Community College Growth Opportunities: Untapped Potential in America's Heartland?*

Terance J. Rephann

http://www.equotient.net

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Abstract: Over 1,100 two year public institutions have been established in the United States which enroll almost two-fifths of all students in post-secondary education. However, some parts of the country may not be adequately served by these educational institutions despite demand and supply indicators that indicate future growth potential in the sub-baccalaureate educational market. This paper examines the geographical, demographic, and economic characteristics of counties which host community colleges. It finds that community college access is uneven. A multiple regression analysis reveals several correlates with community college location and identifies counties where opportunities may exist to "seed" additional community colleges.

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1.0 Introduction

Community colleges have received more attention recently among rural and regional researchers as potential economic catalysts for rural and lagging regions. A 2001 special issue of *Rural America* published by the Economic Research Service focuses on the benefits of community colleges (see Liston and Swanson 2001; Rosenfeld, 1991; Rubin 2001). Two recent conferences on rural economic development organized by the Kansas City Federal Reserve Bank's Center for Rural America featured presentations that addressed the contributions that community colleges could make in rural development. (See Jischke 2000; Drabenstott, Novack, and Weiler 2004). Yet for some areas of rural America, as will be shown in this paper, geographical access to community colleges may be limited.

Community colleges occupy a growing niche in the higher education market. The number of public two year colleges has grown from 19 in 1915 to 1,077 in 1998 (Cohen and Brawer 2003). The greatest periods of growth occurred during the 1960s but leveled off in the 1990s. Community colleges are distinguished by being publicly supported institutions which offer two year (associate) degrees, relatively affordable tuition, and an open door admissions policy. Financial, geographic, and educational access are at the core of most community college missions, and this is reflected in fairly diverse programmatic offerings that address the varied needs of community residents, including transfer education, career education, non-credit or continuing education, adult education, contract workforce training, and small business/entrepreneurship development training. The sizes of these functions vary by community college based on institutional missions,

community needs, and the size and maturity of the particular institution. Community colleges also serve a somewhat different demographic than four year colleges and universities. Their students are more likely to be first generation, female, minority, part-time students, currently employed, and older (Hamm 2004; Wilson 2004). Because of the open door admission policy of community colleges, their students typically reflect a lower high school achievement levels than four year college and universities which often use selective admission criteria.

Some economists who have studied community colleges regard it a neglected area of study within the social sciences (Kane and Rouse 1999; Cohen and Brawer 2003). Indeed, the bulk of economic research on post-secondary education is concerned with universities and/or the benefits that accrue from obtaining a baccalaureate degree.

There are, however, good reasons to focus more scholarly research on the contributions of community colleges. First, much of higher education occurs in institutions that offer educational credentials below the baccalaureate. National Center for Education Statistics data (U.S. Department of Education 2003) indicate that 38% of total post-secondary enrollment occurs in public institutions offering associate (2-year) level awards as their highest degree. Moreover, they account for approximately 44% of total undergraduate enrollment and 54% of all public undergraduate enrollments. Community colleges serve as an important gateway to education for many first-generation, minority, and working-age adults and provide opportunities for economic and social mobility that might not otherwise exist. Secondly, while most studies show that an associate's degree offers a lower private rate of return than a four year degree, they tend still to show a favorable rate of return (Grubb 2002a, 2002b). Thirdly, there are

significant projected gaps in workforce readiness for future jobs, and the fastest growing occupations are in those semi-professional fields requiring associate degrees or certificates such as health vocations. These shortages may be more acute in some areas because of significant regional disparities among U.S. counties in the availability of associate degree level educated residents. Fourth, community colleges are important economic development resources for their communities and a potential source of "intellectual capital" for rural areas (Young 1997).

This paper is concerned with the regional distribution, institutional characteristics, and geographical gaps for community colleges. For the purposes of this paper, a community college is defined as any public educational institution identified as a public two-year institution by the U.S. Department of Education.[1] There are other sectors of the sub-baccalaureate educational market including private junior colleges and technical schools that offer one year certificates and associate degrees. Moreover, some four year colleges and universities offer sub-baccalaureate degree opportunities along with higher degree offerings at their main campuses and branch locations. Each of these kinds of institutions, however, is excluded from the analysis reported here because they play somewhat different roles in higher education and their communities than community colleges. Focusing on the two year public college sector, the argument will be made that the market for community colleges is not yet saturated and that rural economic development may be assisted by filling in the rural "grid" in underserved markets with full-service community colleges.

This paper is divided into several sections. The second (next) section examines arguments for and against community college expansion. The third section describes

spatial characteristics of community colleges. The fourth section provides a multivariate regression analysis of community college location and identifies possible geographical gaps in community college availability. The paper concludes with a summary and conclusion.

2.0 Challenges and Opportunities for Community College Expansion

There are conflicting assessments regarding the need and prospects for additional community colleges. The most prevalent view is that needs are currently being met with the existing network of U. S. community colleges, especially when augmented by the availability of new distance learning technologies. According to Cohen and Brawer (2003):

> "The number of public community colleges will hardly change; practically all the colleges necessary had been built by 1975, when a college could be found within commuting distance of nearly all the people in all but a few states. The number has remained constant ever since, reaching stasis at under eleven hundred. Change in this group will occur only to the extent that public universities organize additional two-year branch campuses or community colleges upgrade satellite centers to full campus status."

Cohen and Brawer's conclusion, however, appears to be based largely on a 30 year old study (Cohen 1972) that determines community colleges to be built out when 90-

95 percent of a state's population lives within commuting distance (25 miles) of a community college.[2] Using 1970 population data, Cohen (1972) estimates that 1,074 community colleges would be needed, approximately 160 fewer than existed at that time. However, much has changed in the nation's demographics in the last 30 years, with markedly more northeast to south and western migration, a huge influx of international migrants into the U.S., and continued decentralization of population from core populated areas. As the next section will show, there are still underserved areas in the United States using the Cohen criterion.

There are, however, potential obstacles to community college growth. The first is the costs of establishing and running a new institution. According to Rubin and Autry (1998), "the rule of thumb" is that "a college needs at least 1,000 students to be financially viable—to generate enough credit hours to cover its administrative cost." Many rural area educational market areas may not be sizeable enough to attract this number of students. The second threat is competition from other educational sectors such as proprietary schools like Devry University and University of Phoenix that have multiple branches and are adept at expanding into new markets and utilizing new distance learning technologies (Hamm 2004). The other threat comes from four year public colleges/universities. Although not always as entrepreneurial as their private, for profit counterparts, they can still be formidable in lobbying their state governments for public higher education allotments. This fact may partly help to explain the finding that "States with more developed four-year college systems tend to have less developed two-year college systems, and vice versa, suggesting that states choose to invest in one system or the other" (Kane and Rouse 1999).

There are reasons, however, to believe that the obstacles may not be insurmountable. For starters, there are powerful forces of demand and supply that are auspicious for community college enrollment growth. On the demand side, according to the *Occupational Outlook Handbook* (U.S. Department of Labor 2002), the greatest growth in demand over the period 2000-2010 will be for workers with associate degree level education. The supply of educable students will also increase. Martinez (2004) estimates that the pool of community college students could increase from 12.9 percent to 46.4 percent based on current and projected population growth and depending on the assumptions made about college attendance rates.

Furthermore, state level studies of community college needs identify deficiencies in community college availability. A report to the Pennsylvania Commission for Community College (National Center for Higher Education Management Systems 1996) finds significant gaps in community college geographical accessibility. Miller and Dziagwa (1997) report similar gaps for West Virginia and indicate that progress has been slow because of: (1) a lack of state financial resources, (2) a reliance on 4-year institutions to meet the needs for higher education, and (3) a widespread perception that more community college level education is not needed.

3.0 Geographical Characteristics of Community Colleges

Two questionable assumptions about the geographical characteristics of community colleges can be found in the literature on community colleges. The first, identified in the last section, is that the higher education market is already adequately

served by existing community colleges. A second is that community colleges already favor rural areas or in the words of Young (1997) "approximately half of all community colleges nationally are rural."

The first assumption can be evaluated by computing the percentage of the population that lies within 25 miles of a community college with more contemporary data. Community colleges were selected by choosing the addresses of active, two year, public colleges from a National Center for Educational Statistics (NCES) Integrated Post-secondary Education Data System (IPEDS) database.[3, 4] These addresses were then geo-coded and distances to populated areas calculated with 2000 U.S. Census TIGER zip code area population centroids and zip code area population files.[5] Table 1 shows a breakdown by state of the percentage of the population that is within 25 miles of a community college. Using the lower range of the Cohen criterion (90 percent within 25 miles), 31 states fall short. Using the upper range (95 percent within 25 miles), 35 states are underserved. Assigning the community colleges to counties using zip code data[6] further reveals that roughly one-fourth (889 out of 3,141) of the counties currently actually host a community college. These counties account for approximately 75% of the U.S. population.

The second assumption can be assessed utilizing the same data. Within IPEDS, institutions self-identify their locations based on an urbanization index. However, only 8% describe themselves as "rural" and an additional 33% are "small town." Furthermore, by categorizing the community colleges county locations as either metropolitan or non-metropolitan[7] one finds that sixty-four percent of community colleges are located in metropolitan areas. While it is certainly true that community colleges are

disproportionately located in non-metropolitan areas relative to the U.S. population distribution (36% of community colleges versus 17% of the Census 2000 population are located in non-metropolitan areas), enrollment is not. Only 14% of community college enrollment occurs in non-metropolitan institutions. That is because non-metropolitan institutions tend to be smaller (see Figure 1). The average size of a non-metropolitan community college is 2,037 students versus 7,150 students in metropolitan areas and only 41% have 2,000 or more students compared to 81% of metropolitan community colleges. In addition, fully 36% of non-metro community colleges have enrollment levels below the purported 1,000 rule of thumb student threshold purported to be needed for viability.

The fact that community colleges are more dispersed than most other types of post-secondary institutions perhaps reflects their "public" character as well as their less specialized offerings. Figure 2 shows the percentage of different segments of the higher education market located in non-metropolitan areas. Community colleges at 36.4% rank second to one year public technical schools (37.1%) in terms of the share located in non-metropolitan areas and ahead of public four year colleges/universities (25.2%). Further disaggregation along the Rural Urban Continuum[8] shows community colleges to be spatially different than their public four year and technical school counterparts (see Figure 3). The rural-urban gradient of community colleges increases from the first category (Counties in metropolitan areas of 1 million population or more) to the fifth category (Non-metropolitan counties that are not adjacent to a metropolitan area but have urban populations of 20,000 or more) with the fifth category being the mode. In contrast both public four year colleges/universities and public technical schools show more of an undulating spatial continuum pattern. In general, public institutions are more

dispersed than non-profit institutions and non-profit institutions more than private institutions. Also, community colleges are more dispersed than public four year colleges but slightly less dispersed than public technical schools.

4.0 Analysis of Geographical Gaps

A series of exploratory probit regressions conducted using variables shown in Table 2 for 3,141 counties and county equivalents[9] help to identify several "stylized facts" about community college location patterns. Linear constraints in the manner recommended by Suits (1984) and in particular Kennedy (1986) were imposed in order to obtain readily interpretable coefficients for each spatial continuum dummy variable instead of arbitrarily dropping out one dummy variable as is often done. The dependent variable (***CC***) indicates whether or not a county contains a community college (1=Yes, 0=No). Three regressions are reported (see table 3). The first includes mainly variables that describe the educational market's population and urbanization characteristics (i.e., county population and location along the urban-rural continuum). The second regression adds market competition variables—whether or not there are competing higher education providers (***C1***—one year technical schools, ***C2***—two year private non-profit or for-profit colleges or ***C4***—four year colleges or universities). The third regression includes other socioeconomic and industrial specialization indicators.[10] Diagnostic tests of collinearity revealed no problems with any of the regressions.

Adding explanatory factors to the base regression preserves the significance of the spatial and population variables. Indeed, the marginal effects of these variables are

greater than any of those remaining. With the notable exception of large metropolitan area counties, more populated counties are more likely to have community colleges. Among the urban-rural continuum categories, the highest marginal changes in probabilities[11] (dF/dX) are found for the fourth (***U4***) and fifth (***U5***) categories; both of these are non-metropolitan county categories with larger urbanized populations (20,000 or more). The larger of the two effects is for the category of counties nonadjacent to metropolitan areas. Other nonadjacent categories have higher marginal probabilities than their adjacent counterparts indicating that the relative isolation affords some degree of market protection. The presence of a four year college/university has a negative and statistically significant effect on community college presence, indicating some negative competitive effects.

Among county typology variables, strong industrial specialization in farming (***FAR***), manufacturing (***MFG***), and the government sector (***GOV***) has a depressing effect on community college presence. Possibly there is some reverse causation here because community colleges may contribute to a more diversified industrial base. Among the remaining variables, retirement counties (***RET***) are less likely to have community colleges, a reflection perhaps of the more limited traditional college-aged adult market available in these counties. Finally, high poverty counties (***POV***) are more likely to have community colleges—a reflection, perhaps, of state government efforts to stimulate economic development in such communities.

One way to determine good county candidates for community college expansion would be to extrapolate existing location patterns; that is to say, compute location likelihoods based on the regression reported above with the highest predictive power.

Figure 4. shows a map of computed likelihoods based on the third regression. The legend categories are determined on the basis of the Natural Breaks (Jenks) method. Counties that currently have community colleges are shown in white. Those with high computed likelihoods but without a community college main campus appear with darker shades. The map shows that counties in the industrialized Midwest and northeast (particularly Pennsylvania, Ohio, and Indiana) stand out. Among southern states, Mississippi and Texas are more prominent.

If one arbitrary designates counties from the first two classes of the Jenks distribution as high likelihood categories (and correspondingly good candidates to host a community college), coverage along the urban rural continuum reflects the pattern show in Figure 5. It shows community college growth throughout the metropolitan proportion of the continuum but more dramatic expansion in the two most urbanized non-metropolitan categories. Indeed, every county in the category of non-metropolitan counties that are nonadjacent to a metropolitan area but have an urbanized population of 20,000 or more would be selected to have a community college.

5.0 Summary and Conclusion

The role of community colleges in the higher education system has received far less attention from academic researchers than four year colleges and universities. In part, this may reflect the smaller size of community colleges and their lack of significant research and development activities. Although community colleges educate a large portion of college undergraduates, they also, as one journalist phrases it “continue to

struggle with an image as the Rodney Dangerfields of higher education - they just can't get no respect" (Hill 2005). Questions are sometimes raised about the quality of students attracted by open admission, the rigor of coursework offered, and the growing need to provide remediation for high school graduates who lack the essential mathematical, English, and readings skills to do college-level work.

This paper argues that community colleges serve a valuable role in post-secondary education and opportunities for new campuses exist in the community college sector because of demographic and economic changes and existing geographic gaps. For many U.S. states, less than 90 percent of the population is within reasonable commuting distance of a community college. Moreover, many non-metropolitan areas that are ideal locations for community colleges are currently underserved. Extrapolating spatial patterns of current community college location results in 15 first tier non-metropolitan candidates and 117 second tier candidates, which make up approximately 55% of all U.S. candidates. This community college 'infill' completes a non-metropolitan grid that favors counties with 20,000 or more urban residents.

An expanded community colleges network would provide one way to improve geographical educational access, decrease geographical educational disparities, and ultimately improve the economic performance of lagging areas. Evidence suggests that geographic access is an important determinant of college attendance (Jones and Kauffman 1994; Rephann 2000; Sá, Florax, and Rietveld 2004; Eliasson 2006; Frenette 2006). Residents living further away from technical schools, colleges and universities, are less likely to matriculate than those who are closer, and this effect is even more pronounced for lower income residents (Frenette 2006; Eliasson 2006). Those regions

with a less educated workforce in turn are more likely to lag economically (Rauch 1993; Mathur 1999; Moretti 2004; Bartik 2004).

There is some evidence that underserved rural states are beginning to recognize the importance of establishing a more comprehensive network of community colleges. For example, calculations here indicated that the State of West Virginia ranked near the bottom in community college access with only fifty-seven percent of the population within twenty-five miles of a community college. However, in the last several years, it has reorganized its higher education system and established two new community colleges in geographically underserved regions. Eastern West Virginia Community and Technical College, located in Moorefield which lies in the state's eastern panhandle, was established in 1999. New River Community and Technical College was established in 2003 with a central campus in Beckley and now has branch campuses throughout southeastern West Virginia . Because these colleges began to enroll students only relatively recently, they were not included in the analyses reported in this paper.

There are several potential extensions of the work here. First, this paper excluded other players in the sub-baccalaureate education market, namely private two year and technical schools, public technical schools, and four year colleges and universities (including branch campuses) that offer associate degrees and certificates in conjunction with four year and graduate degrees. Yet, some states have invested heavily in branch campus systems and technical schools that have expanded regional educational opportunities in ways that are not captured by this analysis. Second, although this paper identifies potential candidates for community college expansion based on extrapolating existing location patterns, there is a need for a more comprehensive evaluation of both

local demand and supply factors to arrive at a more definitive list of county community college location candidates. Third, the community college location problem could be recognized as a location-allocation or central place theory model and distances to competing educational facilities could be formally introduced. Finally, characteristics of competing institutions could be introduced to characterize the heterogeneous product attributes that influence educational market size. These might include program offerings, academic standards, college costs, and college size.

NOTES

[1] This definition may exclude some community colleges that offer baccalaureate degrees in combination with associate degrees but otherwise still publicly identify themselves as community colleges. This expansion into baccalaureate education markets is a growing phenomenon (Fliegler 2006). On the other hand, branch institutions of university systems whose highest level degree offerings are associate degrees will sometimes be included even though they may not offer the "open admissions" policy characteristic of community colleges.

[2] Several studies of commuter and multi-purpose shopping travel patterns have demarcated the outer limit as falling in the fifty to seventy mile range (Fox and Kumar 1965; Berry and Gillard 1977). However, data from the 2001 National Household Travel Survey (U.S. Department of Transportation 2004) are suggestive that educational commuting boundaries are smaller still. Only 36 percent of rural persons whose primary activity was "going to school" traveled more than 50 miles each day for all purposes versus 46% of those whose primary activity was "work." Cohen's estimate of 25 miles appears to be a reasonable educated guess of the community college commuting boundary.

[3] IPEDS provides information about U.S. higher education providers, including institution type, location, and enrollment characteristics (here for fall 2001). The data are compiled from individual reports submitted to the Department of Education by higher

education providers. The reports are mandated in order for institutions to qualify for title IV student financial aid programs. But, many non-title IV institutions respond to the survey as well. IPEDS data has been shown to be more accurate than a leading proprietary source of higher education data (Jackson et al. 2005).

[4] One might raise several objections with using IPEDS data. First, it sometimes excludes information about branch campuses, never includes information about other remote sites where courses could be offered, and doesn't consider the role of distance learning opportunities through television and the Internet. This limitation is likely to be less restrictive for community colleges than college/universities where branch campuses are more prevalent and cross county boundaries. Furthermore, the purpose of this analysis is to assess the effects of institutions which offer the full range of community college services. Branch campuses are often scaled down versions that offer only a small subset of the program opportunities and support services available at the main campus. Indeed, the rationale for branch campuses is often to offer basic level coursework and feed students into the main campus for more specialized programs.

A second objection could be that poor community college access does not necessarily mean that there is poor post-secondary access. For instance, a state may be underserved by community colleges but have a more developed four year college/university system. However, the purpose of this analysis is to measure access to institutions that offer open-door enrollment, affordable tuition (often subsidized by localities in addition to the state) and the variety of other student, business and community support services which accompany community colleges. Four year

institutions do not often offer an open-door policy, are generally far less affordable, and may not offer the same kinds of services and programs as a community college.

[5] This U.S. Census information was downloaded from the MABLE/Geocorr2K website at the Missouri Census Data Center (http://mcdc2.missouri.edu).

[6] Institutional zipcodes were assigned to particular counties for analysis using a commercial zipcode product (Ziplist5 2004).

[7] Metropolitan classifications were obtained from the rural-urban continuum codes file (U.S. Department of Agriculture, Economic Research Service 2003).

[8] The rural-urban continuum codes (U.S. Department of Agriculture, Economic Research Service, 2003) uses nine categories to represent the degree of urbanization/rurality of U.S. counties based on a county's urbanized population and proximity to a metropolitan area. The categories include the following: (1) Counties in metro areas of 1 million population or more, (2) Counties in metro areas of 250,000 to 1 million population, (3) Counties in metro areas of fewer than 250,000 population, (4) Urban population of 20,000 or more, adjacent to a metro area, (5) Urban population of 20,000 or more, not adjacent to a metro area, (6) Urban population of 2,500 to 19,999, adjacent to a metro area, (7) Urban population of 2,500 to 19,999, not adjacent to a metro area, (8) Completely rural or less than 2,500 urban population, adjacent to a metro area, (9) Completely rural or less than 2,500 urban population, not adjacent to a metro area.

[9] The analysis uses all 3,141 counties, parishes, independent cities, boroughs and other county-equivalents contained in the 2000 U.S. Census. The reason for using these units is mainly practical rather than conceptual. Main campus or host counties will admittedly not represent the entire market area of most community colleges but they generate the bulk of enrollment for most institutions. For instance, in the state of Maryland, which has three institutions with multi-county service regions, approximately 80% of statewide enrollment is derived from enrollment in counties where the main community college campus is located.

[10] The county typology codes (U.S. Department of Agriculture, Economic Research Service 2004) characterize counties' industrial structure and other demographic qualities based on binary codes that establish whether counties breach a certain threshold value.

[11] A dummy variable is discrete with values of only zero and one. Therefore, the marginal probability calculation evaluates the change in probability when the variable increases from zero to one.

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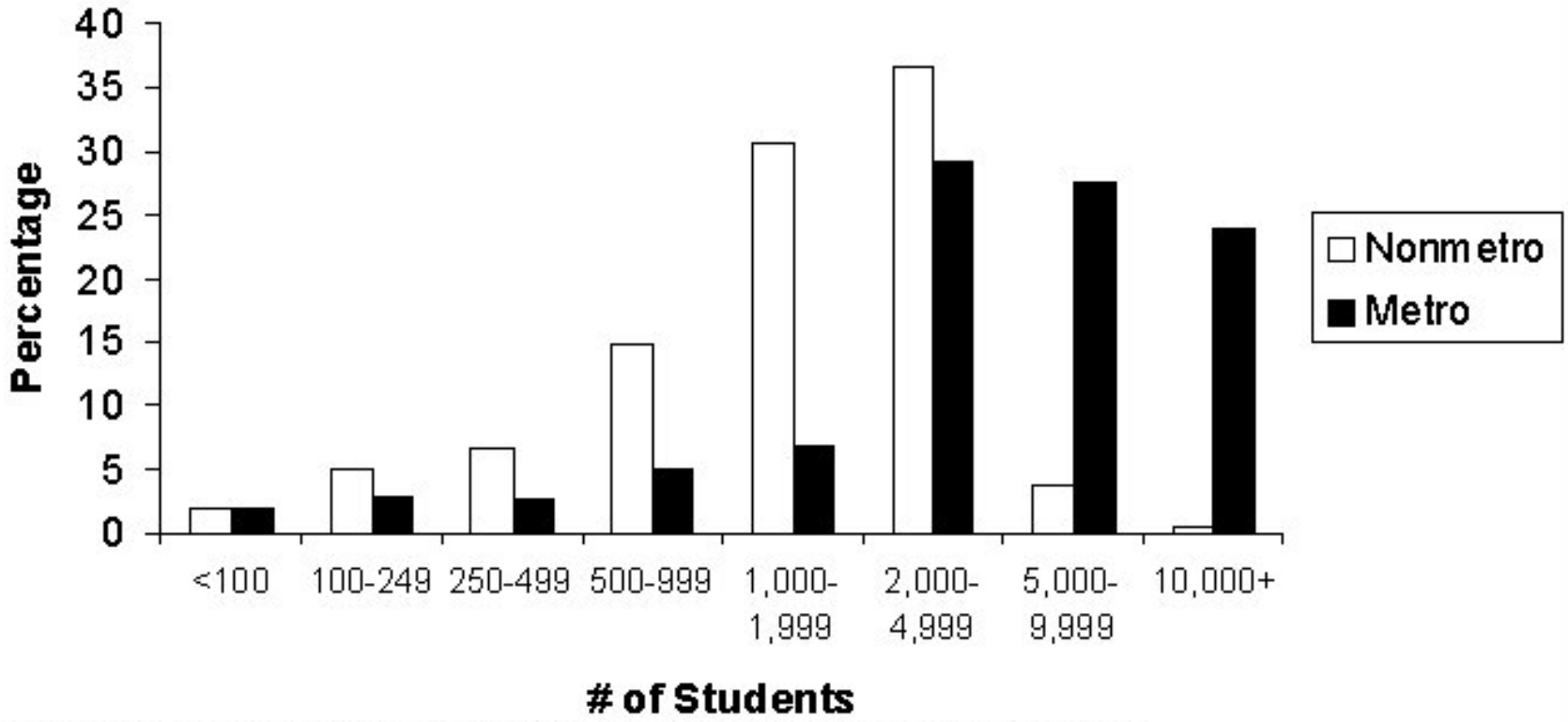
Table 1. Community College Accessibility by State.

State	Population, 2000	Population Density, 2000	% Population within 25 miles
DC	572,059	9,378	100
Delaware	783,600	401	100
Rhode Island	1,048,319	1,003	100
Massachusetts	6,349,097	810	100
New Jersey	8,414,350	1,135	99
North Carolina	8,049,313	165	99
Connecticut	3,405,565	703	98
Maryland	5,296,486	542	98
California	33,871,648	217	98
Louisiana	4,468,976	103	98
Illinois	12,419,293	223	96
New York	18,976,457	402	96
Georgia	8,186,453	141	96
Virginia	7,078,515	179	95
Florida	15,982,378	296	95
Ohio	11,353,140	277	95
South Carolina	4,012,012	133	94
Washington	5,894,121	89	94
Hawaii	1,211,537	189	93
Michigan	9,938,444	175	90
Nevada	1,998,257	18	89
Alabama	4,447,100	88	88
Arizona	5,130,632	45	88
Oregon	3,421,399	36	88
Tennessee	5,689,283	138	87
Indiana	6,080,485	170	87
New Mexico	1,819,046	15	86
Colorado	4,301,261	41	85
Wisconsin	5,363,675	99	85
Pennsylvania	12,281,054	274	84
Minnesota	4,919,479	62	84
New Hampshire	1,235,786	138	84
Texas	20,851,820	80	83
Kentucky	4,041,769	102	82
Missouri	5,595,211	81	80
Oklahoma	3,450,654	50	79
Arkansas	2,673,400	51	77
Maine	1,274,923	41	76
Kansas	2,688,418	33	74
Iowa	2,926,324	52	70
Nebraska	1,711,263	22	68

Utah	2,233,169	27	67
Mississippi	2,844,658	61	65
Wyoming	493,782	5	58
West Virginia	1,808,344	75	57
Vermont	608,827	66	51
Montana	902,195	6	50
South Dakota	754,844	10	48
North Dakota	642,200	9	28
Idaho	1,293,953	16	26
Alaska	626,932	1	1

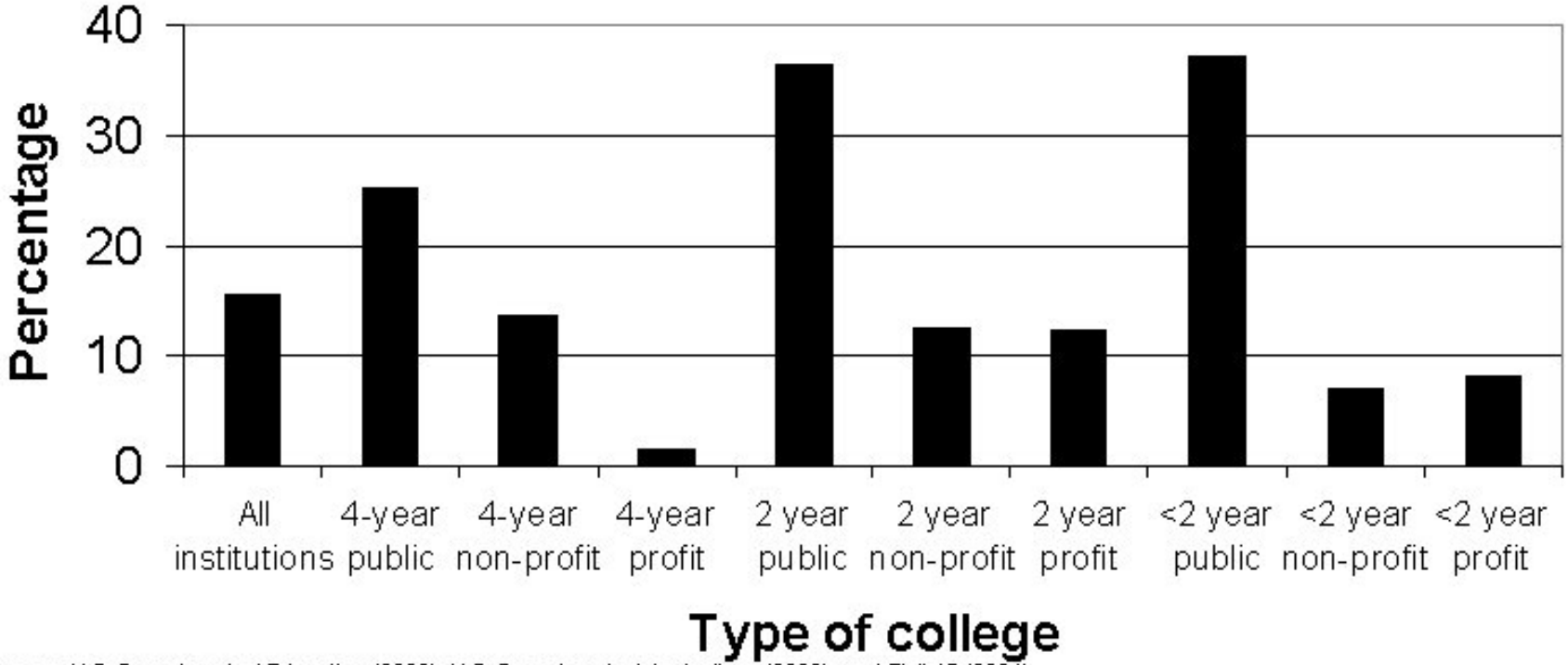
Source: U.S. Department of Commerce (2002), U.S. Department of Education (2003), U.S. Department of Agriculture (2003), and MABLE/Geocorr2k.

Figure 1. Community colleges by size



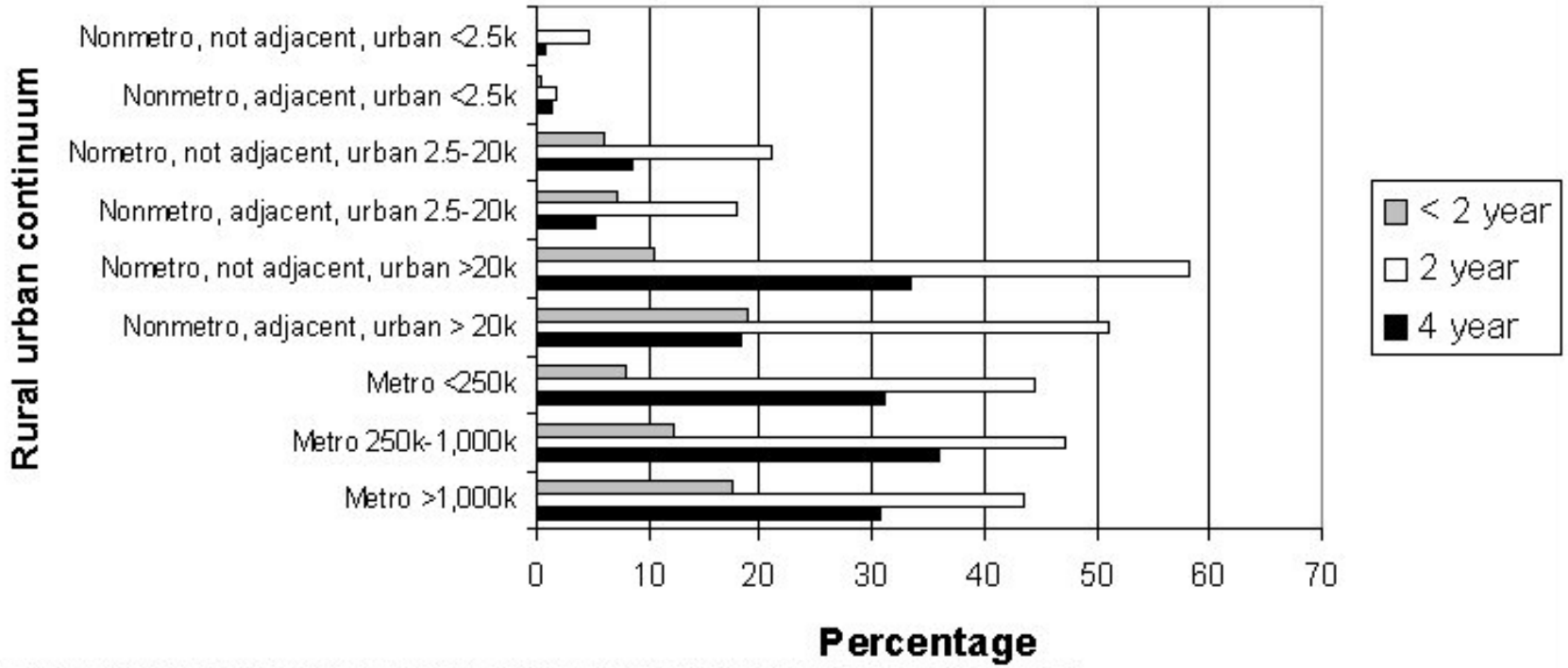
Source: U.S. Department of Education (2003), U.S. Department of Agriculture (2003), and Ziplist5 (2004)

Figure 2. Percentage of colleges in non-metropolitan areas



Source: U.S. Department of Education (2003), U.S. Department of Agriculture (2003), and Ziplist5 (2004)

Figure 3. Percentage of counties with public college by rural urban continuum



Source: U.S. Department of Education (2003), U.S. Department of Agriculture (2003), and Ziplist5 (2004)

Table 2. Variable Descriptions

Variable	Description
CC	Community college presence. 0=no 1=yes
POP[b]	Population, 2000.
U1[b]	County in metro areas of 1 million population or more, 0=no 1=yes
U2[b]	Counties in metro areas of 250,000 to 1 million population, 0=no 1=yes
U3[b]	Counties in metro areas of fewer than 250,000 population , 0=no 1=yes
U4[b]	Urban population of 20,000 or more, adjacent to a metro area, 0=no 1=yes
U5[b]	Urban population of 20,000 or more, not adjacent to a metro area, 0=no 1=yes
U6[b]	Urban population of 2,500 to 19,999, adjacent to a metro area, 0=no 1=yes
U7[b]	Urban population of 2,500 to 19,999, not adjacent to a metro area
U8[b]	Completely rural or less than 2,500 urban population, adjacent to a metro area, 0=no 1=yes
U9[b]	Completely rural or less than 2,500 urban population, not adjacent to a metro area, 0=no 1=yes
C1[a]	Presence of one year technical school, 0=no 1=yes
C2[a]	Presence of two year private school, 0=no 1=yes
C4[a]	Presence of four year college/university, 0=no 1=yes
FAR[c]	Farm-dependent county indicator. 0=no 1=yes
MIN[c]	Mining-dependent county indicator. 0=no 1=yes
MFG[c]	Manufacturing-dependent county indicator. 0=no 1=yes
GOV[c]	Federal/State government-dependent county indicator. 0=no 1=yes
SVC[c]	Services-dependent county indicator. 0=no 1=yes
LED[c]	Low-education county indicator. 0=no 1=yes
LEM[c]	Low-employment county indicator. 0=no 1=yes
POV[c]	Persistent poverty county indicator. 0=no 1=yes
PPL[c]	Population loss county indicator. 0=no 1=yes
REC[c]	Nonmetro recreation county indicator. 0=no 1=yes
RET[c]	Retirement destination county indicator. 0=no 1=yes

Sources:

[a] U.S. Department of Education, National Center for Education Statistics (2003).

[b] U.S. Department of Agriculture, Economic Research Service (2003).

[c] U.S. Department of Agriculture, Economic Research Service (2004).

Table 3. Probit model estimates of community college presence

		Model 1			Model 2			Model 3		
Var	B	t-ratio	dF/dX	B	t-ratio	dF/dX	B	t-ratio	Df/dX	Mean
POP	7.90e-06	16.92***	2.74e-06	8.21e-06	14.44***	2.86e-06	8.32e-06	14.33***	2.87e-06	89596.3
U1	-.432064	-4.78***	-.1499143	-.4512483	-4.94***	-.1572146	-.4558748	-4.84***	-.1570546	.1317632
U2	.0186286	0.21	.0064636	.0237324	0.27	.0082683	.0285366	0.32	.0098312	.1034373
U3	.4512987	6.35***	.156588	.478026	6.59***	.1665439	.4894124	6.55***	.1686087	.1117123
U4	.7396774	8.62***	.2566473	.7491552	8.63***	.2610051	.7418397	8.36***	.2555731	.0693826
U5	1.026743	8.29***	.356251	1.055658	8.35***	.3677905	1.019948	8.01***	.3513849	.0334182
U6	.1101551	1.90*	.0382208	.1037074	1.78*	.0361316	.0679584	1.13	.0234125	.1938256
U7	.2772168	4.15***	.0961865	.2788006	4.16***	.0971339	.2349246	3.40***	.0809345	.1432209
U8	-.9623848	-5.13***	-.3339206	-.9708287	-5.17***	-.338236	-.9569883	-4.99***	-.3296945	.0747931
U9	-.5063302	-5.22***	-.1756824	-.5132227	-5.27***	-.1788064	-.421333	-3.90***	-.1451545	.1384468
C1				.1118345	1.42	.0395964	.103823	1.31	.0363338	.20694
C2				-.0920743	-0.95	-.0314927	-.1046321	-1.07	-.0352672	.132442
C4				-.1450428	-1.98**	-.0496493	-.1724258	-2.29**	-.0581116	.281121
FAR							-.6031877	-4.57***	-.1792871	.140083
MIN							-.0752728	-0.51	-.0254322	.040751
MFG							-.1241556	-1.73*	-.0421351	.288125
GOV							-.1980129	-2.12**	-.0652527	.121299
SVC							-.0808401	-0.73	-.0273576	.107927
LED							.0133695	0.16	.004616	.198026
LEM							-.0649706	-0.64	-.022098	.14645
POV							.298945	2.77***	.1084519	.122891
PPL							.0155086	0.19	.0053567	.19134
REC							.103648	0.97	.0364634	.106336
RET							-.2408099	-2.59***	-.0787454	.140083
Con	-2.198841	-11.03***		-2.197609	-11.02***		-2.057645	-9.71***		
N		3,141			3,141			3,141		
LR chi2		1125.96***			1132.85***			1174.29***		
Log likelihood		-1308.4084			-1304.9626			-1284.2397		
Pseudo R2		0.3008			0.3027			0.3137		

*** α=.01; ** α=.05; * α=.01.

Figure 4. Likelihood of community college

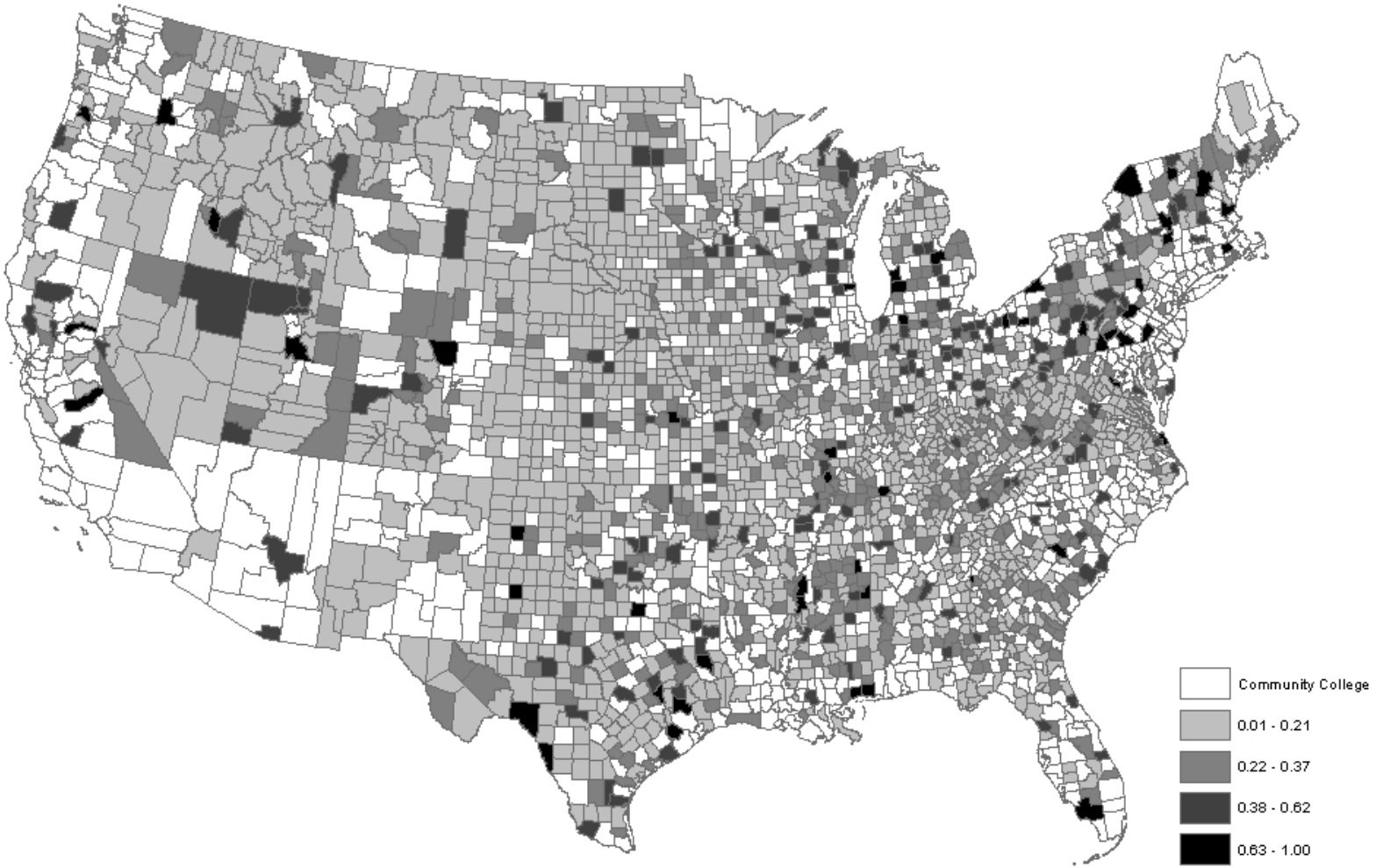


Figure 5. Community college gaps by rural urban continuum