a 1 percent increase in per capita public higher education expenditures increased per capita income by .28 percent. The impact on house prices was even more pronounced. The results here lend support to the argument that universities can provide benefits to a state's economic base. Future research will explore the pathway by which this public spending affects the real economy and the political process that leads to changes in public support for universities.

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