

Bartik, Timothy J.

Working Paper

Increasing the economic development benefits of higher education in Michigan

Upjohn Institute Working Paper, No. 04-106

Provided in Cooperation with:

W. E. Upjohn Institute for Employment Research, Kalamazoo, Mich.

Suggested Citation: Bartik, Timothy J. (2004) : Increasing the economic development benefits of higher education in Michigan, Upjohn Institute Working Paper, No. 04-106, W.E. Upjohn Institute for Employment Research, Kalamazoo, MI,
<https://doi.org/10.17848/wp04-106>

This Version is available at:

<https://hdl.handle.net/10419/64365>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

***Increasing the Economic Development Benefits of
Higher Education in Michigan***

Upjohn Institute Staff Working Paper No. 04-106

Timothy J. Bartik
Senior Economist
W.E. Upjohn Institute for Employment Research
300 S. Westnedge Avenue
Kalamazoo, Michigan 49007
e-mail: bartik "at" upjohn dot org

September 27, 2004

JEL Codes: R580, I280, H720

Presentation for Lt. Governor's Commission on Higher Education and Economic Growth, State of Michigan. This commission was established by Michigan Governor Jennifer Granholm in June 2004, and is charged with "finding ways to double the percentage of Michigan citizens who attain college degrees and other credentials that can propel Michigan to higher levels of economic growth" (Press release from governor's office, June 22, 2004.) This presentation is in response to a request for me to give my thoughts on increasing the economic development benefits of higher education in Michigan. I thank Claire Black for assistance, and Randy Eberts, Kevin Hollenbeck, and John Austin for comments. The opinions expressed in this presentation should not be construed as official views of the Upjohn Institute.

Abstract

This paper considers how a state such as Michigan can increase the economic development benefits of higher education. Research evidence suggests that higher education increases local economic development principally by increasing the quality of the local workforce, and secondarily by increasing local innovative ideas. These economic development benefits of higher education can be increased by: 1) competent management of conventional economic development programs that focus on business attraction and retention; 2) policies that focus on increasing local job skills by educating the state's residents, as opposed to attracting in-migrants; 3) policies that address specific "market failures" in how higher education leads to increased workforce quality or business innovations.

In this paper, I make four points:

- 1) Research suggests that increasing the proportion of college graduates in the local population will have significant economic development benefits for a local economy. These benefits will occur even if this increase in educational attainment is not accompanied by any special policies to promote economic development.
- 2) State and local economic development programs in Michigan are generally well run. These programs are a useful complement to policies to increase educational attainment. Economic development programs will help increase labor demand to match the increase in labor supply from increased educational attainment.
- 3) The economic development benefits of increased educational attainment are greater from policies aimed at educating current state residents, rather than attract educated in-migrants.
- 4) Increasing the economic development effects of higher education requires correcting for “market failures” in how higher education leads to economic development. We should consider how higher education’s new ideas can be more easily reflected in new or improved private businesses. We should also consider options that encourage higher education to be more focused on increasing the number of students who graduate and go on to well-paying jobs in Michigan.

INCREASING THE NUMBER OF COLLEGE GRADUATES HAS ECONOMIC DEVELOPMENT BENEFITS

Research suggests that a one-point increase in percent of a local economy’s population that is college educated increases local growth over a 10-year period by one-half point (Glaeser and Saiz 2003).¹ These research findings come from comparing the growth of metropolitan areas over three 10-year periods: 1970–1980, 1980–1990, 1990–2000.

As is well known, increasing a person’s education will on average increase his wage rate; for example, college-educated workers tend to be paid about 60 percent more than workers with only

¹To clarify units of measure, consider the following example: In 1990, 17.4 percent of Michigan’s population, age 25 and over, had a Bachelor’s degree or higher (Digest of Education Statistics 2002, Table 11). From 1990 to 2000, Michigan’s population grew by 6.9 percent (downloaded from U.S. Census Bureau at <http://quickfacts.census.gov/qfd/states/26000.html>). Glaeser and Saiz’s results imply that if the percent of Michigan’s college-educated in 1990 had somehow been increased from 17.4 percent to 18.4 percent, Michigan’s population would have grown from 1990 to 2000 by 7.4 percent, a half-point increase.

a high school degree (author's calculations using the Current Population Survey, previously presented at Michigan Consensus Revenue Estimating Conference, May 18, 2004). More surprising is the research finding that increasing the proportion of college graduates in a local economy will increase the wage rates of local residents other than those receiving more education. Research suggests that a one-point increase in the percent of a local economy's population that is college educated will increase real wages of non-college-educated local residents by 1.4 percent, and real wages of local college graduates (excluding those receiving more education) by 0.3 percent (Moretti 2003, 2004). Overall average real wages will increase by 1.1 percent, even if we exclude effects on those receiving more education.² These research findings are based on considering the wages of individuals in different metropolitan areas, holding constant as much as possible the individual's own characteristics, and using various statistical techniques to identify the causal effect of the metropolitan area's college-educated proportion on individual wages.

I will discuss later why these wage effects occur. Presumably, increasing the proportion of local college graduates somehow increases the productivity of a local economy. The greater effects on wages of non-college graduates than on college graduates probably reflects the labor market's response to an increase in the relative supply of college-educated workers.

To my knowledge, there has not been similar research on whether the proportion of a local economy's residents with other postsecondary certificates, not just college graduates, also have positive effects on the overall growth or wages of a local economy. If education mainly affects

²Moretti (2004) presents a variety of estimates from different specifications. I use his first-differenced estimates from p. 201. I weight the different groups he considers (high school dropouts, high school graduates only, some college, college graduates) by each group's population share of persons age 25 and over, from Table 9 of the 2002 Digest of Education Statistics. I reduce each number by 0.1 percent to get real wage estimates, under the assumption that a one-point increase in education share will be associated with a half-point increase in population growth (Glaeser and Saiz 2003), which will increase local prices by 0.1 percent (Bartik 1991).

economic development by increasing labor skills, as I argue later, it seems likely that a wide variety of increases in education and skills have these positive economic development effects.

These estimated effects of more college graduates on local growth and wages reflect effects for a typical state or local economy. A typical state or local economy has some “average” economic development program, and engages in some “average” efforts to use higher education for economic development purposes. Therefore, it is reasonable to presume that Michigan could increase its economic development by educational attainment without any special additional policies. However, the economic development effects of increasing educational attainment may be greater if complemented by other policies, which are the focus of the rest of my presentation.

STATE AND LOCAL ECONOMIC DEVELOPMENT PROGRAMS IN MICHIGAN ARE SOUND

Increasing the number of college graduates or postsecondary certificate holders in a state increases labor supply. Growth and increased wages can only occur if employers come forward to hire that increased labor supply at higher wages. Labor supply increases will tend, to some degree, to automatically increase labor demand, as the greater ease of filling vacancies with qualified workers will attract new employers and encourage employment growth in existing employers. However, on the margin it is possible that state and local policies may add to or subtract from this increase in labor demand. Among these state and local policies are economic development programs. I define economic development programs as programs that provide assistance to employers that is more or less customized to individual employer’s needs. Such programs include financial incentives, such as property tax abatements, as well as a wide variety of services, such as information on the state or local economy, help in dealing with various regulatory requirements,

information or training related to technology or management issues, and customized training for new hires or the employer's current workers.

Research suggests that Michigan's economic development programs are generally well run (Bartik, Eisinger, and Erickcek 2003). This research finding is based on interviews with state and local economic developers and businesses, and on surveys showing very favorable ratings of the Michigan Economic Development Corporation's (MEDC's) operations by businesses and other stakeholders. It should be kept in mind that a majority of the time of state and local economic developers is devoted to relatively cheap efforts to provide information to new or existing businesses, or to play an ombudsmen role in helping employers deal with state or local regulations or programs. Such cheap efforts do not require much in the way of economic development payoffs to pass a benefit-cost test. Furthermore, such efforts to make state programs and regulations more transparent and responsive seem to be an easy government activity to rationalize. Government has a unique responsibility, as well as comparative advantage, in providing such information and assistance.

However, a majority of the resources that state and local governments devote to economic development come in the form of financial incentives, which try to reduce the net state and local effective tax rate on a particular business project. Research suggests that Michigan's business tax rates, after "normal" economic development incentives, are surprisingly competitive with our nearby states. After "normal" incentives, principally property tax abatements, average effective state/local business tax rates in the Midwest are: Michigan, 8 percent; Indiana, 16 percent; Ohio, 12 percent; Illinois, 8 percent; Wisconsin, 9 percent (Bartik, Eisinger, and Erickcek [2003], based on Fisher and Peters' [1998] tax simulation model). In addition to normal incentives, Michigan in selected cases provides much larger incentives than these nearby states; the MEGA tax credit program and the

Renaissance Zone program are much bigger than anything done by our neighboring states. Perceptions that Michigan's effective business tax rates are unusually high are outdated.

EDUCATING CURRENT STATE RESIDENTS HAS GREATER BENEFITS THAN ATTRACTING EDUCATED IN-MIGRANTS

In addition to running high-quality economic development programs, there are other ways to increase the economic development benefits from increasing the number of college graduates or postsecondary certificate holders in a local economy. One issue is how we increase the proportion of the state's residents that are college educated (or have other postsecondary credentials). More educational attainment in a state can occur through greater education for current state residents, or through attracting more state residents from elsewhere. I argue here that educating state residents is likely to have greater gross benefits than attracting the educated from outside the state. I hasten to add that the relative net benefits of the two alternative approaches are uncertain, as it is unclear how costly it is to educate state residents versus attracting educated in-migrants.

Educating a state's own residents, compared to attracting in-migrants, has greater gross benefits for two reasons. First, it increases the real earnings of those educated. As discussed above, a one-point increase in the percentage of a local economy's population that is college educated will increase average local real wages by 1.1 percent, excluding the gains in wages of those who are educated. But those educated will benefit from an income gain equal to 0.6 percent of overall local wages, as college-educated workers have real wages about 60 percent greater than workers with only a high school diploma (a 60 percent gain for 1 percent of the population is 0.6 percent of overall wages). Educating a state's own residents therefore has gross benefits equal to 1.1 percent for those

not educated plus 0.6 percent for those educated, whereas attracting in-migrants only has the 1.1 percent benefit.³

Second, attracting in-migrants to a state has a variety of costs, such as more congested public roads and other infrastructure, more environmental problems, higher demands and needs for public services, and higher housing prices. For example, estimates suggest that housing prices will increase by about 0.4 percent in a local economy for a 1 percent increase in population (Bartik 1991). Additional households also produce additional tax revenue, but most estimates suggest that this extra tax revenue does not fully pay, in most cases, for the additional infrastructure costs (Altshuler and Gomez-Ibanez 1993).

WHAT “MARKET FAILURES” MIGHT IMPEDE THE VARIOUS MECHANISMS BY WHICH HIGHER EDUCATION PROMOTES ECONOMIC DEVELOPMENT?

Regardless of how we increase the proportion with more education in a state, we might consider whether there are ways to increase the economic development payoff from having more educated state residents. This analysis requires us to think about why more college graduates might lead to greater economic development. In addition, we might consider whether there are any inefficiencies or other problems that impede the effects of higher education on local economic development, and whether these inefficiencies can be feasibly corrected by the government.

Higher education may increase state and local economic development by increasing the quality of the local workforce, increasing new business ideas that can be used in the local economy, or making the local area a more attractive place to live. My judgment is that the first “transmission

³It could be argue that the in-migrants have gains from in-migrating that should be considered. I have considered this issue extensively elsewhere (Bartik 1991, Chapter 3). In brief, I conclude that the benefits to in-migrants from local policy changes are small because their next best opportunity, staying where they are or moving to another state, is likely to be similar in overall value to moving to this particular state or local economy.

mechanism” by which higher education may affect local economic development, through labor quality, is probably the most important. This judgment is difficult to prove conclusively, but there is some suggestive evidence (Glaeser and Saiz 2003). An increase in the proportion college-educated in a local economy seems to increase wages more than housing prices and other local prices. This suggests that the increase in proportion college-educated is somehow raising the productivity of labor. If the college-educated proportion increased local growth by making an area more attractive to households, we would expect housing prices and other local prices to go up faster than wages, because the increase in labor supply would tend to decrease real wages. (In some economic models, if the only reason that the college-educated proportion increased local growth was that it made an area more attractive to households, we would expect nominal wages to decline enough that additional employers would be attracted despite the higher local land prices.) Another suggestive finding is that statistical models of what determines state or local economic growth find that the college-educated proportion has greater explanatory power than variables measuring the local production of new ideas, such as local patenting activity.

If the college-educated proportion increases local economic development by increasing local labor quality and (to a lesser extent) helping create new ideas, is there any reason to think that the normal workings of private markets and our traditional institutional structures may reduce local economic development by inefficiently impeding these “transmission mechanisms”? Are there any “market failures,” “institutional failures,” or gaps in the causal links from higher education to economic development that have some potential for being dealt with by some feasible government action? Economists pose such conceptual questions to help us focus the policy debate on where we might really improve matters, by helping deal with a particular targeted problem. In this paper, I

just try to find areas to look for possible policy improvements. Further analysis of the questions I raise would be needed to develop new policies.

Let us first consider market failures that might impede translating the new ideas that no doubt are widespread in higher education institutions into the private market in a way that promotes local economic development. First, there may be an insufficient number of entrepreneurs who understand the new product/service ideas in the local higher education institution and have the will or skill to translate those new ideas into a viable business. Development of many types of skills is often inefficient, as buyers of skills may not understand the values of the skills or be able to competently evaluate the quality of skill providers.⁴ Entrepreneurship is often thought of as an inborn personality trait, but the evidence suggests that successful entrepreneurship also involves particular entrepreneurship skills. Research suggests that entrepreneurship training, among individuals interested in becoming an entrepreneur, may increase the number of potential entrepreneurs who successfully start up a small business by one-third, with no greater business failure rate (Benus et al. 1995). This research finding comes from studies examining entrepreneurship training for persons receiving unemployment benefits who expressed an interest in entrepreneurship; the findings were based on an experiment that randomly assigned persons who expressed an interest in entrepreneurship to a group that received entrepreneurship training, and a control group, so the results can be regarded as highly reliable. Is it possible to set up entrepreneurship training for individuals familiar with the new product/technology/service ideas in higher education institutions, with the entrepreneurs being either higher education staff or

⁴Another argument frequently presented in the economics literature is that the level of education chosen in a perfectly free market may be too low because some individuals may find it difficult to borrow against the future level of their human capital. This does not seem the most persuasive argument for why college professors might not choose enough entrepreneurship training.

individuals with close ties to higher education staff? How would this differ from programs already under way, through local small business development centers and other organizations?

Second, there may be problems in transferring the technological knowledge and business know-how in local higher education institutions to already-existing local businesses. We know that information markets are often inefficient, in part because buyers of information find it difficult to evaluate the information's quality. Research suggests that the federally funded "Manufacturing Extension Partnership" program is effective. This program helps fund a number of local offices around the nation, including several in Michigan that are part of the Michigan Manufacturing Technology Center. These local manufacturing extension offices try to provide local manufacturers with useful and reliable information to help improve business productivity. Surveys suggest that about two-thirds of MEP clients report that MEP services led to productivity improvements (National Institute of Standards and Technology 2002). Furthermore, comparisons of clients assisted by manufacturing extension services, with similar firms that were not assisted, suggest average effect on productivity growth of assisted firms of at least 3 percent per year (Oldsman and Russell 1999; see also Jarmin 1999 for supporting evidence of effects of MEP-type programs). Are there ways to expand such information services to businesses so that they more effectively draw on the expertises of more higher education staff, and possibly extend such services to a wider variety of export-base businesses?⁵ Some states, such as Pennsylvania and Tennessee, have long-standing

⁵In regional economics, "export-base" businesses refer to businesses that sell their product or service outside the state, or compete with businesses that import their product or service into the state. The theory is that non-export-base businesses, that sell only locally, with no realistic potential for outside the state competition, can be viewed as having their output determined by the local market size, which depends on the location decisions and success of the area's export-base businesses. These export-base businesses are viewed then as the key drivers of local economic growth, with non-export-base businesses playing a secondary and dependent role. Export-base businesses include most of manufacturing, but also many service industries.

programs that try to transfer the expertise of higher education staff to the private business sector. Does the experience of such states suggest any useful models?

Third, there may be problems in financing some of the new businesses that might result from the new ideas in higher education institutions. Capital markets are often argued to be imperfect, because many business ventures that eventually succeed had trouble receiving financing, and capital markets are extensively regulated. Even if it is conceded that private markets are imperfect, direct government financing of new business ventures is problematic. Correcting for gaps in private capital markets requires that government finance new businesses that are above average in risk. For political reasons, government agencies subject to public scrutiny are uncomfortable with frequent failures of business loans or investments, and government agencies that are shielded from such public scrutiny are at risk of corruption.

Therefore, any successful government intervention in business finance is likely to involve the government indirectly encouraging some type of higher-risk business financing. The state of Michigan is already encouraging private venture capital financing by the Early Stage Investment Act of 2003, which provides some tax credits to help reduce the risks of such financing. This intervention is similar to tax credit programs in 17 other states (Community Development Venture Capital Alliance 2004). To my knowledge, there has been no evaluation of the effectiveness of such state tax credits for venture capital financing. I encourage an independent evaluation of Michigan's efforts.

The government intervention in business finance that has been most extensively and positively evaluated is the Capital Access Program. This program essentially has the state government provide a modest subsidy to banks for higher-risk business loans. This program was created by the state of Michigan in 1986, and was subsequently imitated by 20 other states, but no

longer receives state funding from Michigan. Evaluations suggest that this program was successful in increasing bank loans to businesses that were not excessively risky, but were above average in risk, and therefore unlikely to be made without the program (a brief write-up of this program and its evaluations is in Bartik [2003]; more information is in Berube [2001]). However, from the perspective of economic development professionals, the Capital Access Program was insufficiently targeted at export-base businesses and other businesses that are most critical to a state or local area's economic development. Are there ways of restructuring a Capital Access Program so that it might target business ventures that are more crucial to a state's economic development, such as new business ventures in promising high-technology fields? Could a modified Capital Access Program be targeted to encourage ventures emerging from our higher education institutions?

There may also be market or institutional failures or problems that impede higher education institutions from being as effective as possible in helping students gain skills that will pay off in the state's labor market. First, we know that the information that students and prospective students have about the outcomes of education is imperfect. Are there mechanisms by which students could be provided with specific information about the likely outcomes in the state's labor market of specific majors at specific educational institutions? For example, it would seem feasible to get such information by linking higher education student records with the wage records the state collects for almost all employees under the unemployment insurance system.

Second, we know that most higher education funding by the state government is based on the institution's number of students, not on the outcomes that the institution's students experience, for example, the proportion who graduate and their average employment rates and wage rates. It is certainly possible to enormously change the incentives that higher education institutions face by

basing funding more on such labor market–related student outcomes. Whether such outcome-based funding is desirable is appropriately controversial, as I will discuss at the end of this section.

One way to change the incentives for higher education institutions is to provide supplemental state funding for specific state programs that are closely related to outcomes for students or other state economic development purposes. For example, Michigan, like many other states, provides funding for customized training for firms that the state is seeking to attract or encourage to expand. Such customized training is usually provided through local community colleges. Research suggests that such customized training for firms can have significant positive effects on a firm’s productivity (Holzer et al. 1993). A few states devote much greater resources than Michigan to customized training. For example, if Michigan ran customized training programs at the same real per capita size as North Carolina, the state would spend \$62 million annually on customized training, involving 360,000 workers (derived from pp. 259–260 of Bartik 2001). Is it desirable for the state of Michigan to seek to reshape the focus of its community colleges by providing much larger funding for customized training programs?

A more fundamental way to alter the incentives of higher education institutions is to base more of their core funding from the state on various student outcomes. Some portion of the state’s funding for higher education could be conditioned on the numbers of students who graduate, whether they are employed in Michigan, and at what wage rates. This type of intervention is appropriately controversial because it deals with a very tough question: Exactly what is the social interest in supporting higher education? Is higher education simply supported for the additional wages obtained by its graduates and the benefits provided to the state’s economic development? Or, is higher education supported because of the intangible education in citizenship and culture provided to its students, and the various cultural benefits provided to other state residents? If both benefits are

important, as seems likely, what is the appropriate balance? Is it simply too politically risky to encourage the state government to be constantly tinkering with higher education funding formulas to encourage whatever economic development outcome is popular that year? These are tough questions.

CONCLUSION

A key point from this paper is that even without complementary policies, increasing the average educational attainment of state residents is likely to have significant economic development benefits, particularly if these additional educated residents are “home grown.” Therefore, the first task is to identify policies to increase the proportion of Michigan residents who are able to successfully obtain post-secondary degrees or certificates. This is no easy task.

However, these education policies may have greater economic benefits if accompanied by some complementary policies. This paper has suggested some areas to explore that may draw state higher education institutions and their staff more into activities that promote state economic development. An important policy issue is how far to push such policies that tie higher education institutions to economic development goals, given that higher education also has other important social goals.

REFERENCES

- Altshuler, Alan, and Jose Gomez-Ibanez, 1993. *Regulation for Revenue: The Political Economy of Land Use Exactions*. Washington, DC: Brookings Institution.
- Bartik, Timothy, 2003. "Local Economic Development Policies." Working paper 03-91, Upjohn Institute. Available for download at <http://www.upjohn.org/publications/wp/03-91.pdf>.
- Bartik, Timothy, 2001. *Jobs for the Poor: Can Labor Demand Policies Help?* New York: Russell Sage Foundation.
- Bartik, Timothy, 1991. *Who Benefits from State and Local Economic Development Policies?* Kalamazoo, MI: Upjohn Institute.
- Bartik, Timothy, Peter Eisinger, and George Erickcek, 2003. "Economic Development Policy in Michigan," in *Michigan at the Millennium* (edited by Charles Ballard, Paul Courant, Douglas Drake, Ronald Fisher, and Elisabeth Gerber). East Lansing: Michigan State University Press.
- Benus, Jacob, Terry Johnson, Michelle Wood, Neelima Grover, and Theodore Shen, 1995. *Self-Employment Programs: A New Reemployment Strategy, Final Impact Analysis of the Washington and Massachusetts Self-Employment Demonstrations*. U.S. Department of Labor Unemployment Insurance Occasional Paper no. 95-4. Washington, DC: U.S. Department of Labor.
- Berube, Alan, 2001. "Capital Access Programs: A Summary of Nationwide Performance." Washington, DC: U.S. Department of Treasury.
- Community Development Venture Capital Alliance, 2004. "State Tax Credit Incentives for Equity Investments: A Survey of Current Practices." Available at <http://www.nasvf.org/web/allpress.nsf/pages/9442>.
- Digest of Education Statistics, 2002. Published by National Center for Education Statistics, U.S. Department of Education, and available online at <http://nces.ed.gov/programs/digest/>.
- Fisher, Peter, and Alan Peters, 1998. *Industrial Incentives: Competition Among American States and Cities*. Kalamazoo, MI: Upjohn Institute.
- Glaeser, Edward, and Albert Saiz, 2003. "The Rise of the Skilled City," National Bureau of Economic Research working paper 10191.
- Holzer, Harry, Richard Block, Marcus Cheatham, and Jack Knott, 1993. "Are Training Subsidies for Firms Effective? The Michigan Experience," *Industrial and Labor Relations Review* 45: 625-36.

- Jarmin, Ronald, 1999. "Evaluating the Impact of Manufacturing Extension on Productivity Growth," *Journal of Policy Analysis and Management* 18: 99-119.
- Moretti, Enrico, 2004. "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics* 121: 175-212.
- Moretti, Enrico, 2003. "Human Capital Externalities in Cities," National Bureau of Economic Research working paper 9641.
- National Institute of Standards and Technology, 2002. "The Manufacturing Extension Partnership: Delivering Measurable Returns to Its Clients." Washington, DC: U.S. Department of Commerce.
- Oldsman, Eric, and Jack Russell, 1999. "Industrial Resource Center Program: Assessing the Record and Charting the Future." Unpublished report prepared for the state of Pennsylvania.