Building Knowledge Stocks: The Role of State Higher-Education Policies *

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Abstract

A variety of studies provide evidence that the stock of college-educated labor has fundamental effects on state and local economies through its association with wages, economic growth, personal incomes, and tax revenues. As a result, policymakers in many states try to increase the percentage of the state's population (or workforce) that has a college degree through the use of various higher-education policies that have the potential to influence the supply side of the labor market. This paper reviews evidence on the effectiveness of these policies in achieving that goal. I discuss several types of policies related to the finance and production of undergraduate education within a state, including expansions in degree production and scholarships to encourage attendance at in-state colleges. The evidence suggests that these policies can affect the stock of college-educated labor within a state, but that effect is limited by the mobility of college graduates across state boundaries. I also discuss location-contingent financial aid, adjustments to the composition of enrollment by residency or by field of study, and internships with state-based employers. More research is needed to identify the causal effects of these policies on the behavior of students and to sort out the responses by students and institutions to changes in state policies.

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1. Introduction

In the United States, the concentration of college graduates in the population varies widely by state. In 2000, the percentage of adults aged 25 and older with a bachelor's degree or higher varied from 14.8 percent in West Virginia to 33.2 percent in Massachusetts and 39.1 percent in the District of Columbia. As shown in Figure 1, this percentage was lowest in several Appalachian states and in the South Central region of the country. The percentage was highest in several states in the Northeast and Mid-Atlantic regions and in Colorado.

Cross-state differences in the percentage of state residents with a college degree are quite stable over time. For example, although each state experienced an increase in this percentage from 1990 to 2000 (the cross-state average increased from 20.0 percent to 24.1 percent), the correlation across states between the percentages in 1990 and 2000 is 0.99. Over many decades the pattern is not constant but still quite persistent; for example, the correlation between the percentages in 1950 and 2000 is 0.76 (U.S. Bureau of the Census 2006). Furthermore, the extent of variation across states in the concentration of college graduates was roughly constant between 1934 and 2004 (Bauer, Schweitzer, and Shane 2008).

Policymakers in many states seek to increase the percentage of their state's population with college degrees. The motivation for this goal is the documented relationship between knowledge stocks and the economic vitality of states, cities, and regions. Evidence from cities suggests that raising the overall education level of an area increases the wages of all workers in the area (Moretti 2004) and contributes to economic growth (Glaeser, Scheinkman, and Shleifer 1995). Evidence from states indicates that the share of the workforce with a college degree is a key factor in the state's productivity (Iranzo and Peri 2009) and relative per-capita personal income (Bauer et al. 2008). Moreover, college graduates earn more and therefore pay more in

state taxes. On the flip side of government budgets, college graduates are less likely to receive public assistance (welfare and Medicaid), have lower costs for employment-related programs (unemployment insurance and worker's compensation), and are less likely to be imprisoned (Trostel and Gabe 2007).

Higher education in the United States in financed to a large extent through state governments. Public colleges and universities account for about 65 percent of all bachelor's degrees awarded (National Center for Education Statistics 2008). Given the large role of states and the economic benefits to knowledge stocks, many states try to use higher-education policies to increase the percentage of their state's population (or workforce) that has a college education. However, given the mobility of the labor force in general (Long 1988; Bartik 1991; Blanchard and Katz 1992) and of college-educated labor in particular (Long 1988; Bound and Holzer 2000; Wozniak 2006), a policy change in a given state may not necessarily affect the number of college graduates living in the state.

This article reviews the effectiveness of state higher-education policies at influencing the supply of college-educated labor within a state. Although in practice states use both demand-side and supply-side policies to promote economic development (Bartik 1991), my focus in this article is on the supply side. At issue is the relative effectiveness of supply-side and demand-side policies in affecting the location choice of college-educated workers. I discuss policy options that have been implemented (or proposed) and highlight research that is relevant to evaluating these policies. My focus is on policies at the undergraduate level; in practice, state policies also affect the production of advanced degrees (e.g., master's degrees and doctorates) and sub-baccalaureate degrees (e.g., associates degrees).

The next section of the paper presents a conceptual model of the supply and demand for college-educated labor in a state. The subsequent sections discuss various types of policies related to the finance and production of undergraduate education in a state. Section 3 discusses expansions in the number of degrees awarded by institutions in the state. Section 4 discusses merit-based scholarships, an increasingly popular form of student financial aid. Section 5 discusses location-contingent financial aid, which directly links retention with recruitment. Section 6 considers adjustments to the composition of enrollment by residency or by field of study. Section 7 discusses other retention and recruitment programs. I offer some concluding thoughts in the final section of the review.

2. Conceptual Framework

Students graduating from high school face a sequence of choices regarding their education and employment.[1] First is the decision of whether to go to college or to enter the workforce. Among those who attend college, the second choice is which college to attend. Students make these choices based on their aptitude for academic study, the educational opportunities and costs at various colleges, and the proximity of these colleges to family and friends. Once enrolled in college, students choose a major field of study, how much effort to apply to their studies, and how to finance their college costs. Students who complete a college degree must decide which occupation to enter and where to work. These choices are shaped by the wages and employment opportunities in the occupations for which their major prepares them. These opportunities often vary across space and therefore geographic considerations play a large role in graduates' employment choices.

[1] For a review of empirical research on the role of various public policies on college enrollment rates, persistence in college, and college graduation rates, see Ehrenberg (2004).

A simple conceptual model helps to organize thoughts about the effects of various policies. The model presented in this section places state-level degree outputs in the context of demand and supply in the labor market. The model, which is based on Bound, Groen, Kezdi, and Turner (2004), is appropriate to the U.S. context because any given state is an open economy: workers can move freely into and out of the state depending on economic opportunities in the state and in other states. Firms are also mobile across state borders. At issue is the extent to which employers' location choices are motivated by the educational attainment of the workforce in different states (i.e., employers move to workers) or workers move to jobs.

The model is shown graphically in Figure 2, with the horizontal axis indicating the quantity of college-educated labor relative to high school-educated labor within the state and the vertical axis indicating relative wages for college-educated labor within the state. The *F* curve represents the relative flow of college-educated labor arising from the production of bachelor's degrees within the state. Without post-college migration, this would be the supply of college-educated labor relative to supply of high school-educated labor in the state. The *S* curve incorporates migration. Under infinitely elastic migration, *S* would be horizontal at the national wage ratio. The figure represents the case of imperfect but nonzero mobility, which is shown by the *S* curve being more elastic than the *F* curve. The two curves cross at the relative wage level for which there is no net migration. For wages above this point there is net in-migration of college-educated labor and *S* lies to the right of *F*; for wages below this level there is net out-migration of college-educated labor and *S* lies to the left of *F*.

The *D* curve represents the relative long-run demand schedule for college-educated labor within the state. Shifts in the relative supply of college-educated labor in a state (the *S* curve) lead to adjustments in production, with shifts toward industries and technologies intensive in

college-educated workers when this factor is relatively plentiful (movements along the *D* curve). In this way, changes in output mix are one way that state labor markets can adjust to supply shifts (Hanson and Slaughter 2002). The elasticity of demand is tied to the mix of traded and non-traded goods produced in the state. For workers (e.g., engineers) employed in the production of goods and services that are traded across state boundaries, the within-state demand curve is likely to be relatively flat, because there is more room for the reallocation of labor across sectors. By contrast, the demand curve is likely to be relatively steep for types of skilled labor employed in the production of goods and services that are not traded across state boundaries but instead produced and consumed locally (e.g., teachers).

Point A in Figure 2 represents equilibrium in the state labor market. In the case represented, the state is a net importer of college-educated labor: equilibrium stocks are greater than flows. In practice, some states are net exporters and others are net importers. This distinction is likely driven by variation across states in degree flows and in the demand for college-educated labor. Variation in degree flows across states may occur because some states have a comparative advantage in the production of higher education, with differences derived from historical forces affecting where colleges were located more than a century ago, proximity to population centers, or willingness of voters to support higher education.

Variation across states in demand for college-educated labor may occur because some states have a comparative advantage in the production of goods and services intensive in college-educated labor. This type of comparative advantage might arise from the pattern of settlement of the country, the initial location of particular industries, and the pattern of resource endowments and climate. Examples might include the nation's political capital (Washington, D.C.) and its

suburbs in Maryland and Virginia, and the nation's financial capital (New York City) and its suburbs in Connecticut, New Jersey, and New York.

Each of the policies discussed in this review seeks to increase the relative quantity of college-education labor in a state by shifting the supply curve. A shift in the relative supply of college graduates in a state is represented in Figure 2 as a shift in the supply schedule from S to S'. In keeping with my focus on supply-side policies, I assume that the shift in S does not directly affect the demand for college-educated labor. With the shift in the supply schedule, equilibrium stocks increase from q to q' and equilibrium wages for college graduates fall from w to w'. For a given shift in the supply curve, the increase in the relative quantity of college-educated labor (q to q') depends on the elasticity of demand: the more elastic is demand, the greater the increase in quantity. Note that although the shift in supply is assumed not to affect demand, this shift may lead to an increase in the quantity demanded.

3. Expansions of Degree Production

One policy option for shifting the supply curve is to increase the number of degrees awarded by colleges and universities in the state. Such a change is represented graphically in Figure 2 by an outward shift in the F curve. The shift in F would induce a shift in the net relative supply of college-educated labor (the S curve), and the equilibrium would shift along the demand curve from point A to a point such as point B. In practice, a state could increase the relative flow of college-educated labor by increasing the number of students pursuing bachelor's degrees or by increasing the share of entering students who go on to earn a bachelor's degree (i.e., by reducing attrition from college).

Bound et al. (2004) estimate the relationship between the relative flows of college graduates at the state level and the stock of college-educated workers in the state. Using a formal

version of the model illustrated in Figure 2, they show that in response to an exogenous increase in flows, the ratio of the change in stocks to the change in flows is $\beta \equiv [\sigma/(\sigma+\theta)]$, which is less than or equal to 1. In this expression, σ represents the elasticity of within-state relative demand (i.e., the elasticity of substitution between college- and high school-educated labor) and θ represents the migration elasticity (which determines the contrast between the *F* and *S* curves).

This equation is useful in understanding the determinants of the effect of flows on stocks. The larger the elasticity of demand (σ), the larger will be the effect of changes in flows on changes in stocks. For example, the effect would likely be larger for degree types employed in the traded-goods sector than for those employed in the production of non-traded goods. This is because the traded-goods sector can sell in other states the increased output resulting from the increased use of college-educated labor. By contrast, more mobility (θ) dampens the effect of flows on stocks. At one extreme, no mobility ($\theta=0$) leads to a one-to-one mapping between changes in flows and changes in stocks (since in this case the *S* and *F* curves are identical). At the other extreme, frictionless mobility ($\theta=\infty$) leads to a zero effect of flows on stocks.

Bound et al. (2004) estimate β separately for two degree types: bachelor's degrees and medical degrees. The elasticity of demand in state labor markets is likely to be greater for baccalaureate graduates than for medical doctors because baccalaureate graduates are more likely to be employed in the traded-goods sector.[2] Consequently, employers can concentrate production of traded goods and services in areas where college-educated labor is relatively plentiful. By contrast, medical doctors work largely in the non-traded sector, providing services to patients who live in a particular geographic area.

[2] Another difference between these two types of graduates is their degree of specialization. The general skills taught in college suggest that employers can mold baccalaureate graduates, whereas medical doctors are more specialized when they graduate.

The empirical results indicate a modest association between flows and stocks for bachelor's degrees. Based on data for individuals who received their degrees between 1966 and 1985, a 10 percent increase in per-capita degree production in a state is associated with a 3.2 percent increase in concentration of bachelor's recipients in the state's population.[3] Thus, stocks and flows are related, but the relationship is appreciably less than one-for-one and points to the importance of migration of graduates across state boundaries.

For medical degrees, by contrast, the cross-sectional relationship between production of MD degrees and the representation of doctors in the population is remarkably weak. A 10 percent increase in per-capita degree production is associated with an increase in concentration of physicians of less than 1 percent.[4] The weak link between flows and stocks for medical degrees is consistent with an inelastic demand for medical services within states, reflecting employment concentrated in the non-traded sector.

The graphical presentation of flows and stocks in Figure 3 helps to sharpen understanding of the regression estimates. In each panel, the horizontal axis shows the average production of each type of degree for the 1966–85 degree cohorts and the vertical axis shows the average concentration of these degree holders in the population. The diagonal line distinguishes net importers (above the line) from net exporters (below the line). For bachelor's degrees, net importers include California, Maryland, and Connecticut; on the flip side, states such as South Dakota, Utah, and Vermont are net exporters of baccalaureate-trained personnel. The importing states have a large fraction of college graduates in their workforces even though they do not produce a lot of graduates. The exporting states produce a lot of graduate but have a relatively small fraction of college graduates in their workforces. The figure makes clear the positive

[3] Bound et al. (2004), Table 2.
[4] Bound et al. (2004), Table 2.

association between stocks and flows for bachelor's degrees and the complete lack of association for medical degrees. The figure also demonstrates that the variation across states in the concentration of degree recipients is less than the variation of degree production—especially in the case of medical degrees.

The modest association between stocks and flows for bachelor's degrees suggests that the presence of college graduates in a state works, to some extent, to expand output in industries that are intensive in college-educated labor. However, the relationship between stocks and flows is much less than one-for-one, which suggests that increasing the scale of a state's higher-education system has a limited effect on the human-capital level of its workforce. Therefore, although there are many reasons why states might invest in higher education, the geographic mobility of college-educated labor reduces incentives for states to make such investments (Justman and Thisse 1997).

4. Scholarships to Encourage Attendance at In-State Colleges

Historically, state subsidies to undergraduate students came in the form of below-market tuition rates for in-state students at public colleges and universities. On top of that, states also allocated money to individual students based on their financial need. Since the early 1990s, many states shifted the latter form of aid from need-based to merit-based aid. During the 1990s a dozen states introduced large-scale merit-aid programs (Education Commission of the States 2001; Dynarski 2004).

These programs waive tuition and fees for students who achieve a minimum grade point average (GPA) in high school (typically 3.0) and maintain a minimum GPA in college (typically 2.5 to 3.0). Eligibility is restricted to those who attended high school in the state. The programs usually cover attendance at any public institution in the state, and some programs allow students

to receive a subsidy of comparable value for attendance at a private institution in the state. Arkansas implemented its merit-aid program in 1991 and Georgia introduced its program in 1993.

These merit-aid programs are typically quite broad in application. For example, nearly 60 percent of students graduating from high school in Georgia qualify for its merit scholarship (Dynarski 2008). In addition to the broad-based merit-aid programs, states also have smaller merit-aid programs that are targeted at their "best and brightest" high school graduates. For example, Tennesee's Ned McWherter Scholars Program requires students to have a high school GPA of at least 3.5 and to score in the top 5 percent on the ACT or SAT. As of 2000, there were 17 states with selective merit-aid programs (Indiana Fiscal Policy Institute 2000). My analysis here focuses on the case of broad-based merit aid, but many of the same considerations also apply to merit aid that is more narrowly targeted.

One goal of merit-aid programs is to increase the supply of college-educated labor in a state. Given that the market for higher education in the United States is regional or even national in scope, many academically talented students choose to attend colleges outside their home states (Hoxby 1997). A perception among policymakers in many states is that talented students leave the state for college and do not return (Schmidt 1998). Nationwide in 1996, 25 percent of first-time undergraduates at four-year colleges and universities attended an institution outside their home state, up from 20 percent in 1975 (Groen 2004). This percentage is higher among those with stronger academic backgrounds. For example, among students who entered a set of selective institutions in 1976 (those in the Mellon Foundation's College and Beyond database), 59 percent attended an institution outside their home state (Groen 2004).

By reducing the relative price of attending in-state institutions, merit-aid programs seek to increase the number of talented students who attend college in their home state rather than other states.[5] Empirical evidence from Georgia and New Mexico suggests that they do indeed affect college choice in this way (Dynarski 2000; Binder and Ganderton 2002; Cornwell, Mustard, and Sridhar 2006). For example, Georgia's HOPE Scholarship reduced the number of students leaving Georgia to attend college, and the magnitude of this reduction accounts for two-thirds of the scholarship's enrollment effect at four-year institutions attributable to freshmen who recently graduated from high school (Cornwell et al. 2006).

Do merit-aid programs accomplish their ultimate goal of increasing the supply of college-educated labor in a state? Or do they simply delay the exodus of talented individuals from the state? The answer depends on whether attending college in a state actually encourages students to work in the state after college. After students leave college, merit-aid programs do not provide any direct financial incentive for graduates to remain in the state. Instead, these programs can influence the location decisions of college graduates through the accumulation of location-specific capital, which is a generic term for factors that "tie" someone to a particular place (DaVanzo and Morisson 1981). This concept includes features specific to a place that are more valuable to an individual in one location than in another, such as personal knowledge of an area, employment connections, community ties, and social networks. For example, Georgia residents would likely accumulate more Georgia-specific capital from attending a college in Georgia than from attending a college in, say, Massachusetts.

Groen (2004) provides indirect evidence on the effectiveness of merit-aid programs by estimating the impact of attending college in one's home state on the probability of working in

[5] A related goal of merit-aid programs is to increase the share of high-school graduates who go to college; see Cornwell, Mustard, and Sridhar (2006) and Dynarski (2000, 2004).

the state after college. Data from two samples of students who attended college in the 1970s contain information on students' location during high school, the colleges they applied to and attended, and their state of residence 10–15 years after college. In the context of merit-aid programs, the focus is on the probability of graduates residing in their home state. The parameter of interest is the difference between this probability among those who attended college in their home state and the probability among those who attended college in another state.

To control for differences in students' preferences for living in their home state, which are manifest in both their choice of college and their choice of post-college location, Groen (2004) limits the sample to students who applied to at least one college in their home state and to at least one college outside this state. Estimates from both datasets indicate that those who attended college in their home state are about 10 percentage points more likely to live in this state after college than are those who attended college outside their home state. For the Mellon Foundation's College and Beyond database, which covers a set of selective institutions, the estimated effect is 0.09 (0.48–0.39). For the National Longitudinal Study of the High School Class of 1972, the estimated effect is 0.10 (0.62–0.52).[6] These estimates likely overstate the causal effect of attending college in one's home state because the use of applications information does not perfectly control for selection into colleges based on location preferences.

The magnitude of the estimated effect is rather small, especially considering its upward bias. This can be seen in the context of an example. Suppose a merit scholarship induces 100 additional students to attend college in their home state rather than another state. The results imply that no more than 10 of them would be working in the state 10–15 years after college. That the translation of additional students to additional college graduates working in the state is much less than one-for-one suggests the importance of the migration of college graduates across

[6] Groen (2004), Tables 4 and 5.

state boundaries. This result suggests that broad-based merit-aid programs may not be a cost-effective way for states to increase the supply of college-educated labor.

Tornatzky, Gray, Tarant, and Zimmer (2001), however, reach the opposite conclusion. Using data from the National Survey of Recent College Graduates on students who received bachelor's degrees in science and engineering in 1994–96 and were interviewed 1–3 years after college, they report estimates of the effect of attending college in one's home state that are quite large. In their data, the probability of living in the home state is 0.76 for those who attended college in this state and 0.23 for those who attended college in another state, which implies an effect of 53 percentage points. However, this estimate likely overstates the causal effect because Tornatzky et al. (2001) do not control for selection into colleges based on location preferences. Groen (2004) shows that not controlling for location preferences leads to much larger estimated effects. Their results might also differ from Groen (2004) because they measure post-college locations only a few years after college (when some graduates are enrolled in graduate school) and because their sample covers only science and engineering graduates.

5. Location-Contingent Financial Aid

In contrast to broad-based merit-aid programs, other state scholarship programs make a direct connection between receiving aid and working in the state after graduation. These programs are usually smaller in scale than broad-based merit-aid programs and are targeted to particular fields, such as medical services, teaching, or science and technology.

In practice there are two types of location-contingent aid. One type provides a scholarship during college in exchange for a commitment to work in the state after graduation; students who do not fulfill the work requirement must repay the scholarship. For example, the Maryland Science and Technology Scholarship provides up to $3,000 per year for use in eligible

academic programs at any Maryland four-year institution. Recipients must work in Maryland after graduation one year for each year they receive the scholarship; those who fail to meet the service obligation must repay the scholarship (National Governors Association 1998).

The second type of location-contingent aid provides subsidies not during but after college, in the form of repayments of student loans. For example, the Opportunity Maine program provides a tax credit of up to $5,500 per year in loan-repayment assistance to anyone who earned a bachelor's degree from a Maine college (public or private), stays in Maine after graduation, and has loan debt (beginning with loans originating in January 2008).[7] Compared to other location-contingent aid programs, the Maine program is notable for being available to students regardless of their field of study.

Location-contingent aid programs for undergraduate education are relatively new and, to my knowledge, have not been subject to formal evaluations. However, some lessons can be gleaned from the experience with contingent aid programs in other educational settings, notably law school and medical school.

Field (2009) examines a financial-aid experiment at a law school involving two alternative aid packages assigned by lottery to a set of admitted students. The packages had equivalent monetary value, but differed in the timing of payments and debt. One package required the student to take on a loan that would be repaid by the school if he worked in public-interest law. The other package covered tuition but required the student to reimburse the school if he did not work in public-interest law. The tuition-assistance approach was much more effective: recipients had a higher placement rate into public-interest law and (when lottery results were announced prior to enrollment) were more likely to enroll in law school. These findings are consistent with other evidence on "debt aversion" (Thaler 1992) and suggest that location-

[7] Based on the Opportunity Maine website (http://www.opportunitymaine.org).

contingent aid would be more effective when structured as tuition assistance than forgivable loans.

The federal government operates several programs to encourage primary-care physicians and other health-care practitioners to work in underserved areas. The most visible federal program is the National Health Service Corps (NHSC), which is operated by the U.S. Department of Health and Human Services. There are two components to the NHSC, which parallel the types of location-contingent aid at the undergraduate level. The NHSC Scholarship Program, established in 1972, provides a full scholarship to medical students in exchange for a commitment to work in an underserved area following graduation (or the completion of residency training). The NHSC Loan Repayment Program, established in 1987, recruits already-trained clinicians (physicians and related professionals) to work in underserved areas in exchange for annual payments against students loans. By 1998, the NHSC had supported more than 42,000 clinician years of service and 15,000 scholarships (Mullan 1999). In addition to the NHSC, many state governments fund programs with the objective of influencing the geographic distribution of the health-care workforce within their state's borders (Pathman et al. 2000). Finally, some programs are funded jointly by the federal government and state governments.

The most common of the state programs are those similar to the NHSC's programs, in which financial support is provided to students and health-care practitioners in exchange for a period of service in underserved communities (Pathman et al. 2000). Among state programs in 1996, the most numerous types were loan-repayment and scholarship programs, which are similar to the two NHSC programs. States also have programs to provide loans to medical students that are to be repaid after training, either financially or by providing service. States also

have direct financial-incentive programs that are similar to loan-repayment programs except that funds are used to pay practitioners directly rather than to pay educational debt.

In the context of financing undergraduate education, location-contingent aid could be a way for states to provide funding for college while providing incentives to reside in a state after college (either because loans get repaid or because scholarships do not have to be repaid). However, there are a number of issues that should be considered in designing these programs for the undergraduate context. The discussion that follows highlights administrative costs and complexity, debt levels, and selection into aid programs.

Comparing the scholarships and loan repayments, there seems to be a large difference in administrative costs between the two when the service requirement is not met. Under loan repayment this case is simple: the state does not repay loans. But with scholarships, the money has already been spent so the state would have to collect some of the scholarship; this process could be messy and costly. This process is analogous to what is called "clawback" in the context of economic-development incentives provided by state and local governments. Clawback provisions provide recourse for governments to reclaim all or part of a public subsidy when a firm relocates or fails to create a certain number of jobs (Ledebur and Woodward 1990; Peters 1993).

In the undergraduate case, service requirements would be broken in many cases because students failed to graduate. This consideration is important given the large amount of attrition that occurs. About 50 percent of students who enroll at a four-year college do not go on to earn a bachelor's degree (National Center for Education Statistics 2002); by comparison, only about 5 percent of entering medical students fail to complete an MD (Association of American Medical Colleges 2007). To ensure clawback in the case of attrition (and other breaches of the service

requirement), the scholarships would need to contain complicated provisions. This facet could discourage eligible students from accepting these scholarships, in light of the evidence that complexity in the aid process limits the take-up of student loans and grants by the target population (Dynarski and Scott-Clayton 2008).

In addition to attrition, another difference between undergraduate education and medical school is the amount of debt taken on by students. Medical students typically have greater debt burdens at graduation, consistent with the payment of higher tuition.[8] Medical students have an average debt of approximately $80,000 at graduation (Association of American Medical Colleges 1998). College graduates, by contrast, had lower debt levels at graduation. Among 1999–2000 bachelor's degree recipients, 65 percent had borrowed and the average amount borrowed was $19,300 (National Center for Education Statistics 2004); thus, the average debt at graduation for all students was about $12,500. As a result, the scope for loan repayments as a vehicle for location-specific subsidies is much less among college graduates than among MD recipients. Plainly, an offer to repay loan debt would provide little incentive for college graduates who had no debt or small amounts of it. By contrast, a more direct financial incentive, such as cash payments or income-tax deductions, would be applicable to a broader range of graduates. This is consistent with a proposal in 2001 by the governor of Iowa to provide tax credits to graduates of Iowa colleges who settle in the state (New York Times 2001).

Another important issue in the potential effectiveness of location-contingent aid programs is the composition of students who select into these programs. Since the programs provide

[8] For the academic year 1996–97, tuition for medical students was roughly 1.4 to 3.3 times tuition for undergraduate students, depending on institution type. For institutions offering both bachelor's and MD degrees, private universities charged on average a tuition of $18,235 in undergraduate programs and $25,655 in MD programs; public universities charged non-residents on average a tuition of $8,668 in undergraduate programs and $22,353 in MD programs; and public universities charged residents on average a tuition of $3,140 in undergraduate programs and $10,398 in MD programs. Data for tuition and fees in MD programs are from the Association of American Medical Colleges and the corresponding undergraduate data are from the IPEDS survey.

funding for locating in a particular state, they would appear to appeal more to students who already have plans to locate in the state, either because of location preferences (e.g., wanting to be close to family) or because of occupational choice (e.g., the state has many jobs in chemical engineering). To the extent this occurs, it would limit the program's causal effect on the geographic distribution of college graduates. Said another way, most of the money spent on these programs could go to people who would locate in the state anyway. The size of a program could be an important factor in the balance between selection and causal effects, with the selection effect being larger in smaller programs. Another factor in this regard could be whether aid is targeted to specific fields of study.

6. Adjustments to the Composition of Enrollment in Public Universities

Mix of In-State and Out-of-State Students

The introduction of a broad-based merit-aid program usually leads to increased demand for college attendance in a state from resident students who are eligible for the scholarships. The increased demand could be accommodated in at least three ways: (1) increasing overall enrollment in institutions in the state; (2) decreasing enrollment of resident students who do not qualify for the scholarships; and (3) decreasing enrollment of non-resident students. These shifts could manifest themselves not only at the state level but also across institutions and across different types of institutions.[9]

Suppose that a merit-aid program leads to a reduction in enrollment of non-resident students. Would this change lead to an increase in the number of college graduates in the state's workforce? Many policymakers believe that it would, because out-of-state students are less likely than in-state students to locate in the state after college. However, out-of-state students are

[9] For example, the introduction of merit-aid programs in Georgia and New Mexico caused a shift in enrollment from two-year to four-year institutions because the programs reduced the tuition differential between these types of institutions (Cornwell et al. 2006; Binder and Ganderton 2002).

relevant for retention because attending college in a state can encourage these students to permanently relocate to the state. Groen (2004) estimates that non-residents' probability of locating in a state 10–15 years after college is increased by 6 to 10 percentage points as a result of going to college there. For the College and Beyond database, the estimated effect is 0.06 (0.11–0.05). For the National Longitudinal Study of the High School Class of 1972, the estimated effect is 0.10 (0.15–0.05).[10]

The mix of in-state students and out-of-state students can be affected by admission standards (Groen and White 2004) and by tuition levels (Ehrenberg and Rizzo 2004; Zhang 2007).[11] Groen and White (2004) focus on the divergence of interest between public universities and state governments concerning minimum admissions standards for in-state versus out-of-state applicants at selective public universities. In their model, universities' goal is to maximize average student ability, but states would like to maximize the present value of future state tax revenues.[12] If universities are free to follow their own interests, then they are predicted to set equal standards for both groups. By contrast, states would like their universities to set standards such that the additional expected future state tax revenue from the marginal student admitted is the same for in-state and out-of-state students. (Marginal students are those just above the minimum standard required for admission.)

As a result, the state's preferred mix of in-state students and out-of-state students depends on how attending college in a state affects marginal students' probability of working in that state.

[10] Groen (2004), Tables 4 and 5.

[11] Though non-resident tuition is typically much higher than resident tuition, the differential between these two charges is smaller at universities that participate in tuition reciprocity agreements. One type of reciprocity agreement is a bilateral agreement that is negotiated between two states; an example of this type is the agreement between Minnesota and Wisconsin, which goes back to 1968 (DesJardins 1999). Another type is consortium agreements, in which a number of states in a geographic region are treated similarly under the agreement; an example is the Academic Common Market, which is administered by the Southern Regional Education Board and covers institutions in 16 states.

[12] They also consider that universities might set admission standards to maximize total revenue (from tuition and future donations from graduates), but the empirical evidence is not consistent with this objective.

Estimates from the College and Beyond database indicate that the size of this effect is similar for marginal in-state and out-of-state students. For marginal in-state students, attending college in the state increases the probability of working in the state 20 years after college by 11 percentage points (from 0.34 to 0.45); the comparable increase for marginal out-of-state students is 10 percentage points (from 0.04 to 0.14).[13]

Groen and White (2004) found that, in practice, public universities set lower admission standards for in-state than out-of-state applicants, presumably in response to state pressure. However, they also found that favoring in-state applicants goes against states' long-term financial interest. With higher standards for out-of-state students, marginal out-of-state students have higher earnings and thus pay more in future state taxes. Average lifetime state tax payments for marginal out-of-state students at public universities were $227,000, compared to only $185,000 for marginal in-state students.[14] Since the location effects are similar for both sets of marginal students, the additional expected future state tax revenue is greater for marginal out-of-state students than for marginal in-state students.

Mix of Students by Field of Study

States may also seek to influence the supply of college-educated labor by adjusting the composition of enrollment by field of study. In their study of the growth of public higher education from 1890 to 1940, Goldin and Katz (1999) argue that a primary reason for state support to higher education during this period was to provide goods and services of value to citizens and local industrial interests. One of these goods and services was training in fields in which the state's economy was specialized. In states having a concentration of economic activity in a particular industries (or products), the public sector often invested heavily in training

[13] Groen and White (2004), Table 2.
[14] Groen and White (2004), Table 3.

and research in these industries. For example, Wisconsin subsidized work on dairy products, North Carolina on tobacco, and Colorado on mining. Since public universities provided training in fields that their states specialized in, graduates tended to remain in the state; this allowed states to capture the benefits of their investments. Consistent with this argument, Goldin and Katz find that the shares of employment in mining, manufacturing, and agriculture are positively related to state support for higher education over this period.

As state economies have become more diversified over time, the rationale for states to target particular industries in their funding of higher education has presumably become less important. Though there are still some regional specializations (e.g., forestry in Michigan), most universities offer training in a wide range of subjects. Still, targeting specific industries is in line with the finding that the elasticity of demand for college-educated labor is greater for degree types more likely to be employed in the production of traded goods (Bound et al. 2004). If a state were to shift the composition of degrees awarded by its universities towards degree types employed in the traded-good sector, then the relative stock of college-educated labor would be more responsive to changes in the relative flow of bachelor's degrees.

As another motivation for state funding in the twenty-first century, states might invest heavily in a field in an attempt to become a dominant location in an emerging industry. Consider, for instance, the desire to be the next Silicon Valley (Saxenian 1996) or a leading center for the biotechnology industry (Dewan 2009). Of course, if there are large benefits to be gained by establishing a state as the center of the "next big thing" then states would likely compete for that opportunity. That competition would in turn lead to tax incentives and other subsidies, which would drive down the net benefits to the state that won the competition.

7. Other Retention and Recruitment Policies

Many states have promoted internships for college students as a vehicle for encouraging graduates of colleges in their states to remain in the state after graduation. In these programs, states function as intermediaries between students seeking internships and employers seeking interns. The economic logic for such programs is internships will engage students with state-based employers and promote the development of location-specific human capital that will encourage them to stay in the state after graduation.

For example, Pennsylvania's SciTech Scholarship includes an internship component with a location-contingent scholarship (National Governors Association 2000). The scholarship provides up to $3,000 per year for Pennsylvania residents to pursue a bachelor's degree in an approved science and technology field at a Pennsylvania institution. Students must complete an internship with a Pennsylvania company, and after graduation must work in Pennsylvania one year for each year of scholarship assistance. If these requirements are not met, the scholarship converts to a loan.

Apart from this particular scholarship, Pennsylvania is promoting internships as part of its "Stay Invent the Future" initiative that is designed to reverse the net outward migration of college graduates from the state (Wirtz 2003). In other respects this initiative is a marketing campaign that promotes Pennsylvania as a great place to live, work, and play. Related initiatives in other states seek to appeal to those who had previously lived in the state. For instance, in 1998 the state of Michigan mailed recruitment letters to engineering graduates who had left the state (Durbin 2000).

Other state programs go beyond providing information and promoting the state's image. North Dakota, South Dakota, and Vermont all have formal programs that augment marketing

efforts with job-search assistance by matching participants with job openings from state-based employers (Dougherty 2007). These programs target those with ties to the state to return to the state.

8. Concluding Thoughts

This review has focused on state policies that target the supply side of the labor market. Of course, states use both demand-side and supply-side policies to promote economic development (Bartik 1991). In applying the lessons from this review to an actual situation, it is important to consider what demand-side policies are in place. As emphasized in Section 2, the level of demand for college-educated labor within a state is a crucial determinant of the number of college-educated workers in the state. It is therefore natural for states to try to attract firms that are intensive in their use of college-educated labor.

State policymakers often discuss the migration of college graduates with an exclusive focus on "brain drain"—the outward migration of college graduates who were either raised in the state or attended college in the state. This group is important both for practical reasons (these graduates are good candidates to return) and for political reasons (their parents often still reside in the state). However, from an economic perspective, a college graduate trained in another state is just as valuable as one trained locally. Plainly, every state has some residents who were educated in other states; one state's "brain drain" is another state's "brain gain." Furthermore, the evolution of the stock of college-educated labor in a state depends on the net migration of college-educated workers (i.e., the difference between inflows and outflows). Outflows are inevitable, but they can be compensated for by inflows.

The mobility of college-educated labor appears to reduce incentives for states to invest in higher education. However, affecting the concentration of college graduates is presumably only

one of many reasons why states might invest in higher education. The private benefits of higher education are large and accrue to graduates wherever they choose to locate. Furthermore, some of the social benefits to higher education do not depend on the location decisions of graduates. For instance, universities might promote economic growth through relationships between university research and local industry (Hill and Lendel 2007; Governor of New York 2009).

In evaluating programs, it is wise to distinguish between beneficiaries whose behavior is affected by a program and those whose behavior is unaffected. For example, what percentage of the awards from a state's merit-aid program go to students who are diverted from out-of-state colleges, and how much goes to students who would have attended in-state colleges even in the absence of the program? A lesson from the literature on the design and evaluation of public programs is that efficiency is improved by targeting subsidies to those whose behavior is most likely to be influenced by the subsidy (e.g., Nichols and Zeckhauser 1982). In the context of the financial-aid programs considered here, targeting could be affected by the criteria used to determine eligibility—for example, the minimum GPA in high school required for a merit-aid program, or whether a state's loan-repayment program is open to those who graduated from colleges in other states.

Many analyses of higher-education policy consider one state in isolation and assume that policies in other states will not change. However, in practice a policy change by one state is often followed by policy changes in other states (Besley and Case 1995), and these responses can alter the impact of the initial policy change. This possibility is particularly relevant to the policies discussed here because students' choice of college and graduates' choice of work location both depend not just on their opportunities in any one state but on their relative opportunities in many states.

For instance, the spread of merit-aid policies throughout the Southeastern states amounts to a competition for high-ability students. Georgia implemented its merit-aid program in 1993 and witnessed an increase in the average ability of college freshmen in its public institutions (Cornwell et al. 2006). But when neighboring states later enacted their own merit-aid programs, many high-ability students in these states chose to attend home-state colleges rather than Georgia colleges, which may have dissipated some of Georgia's initial gains. In the long run, the number of high-ability students attending college in a given state might be little different than the number before the wave of merit-aid plans. Meanwhile, the changes might have worsened the matching of students to colleges because students selected their colleges based more on tuition than on other factors.

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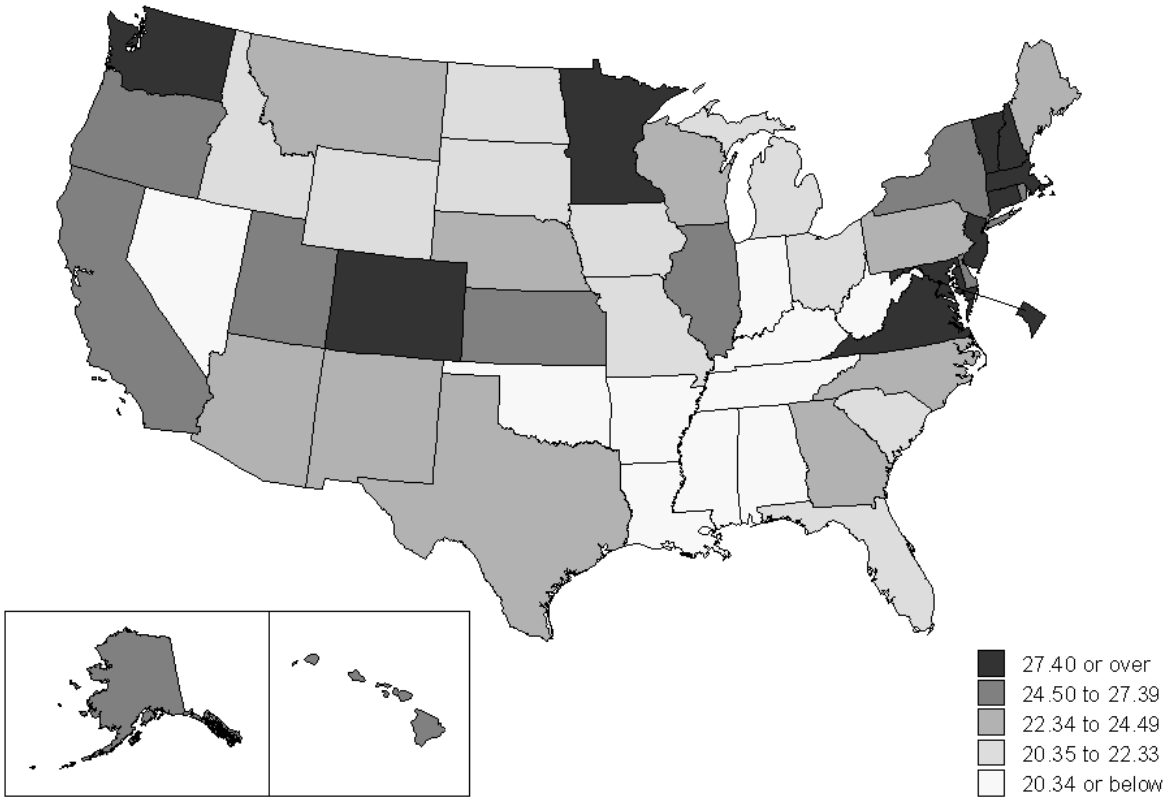
Figure 1. Percentage of Residents Aged 25 Years and Older with a Bachelor's Degree or Higher, by State, 2000.



Source: 2000 Census of Population and Housing.

Figure 2. Supply and Demand for College-Educated Labor in a State

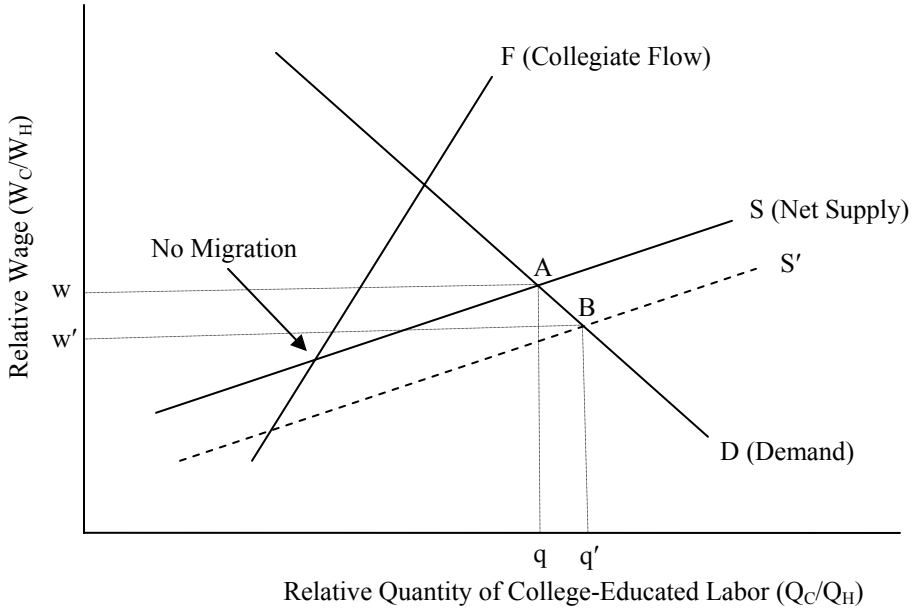
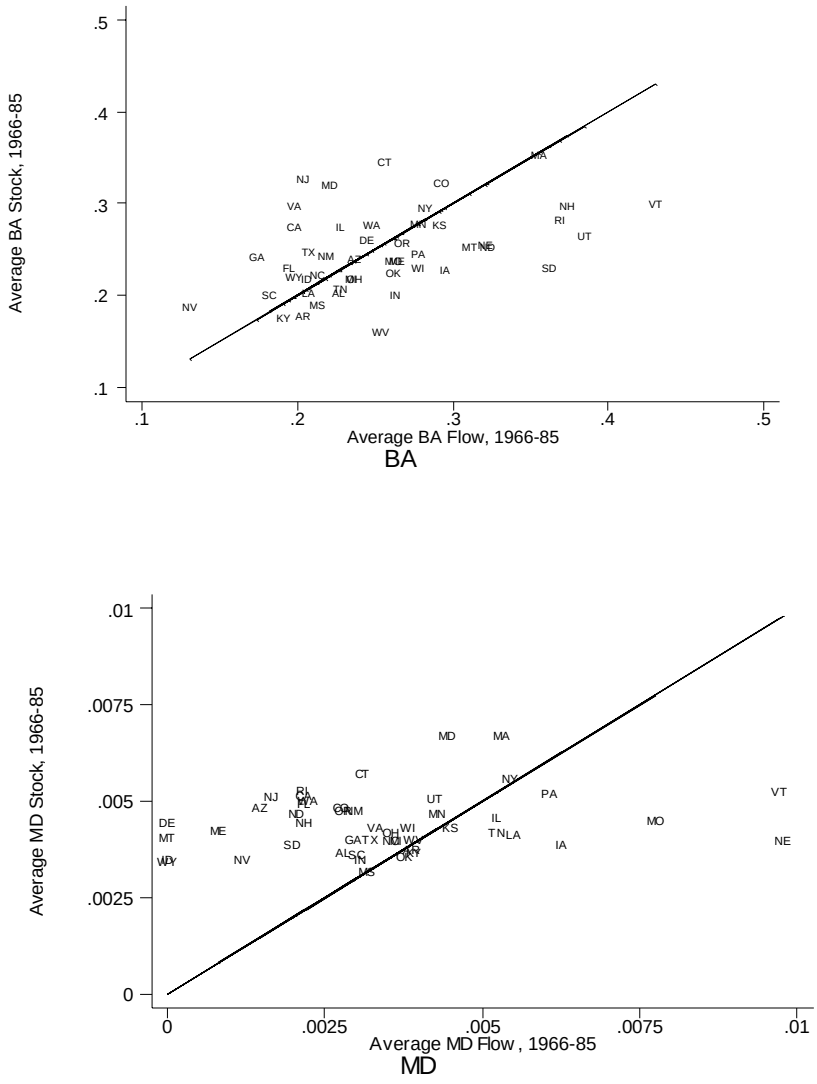


Figure 3. Stocks and Flows of Degrees Awarded Relative to Cohort Size, Bachelor's Degrees and Medical Degrees, 1966–85 Degree Cohorts



Source: Bound, Groen, Kezdi, and Turner (2004).