

Ben S Bernanke: Education and economic competitiveness

Remarks by Mr Ben S Bernanke, Chairman of the Board of Governors of the US Federal Reserve System, at the US Chamber Education and Workforce Summit, Washington DC, 24 September 2007.

The original speech, which contains various links to the documents mentioned, can be found on the US Federal Reserve System's website.

* * *

When I travel around the country, meeting with students, business people, and others interested in the economy, I am occasionally asked for investment advice. Usually (though not always) the question is posed in jest. No one really expects me to tell them which three stocks they should buy. However, I know the answer to the question and I will share it with you today: Education is the best investment.

Here at the U.S. Chamber Education and Workforce Summit, I don't really need to convince you that, as an investment, education provides excellent returns, both for individuals and for society. As executives accustomed to making hard cost-benefit decisions, you doubtless assign a high priority to the quality of your business's workforce because you know that a key – perhaps *the* key – to your success is the capabilities of the people you employ. To a significant extent, those capabilities are the product of education. Here I am speaking not just of education acquired formally in classrooms before entering the workforce but also of lifelong learning that, yes, includes the formal classroom training that might first come to mind but that also includes early childhood programs, informal mentoring on the job, and mid-career retraining, to name a few examples. And when I speak of capabilities, I mean not only the knowledge derived from education but also the values, skills, and personal traits acquired through education, which are as important as, and sometimes even more important than, the specific knowledge obtained. These include such qualities as the ability to think critically, to communicate clearly and logically, and to see a project through from start to finish.

Today, I would like to offer a broad overview of education and its importance to our economy from my perspective not only as an economist but also as a one-time school board member, the spouse of a teacher, and the parent of two young adults pursuing higher education. Although the United States has long been a world leader in expanding educational opportunities, we have also long grappled with challenges, such as troubling high-school dropout rates, particularly for minority and immigrant youths, and frustratingly slow and uneven progress in raising test scores and other measures of educational achievement. If we are to make progress in meeting these challenges, we must be willing to actively debate their causes and continually experiment and innovate to find solutions.

The benefits of education

Education imparts significant benefits both to our society and the individuals who pursue it. Economists have long recognized that the skills of the workforce are an important source of economic growth. Moreover, as the increase over time in the returns to education and skill is likely the single greatest cause of the long-term rise in economic inequality, policies that lead to broad investments in education and training can help reduce inequality while expanding economic opportunity (Bernanke, 2007). But the benefits of education are more than economic. A substantial body of evidence demonstrates that more-highly-educated individuals are happier on average, make better personal financial decisions, suffer fewer spells of unemployment, and enjoy better health. Benefiting society as a whole, educated individuals are more likely to participate in civic affairs, volunteer their time to charities, and subscribe to personal values – such as tolerance and an appreciation of cultural differences

– that are increasingly crucial for the healthy functioning of our diverse society (Glaeser, Ponzetto, and Shleifer, 2006; Dee, 2004).

From a macroeconomic standpoint, education is important because it is so directly linked to productivity, which, in turn, is the critical determinant of the overall standard of living. The Bureau of Labor Statistics estimates that, between 1987 and 2006, ongoing improvement in the education and experience of the U.S. workforce contributed 0.4 percentage point per year to the increase in nonfarm business labor productivity (U.S. Department of Labor, 2007), a significant amount. These estimates are however conservative in that they hold fixed other sources of productivity growth, such as the accumulation of various forms of capital and the advance of technology; but workers' skills certainly contribute indirectly to productivity growth by affecting these other factors as well. For example, the state of technology is affected both by the creativity and knowledge of scientists and engineers engaged in formal research and development as well as by the efforts of skilled workers on the shop floor who find more efficient ways to accomplish a given task. Managers who develop a new business plan or find new ways to use evolving technologies can also be thought of as adding to the "intangible," or knowledge-based, capital of the firm, which by some estimates is comparable in importance to physical capital such as factories and equipment (Corrado, Hulten, and Sichel, 2006).

For individuals, the economic returns to education are substantial as well. In 2006, the median weekly earnings of college graduates were 75 percent higher than the earnings of high-school graduates. In turn, workers with a high-school degree earned 42 percent more than those without any diploma.¹ These differentials are large and have been growing; indeed, they have roughly doubled in the past twenty-five years or so. The source of the widening wage gap between the more-educated and less-educated is nothing more complicated than supply and demand. The demand for more-educated workers has been increasing rapidly, partly because the much more widespread use of computers and other sophisticated information and communication technologies in the workplace has increased the reward for technical skills. The supply of highly educated workers has also risen. At the start of the 1980s, 22 percent of young adults aged 25 to 29 held a college degree or more; by last year, that fraction had moved up to 28.5 percent.² Nevertheless, the supply of educated workers has not kept pace with demand, thus generating an increased salary premium for education. Because the wages of those at the top of the educational ladder have increased the fastest, increasing our investment in education can benefit not only individuals and society but also might narrow income gaps.

Education and the challenges facing America today

The educational challenges our society faces should be considered in the context of three broad trends: the retirement of the baby-boom generation, the inexorable advance of the technological frontier, and the ongoing globalization of economic activity.

As the baby boomers, now ranging in age from their late 40s to early 60s, leave the workforce, their places will be taken by the smaller cohort of workers born in the mid-to-late 1960s and early 1970s. As a result, the U.S. workforce – as a matter of simple arithmetic – will increase more slowly and is likely to become less experienced on average (Jorgenson and others, 2007; Aaronson and Sullivan, 2002). In a broader sense, the ratio of working people to retirees will decline, meaning that those still working will, in effect, be supporting relatively more non-working people. This year, there are about five working-age people (20-

¹ The data are weekly earnings of full-time wage and salary workers aged twenty-five and older and are derived from the Current Population Survey, published by the U.S. Bureau of Labor Statistics.

² The data are derived from the Current Population Survey, published by the U.S. Bureau of Labor Statistics.

64) for every person aged 65 and older; by 2030, the ratio will be about 3-to-1 (Bernanke, 2006). The slower expansion of the labor force, all else equal, implies slower growth of potential output. More schooling for more of the workforce could help cushion the impact of this demographic transition on economic growth by boosting productivity growth.

Continuing advances in technology also put a premium on education. Which jobs will be most affected by technology is difficult to predict, although some research suggests that sectors that now use information technology (IT) relatively less intensively, such as health-care and other service sectors, are likely to step up their use of software and IT services (Mann, 2003). Regardless, better-educated workers are likely better prepared to adapt to new technologies as they develop (Doms, Dunne, and Troske, 1997).

Ongoing globalization of economic activity will also lead to continuing changes in the structure of the U.S. economy – including the composition of our output of both goods and services, and thus the structure of our labor force. The world economy is benefiting from the expansion of trade and the rising productivity of countries abroad that are making great strides expanding both their infrastructure and the educational attainment of their workforces. That can be good for them, and for us. Importantly, our ability to reap the benefits of globalization will depend on the flexibility of our labor force to adapt to changes in job opportunities, in part by investing in the education and training necessary to meet the new demands (Bernanke, 2004).

Educational attainment and achievement: where do we stand?

The United States has a long tradition of recognizing the significant social and economic benefits of providing high-quality education for as many of its citizens as possible. The United States led the world, first, in expanding access to high-school education and, then, in the post-World War II era, access to college (Goldin, 2001; Goldin and Katz, 1999). By 1966, about half of the workforce aged 25 and older had completed high school and about 10 percent had completed college. By 2006, more than 90 percent of adults in the labor force had a high-school education and more than 20 percent held at least a bachelor's degree. However, most of the progress over the past forty years occurred in the 1970s and early 1980s. Since then, for example, the high-school graduation rate for 25-to-29-year-olds has not increased, and the college completion rate has risen only modestly (U.S. Department of Education, 2007b).

One trend is particularly disappointing: Both high-school and college completion rates for minorities continue to lag.³ Over the past ten years, the high-school completion rate for whites aged 25 to 29 hovered above 93 percent, while the rate for blacks of the same age stayed near 87 percent; the rate for Hispanics, though trending up over the period, was only 63 percent last year. The gaps in college completion are wider. In recent years, more than one-third of whites aged 25 to 29 had at least a bachelor's degree, compared with less than one-fifth of same-aged blacks and around 10 percent of Hispanics.

Assessing where we stand in terms of educational achievement (how much students learn) is fraught with considerably greater difficulties than assessing attainment (how far students progress in their schooling). And, the results of various metrics highlight both discouraging and encouraging elements. The Department of Education's National Assessment of Educational Progress shows the average reading levels of our high-school seniors have stagnated in recent years; however, our fourth graders continue to improve in reading, and both fourth and eighth graders have improved in math (U.S. Department of Education, National Center for Education Statistics, 2007b). At the same time, some initial results from

³ The data are derived from the Current Population Survey, March and Annual Social and Economic Supplement, 1971-2006, published by the U.S. Department of Commerce.

the adoption of state accountability standards suggest that they have had a positive effect on students' test-score gains (Jacob, 2005; Hanushek and Raymond, 2004). International comparisons of student achievement are even more difficult and present a mixed picture.⁴ Compared with students around the world, U.S. students still perform relatively well in reading and, in the lower grades, at math and science. Older U.S. students, however, show less ability to apply math and science skills than their peers in other industrialized countries.

Lifelong learning can help us meet economic challenges

In the past, the U.S. education system has responded to the needs of a changing economy, and I believe that as we address such challenges as the retirement of the baby-boom generation, advancing technology, and globalization, our education system will again make an important contribution to the adjustment process. That means, of course, that we will have to grapple with difficult issues – how to boost educational attainment, particularly for minorities and immigrant youths; how to make more consistent and noticeable progress in raising academic achievement; and how to ensure that older workers have meaningful opportunities to refresh their skills.

What can be done so that our educational system will continue to play a significant role in supporting economic change? In broad terms, we must begin by recognizing that learning is a lifelong process and that we have opportunities to improve education at every point along the way. Many of these opportunities lie outside the traditional route of a kindergarten-through-twelfth-grade education followed by four years of college. I'd like to comment briefly on what economists have found about the benefits of educational investments at different points in the life cycle.

Early childhood education

Building the foundation for lifelong learning from the earliest ages is crucial (Heckman, Stixrud, and Urzua, 2006). Research suggests that the home environment is especially important and that children who start behind find catching up increasingly difficult (Heckman and Masterov, 2007). Thus, the payoff from high-quality pre-school and home visitation programs is likely very high, especially for children born into poor or otherwise disadvantaged families. Recent research – some sponsored by the Federal Reserve Bank of Minneapolis in collaboration with the University of Minnesota – has documented high returns from early childhood programs in terms of subsequent educational attainment and in lower rates of social problems, such as crime, teenage pregnancy, and welfare dependency (Burr and Grunewald, 2006).⁵ But early childhood education is only the beginning. Positive results from programs such as Head Start dissipate without further high-quality schooling at the elementary and secondary levels (Garces, Thomas, and Currie, 2002).

Elementary and secondary schooling

Deciding what and how to teach students from kindergarten through high school and then evaluating our schools' effectiveness in preparing students for the workforce and a lifetime of

⁴ The results of two prominent international assessments – The Trends in International Mathematics and Science Study, conducted under the aegis of the International Association for the Evaluation of Educational Achievement, and the Organization for Economic Cooperation and Development's Program for International Student Assessment – are summarized in the 2006 Digest of Education Statistics published by the U.S. Department of Education (2007a). http://nces.ed.gov/programs/digest/d06/ch_6.asp

⁵ More information on the Early Childhood Research Collaborative and copies of its research papers can be obtained from the website of the Federal Reserve Bank of Minneapolis, www.earlychildhoodrc.org.

learning is a daunting task. I will make only a few observations on the goals we should keep in mind as we explore ways to improve learning at the elementary and secondary levels.

First, we should encourage experimentation and innovation. By my reading, the research on K-12 education has, to date, yielded no easy answers to the questions of how to raise academic achievement and how to ensure that students finish high school well prepared to move on to more advanced study. A wide range of approaches has been and is being explored: smaller class size, school choice, charter school programs, accountability standards, flexibility in teacher certification rules, better teacher pay, merit-based pay, year-round schooling – the list is long and probably will get longer. The size and diversity of our country, together with the fact that state and local policymakers retain significant discretion over how to structure their educational systems, provides us a natural laboratory for assessing the effectiveness of alternative educational strategies. I view the debate about what works and what doesn't to be a crucial part of discovering cost-effective ways to improve our educational system.

The business community has an obvious interest in how well our schools prepare students for a future in the workforce and should actively participate in the debate. But we all have a stake. Students at the elementary and secondary levels are being prepared not just for work but for life. Such skills and acquired traits as critical and creative thinking, social ability, persistence, and satisfaction in accomplishment make not only good employees but good citizens as well. Exposure to the arts and culture and experience in serving the community can help support the development of these broader, harder-to-measure skills, alongside more readily measurable cognitive accomplishments in reading, math, and science.

Second, teacher quality is critical. Studies show that student performance depends on putting high-quality teachers in the classroom and retaining them as long as possible (Aronson, Barrow, and Sander, 2007; Rivkin, Hanushek, and Kain, 2005; Rockoff, 2004). Indeed, many initiatives focus on linking students, especially disadvantaged students, with high-quality schools staffed by high-quality teachers. High-quality teachers instill in their young students a desire to stay in school and seek more education later in life, and the evidence suggests that the quality of teaching might have the biggest impact on lower-ability students (Murnane and Steele, 2007; Clotfelter and others, 2006; Hanushek, Kain, and Rivkin, 2004). Unfortunately, our most disadvantaged communities, the ones most troubled by high dropout rates, have difficulty attracting and keeping qualified teachers.

We must instill a desire among students to stay in school and to seek more education and training over their working lives. Our elementary and secondary schools must provide students a strong foundation for a life of learning. Although a wide range of remedial education programs exist, research suggests that they are more costly and less effective than a solid, sustained course of study through high school. In particular, government training programs for disadvantaged youth have a rather disappointing reputation, particularly those that are less intensive and not well tied to labor market needs (Martin and Grubb, 2001; Heckman, LaLonde, and Smith, 1999).

A number of possibilities for improving the education of disadvantaged students seem worth exploring. For example, several experiments suggest that smaller schools and smaller classes may help disadvantaged students (although the benefits of such programs for the general student population remain controversial). Supplemental education, including after-school and mentoring programs such as Big Brothers Big Sisters, have been shown to boost school attendance (Grossman and Tierney, 1998). Increasing school time – either through longer school hours or summer school – also has found some support (Jacob and Lefgren, 2004).

Higher education

In many ways, higher education represents the strongest part of the U.S. educational system, as demonstrated by the fact that students from all parts of the world come here to

study. Our institutions of higher learning are extraordinarily varied, ranging from large public research universities to small liberal arts colleges to community colleges and vocational schools.

The main business of our institutions of higher education is, of course, undergraduate teaching. But unlike some countries, we do not separate research and undergraduate education; our advanced, graduate-level research programs are housed in universities with strong undergraduate programs. Thus, our colleges and universities are important sources of research and development (National Science Foundation, 2007; Litan, Mitchell, and Reedy, forthcoming). More than half our basic research – the foundation for breakthroughs that create new industries – is conducted at universities. Additionally, higher education has embraced the broader mission of translating research into new products and enterprises; our colleges and universities account for 15 percent of applied research and development (National Science Foundation, 2007). The innovations that begin on campuses are diffused to businesses through patents, start-up companies, and consulting arrangements between faculty and industry.

One great challenge in higher education lies in making sure our high-school graduates are prepared for it and have access to it. With college enrollment rates having leveled off in recent years, much debate surrounds how we can move more students into higher education and keep them in school until they graduate. Researchers have demonstrated a strong relationship between family income and college attendance. Since 1990, nearly 80 percent of high-school completers from high-income families (the top 20 percent of income) have enrolled in college the next fall. The proportion of those from low-income families who enroll in college the following fall has been moving up gradually, but it remains much lower – just over 50 percent.⁶ This discrepancy holds even for students classified as high achievers: A longitudinal study of eighth graders in 1988 found that only 29 percent of those scoring in the top fourth of the group in math – but who were from families with low social and economic status – had completed a bachelor's degree or more by 2000, while three-fourths of those from families with high social and economic status finished their undergraduate degrees (Fox, Connelly, and Snyder, 2005).⁷ Surely, high tuition must be one barrier to attending and completing college (Card, 2001; Kane, 1994), but it is not the only barrier (Dynarski, 2005). Low-income students, in particular, are more likely to come from school and family environments that do a poor job of preparing them for a successful transition to college (Carneiro and Heckman, 2003). This suggests that supplemental programs to help under-prepared college students could improve eventual college completion rates; unfortunately, the research on the benefits of such programs is mixed, which reinforces the need to improve educational achievement in regular high school classes (Bettinger and Long, 2005; Angrist, Lang, and Oreopoulos, 2006).

Community colleges have made a significant contribution to expanding educational opportunities. Offering lower costs and more-flexible schedules, they now enroll almost one-half of U.S. undergraduates. Attendance at one of these institutions is associated with higher wages, even if a degree is not completed. Evidence suggests that each year of credit at a community college is worth almost as much, in terms of increased earnings potential, as a year at a four-year college. The average student who entered, but did not complete, community college earns 9 percent to 13 percent more than the average for students who

⁶ These data are derived from the annual October Supplement to the Current Population Survey. They are summarized in the U.S. Department of Education's Condition of Education 2007 available at <http://nces.ed.gov/programs/coe/2007/section3/indicator25.asp#info>.

⁷ Socioeconomic status was measured by a composite score on parental education and occupations and family income. The study also found that the proportion of low-scoring math students from high socioeconomic families who completed at least a bachelor's degree was 30 percent versus only 3 percent for those from lower socioeconomic families. For those in the middle quintiles of both scores and family characteristics, the proportion was 21 percent.

ended their education with high school. Those who completed a two-year associate degree earn an even larger premium, 15 percent to 27 percent (Kane and Rouse, 1999). And the earnings of graduates who started at two-year schools and transferred to four-year programs ultimately match those who begin their post-high-school education at four-year institutions (Gill and Leigh, 2003). Community colleges play a constructive role not only for 18-to-22-year-olds but also for older adults, providing flexible programs for obtaining new skills, specialized training contracted for by individual businesses, remedial education, and adult enrichment.

Adult education

Today we are increasingly recognizing that education need not, indeed should not, stop at the age of 22. Economists have long argued that on-the-job training and learning-by-doing are significant components of the acquisition of human capital. Research shows that the knowledge and experience gained over time through informal and formal learning on the job appear to pay off for workers and accrues particularly rapidly early in their careers (Altonji and Williams, 2005; Topel, 1991). An extensive survey of firm-sponsored training a number of years ago found that 84 percent of employees received some kind of formal training while working for their current employer, and 96 percent received some type of informal training (Bureau of Labor Statistics, 1996). With the advance of technology and the need to attract and retain skilled workers, I am certain that business-sponsored training will remain an important component of the management toolkit.

Upgrading skills through continuing education and training outside the job is also important, particularly in an environment in which workers can face displacement from international competition or technological advance. Recognizing this possibility, many workers continue to acquire formal education later in life than was once traditional. For example, almost one-fifth of students at post-secondary institutions of all types are at least 35 years old (National Center for Education Statistics, 2007a). And, for older workers looking to retool their skills, classroom instruction has been shown to be effective. For example, classroom training for displaced workers is estimated to boost future wages as much as for students of the usual school age, although the overall return on investment for displaced workers is lower because they have fewer remaining working years than do new entrants to the labor force (Jacobsen, LaLonde, Sullivan, 2005). Similarly, studies of a number of welfare-to-work programs have reported long-term gains for those who participated in intensive basic education and vocational training (Dyke and others, 2006; Hotz, Imbens, Klerman, 2006). Such results suggest that well-designed programs to assist workers who lose their jobs can contribute to cushioning the effects of globalization and technological change.

Conclusion

Let me close by reiterating that education – lifelong education for everyone, from toddlers to workers well advanced in their careers – is indeed an excellent investment for individuals and society as a whole. Education fundamentally supports advances in productivity, upon which our ability to generate continuing improvement in our standard of living depends. If we are to successfully navigate such challenges as the retirement of the baby-boom generation, advancing technology, and increasing globalization, we must work diligently to maintain the quality of our educational system where it is strong and strive to improve it where it is not. In particular, we must find ways to move more of our students, especially minorities and students from disadvantaged backgrounds, into educational opportunities after high school. To do that, we must continually experiment, innovate, and evaluate so that we can make rational decisions about what works and what doesn't in education. Because the quality of your workforces is so vital to the success of your businesses, you as business executives must participate fully in this process, along with other stakeholders – students, parents,

teachers, and policymakers. I'm encouraged that you are devoting so much energy and thought to this topic at this three-day conference.

References

Aaronson, Daniel, Lisa Barrow, and William Sander (2007). "Teachers and Student Achievement in the Chicago Public High Schools," *Journal of Labor Economics*, vol. 25 (no. 1), pp. 95-135.

Aaronson, Daniel, and Daniel G. Sullivan (2002). "Growth in Worker Quality," Federal Reserve Bank of Chicago, *Chicago Fed Letter*, vol. 2002 (February), pp. 1-4, www.chicagofed.org/economic_research_and_data.

Altonji, Joseph G., and Nicolas Williams (2005). "Do Wages Rise with Job Seniority? A Reassessment," *Industrial and Labor Relations Review*, vol. 58 (April), pp. 370-97.

Angrist, Joshua D., Daniel Lang, and Philip Oreopoulos (2006). "Lead Them to Water and Pay Them to Drink: An Experiment with Services and Incentives for College Achievement," NBER Working Paper Series 12790. Cambridge, Mass.: National Bureau of Economic Research, December, www.nber.org/new_archive.

Bernanke, Ben S. (2004). "Trade and Jobs", Distinguished Speaker Series, speech delivered at the Fuqua School of Business, Duke University, Durham, N.C., March 30, www.federalreserve.gov/newsevents.

Bernanke, Ben S. (2006). "The Coming Demographic Transition: Will We Treat Future Generations Fairly?" speech delivered at the Washington Economic Club, Washington, October 4, www.federalreserve.gov/newsevents.

Bernanke, Ben S. (2007). "The Level and Distribution of Economic Well-Being", speech delivered at the Greater Omaha Chamber of Commerce, Omaha, Neb., February 6, www.federalreserve.gov/newsevents.

Bettinger, Eric P. and Bridget Terry Long (2005). "Addressing the Needs of Under-Prepared Students in Higher Education: Does College Remediation Work?" NBER Working Paper Series 11325, Cambridge, Mass.: National Bureau of Economic Research, May, www.nber.org/new_archive.

Burr, Jean, and Rob Grunewald (2006). "Lessons Learned: A Review of Early Childhood Development Studies," *Early Childhood Development*, Staff Study, Minneapolis: Federal Reserve Bank of Minneapolis, April, <http://minneapolisfed.org/research/studies/earlychild/lessonslearned.pdf/earlychild>.

Card, David (2001). "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems," *Econometrica*, vol. 69 (September), pp. 1127-60.

Carneiro, Pedro, and James J. Heckman (2003). "Human Capital Policy," in James J. Heckman and Alan B. Krueger, eds., *Inequality in America: What Role for Human Capital Policies?* Cambridge, Mass.: MIT Press, pp. 77-239.

Clotfelter, Charles, Elizabeth Glennie, Helen Ladd, and Jacob Vigdor (2006). "Would Higher Salaries Keep Teachers in High-Poverty Schools? Evidence from a Policy Intervention in North Carolina," NBER Working Paper Series 12285. Cambridge, Mass.: National Bureau of Economic Research, June, www.nber.org/new_archive.

Corrado, Carol A., Charles R. Hulten, and Daniel E. Sichel (2006). "Intangible Capital and Economic Growth," NBER Working Paper Series 11948. Cambridge, Mass.: National Bureau of Economic Research, January, www.nber.org/new_archive.

Dee, Thomas S. (2004). "Are There Civic Returns to Education?" *Journal of Public Economics*, vol. 88 (August), pp. 1697-720.

- Doms, Mark, Timothy Dunne, and Kenneth R. Troske (1997). "Workers, Wages, and Technology," *Quarterly Journal of Economics*, vol. 112 (February), pp. 253-90.
- Dyke, Andrew, Carolyn J. Heinrich, Peter R. Mueser, Kenneth R. Troske, and Kyung-Seong Jeon (2006). "The Effects of Welfare-to-Work Program Activities on Labor Market Outcomes," *Journal of Labor Economics*, vol. 24 (July), pp. 567-607.
- Dynarski, Susan (2005). "Building the Stock of College-Educated Labor," NBER Working Paper Series 11604. Cambridge, Mass.: National Bureau of Economic Research, September, www.nber.org/new_archive.
- Fox, Mary Anne, Brooke A. Connolly, and Thomas D. Snyder (2005). *Youth Indicators 2005: Trends in the Well-Being of American Youth*, NCES 2005-050. Washington: Department of Education, Institute for Education Science, National Center for Education Statistics, July, <http://nces.ed.gov/pubs2005/2005050.pdf>.
- Garces, Eliana, Duncan Thomas, and Janet Currie (2002). "Longer-Term Effects of Head Start," *The American Economic Review*, vol. 92 (September), pp. 999-1012.
- Gill, Andrew M., and Duane E. Leigh (2003). "Do the Returns to Community Colleges Differ Between Academic and Vocational Programs?" *Journal of Human Resources*, vol. 38 (Winter), pp. 134-55.
- Glaeser, Edward L., Giacomo Ponzetto, and Andrei Shleifer (2006). "Why Does Democracy Need Education?" NBER Working Paper Series 12128. Cambridge, Mass.: National Bureau of Economic Research, March, www.nber.org/new_archive.
- Grossman, Jean Baldwin, and Joseph P. Tierney (1998). "Does Mentoring Work? An Impact Study of the Big Brothers Big Sisters Program," *Evaluation Review*, vol. 22 (June), pp. 403-26.
- Goldin, Claudia (2001). "The Human-Capital Century and American Leadership: Virtues of the Past," *Journal of Economic History*, vol. 61 (June), pp. 263-92.
- Goldin, Claudia, and Lawrence F. Katz (1999). "The Shaping of Higher Education: The Formative Years in the United States, 1890-1940," *Journal of Economic Perspectives*, vol. 13 (Winter), pp. 37-62.
- Hanushek Eric A., John F. Kain, and Steven G. Rivkin (2004). "Why Public Schools Lose Teachers," *Journal of Human Resources*, vol. 39 (Spring), pp. 326-54.
- Hanushek, Eric A., and Margaret E. Raymond (2004). "Does School Accountability Lead to Improved Student Performance?" NBER Working Paper Series 10591; Cambridge, Mass.: National Bureau of Economic Research, June, www.nber.org/new_archive.
- Heckman, James J., and Alan B. Krueger (2003). *Inequality in America: What Role for Human Capital Policies?* Cambridge, Mass.: MIT Press.
- Heckman, James, J., Robert J. LaLonde, and Jeffrey A. Smith (1999). "The Economics and Econometrics of Active Labor Market Programs," in Orley C. Ashenfelter and David A. Card, eds., *Handbook of Labor Economics*, vol. 3A. Amsterdam: Elsevier Science and North-Holland, pp. 1865-2097.
- Heckman, James J., and Dimitriy V. Masterov (2007). "The Productivity Argument for Investing in Young Children," NBER Working Paper Series 13016. Cambridge, Mass.: National Bureau of Economic Research, April, www.nber.org/new_archive.
- Heckman, James J., Jora Stixrud, and Sergio Urzua (2006). "The Effects of Cognitive and Noncognitive abilities on Labor Market Outcomes and Social Behavior," *Journal of Labor Economics*, vol. 24 (July), pp. 411-82.
- Hotz, V. Joseph, Guido W. Imbens, and Jacob Alex Klerman (2006). "Evaluating the Differential Effects of Alternative Welfare-to-Work Training Components: A Re-Analysis of

the California GAIN Program,” NBER Working Paper Series 11939. Cambridge, Mass.: National Bureau of Economic Research, January, www.nber.org/new_archive.

Jacob, Brian A. (2005). “Accountability, Incentives, and Behavior: The Impact of High-Stakes Testing in the Chicago Public Schools,” *Journal of Public Economics*, vol. 89 (June), pp. 761-96.

Jacob, Brian A., and Lars Lefgren (2004). “Remedial Education and Student Achievement,” *Review of Economics and Statistics*, vol. 86 (February), pp. 226-44.

Jacobson, Louis, Robert J. LaLonde, and Daniel Sullivan (2005). “The Impact of Community College Retraining on Older Displaced Workers: Should We Teach Old Dogs New Tricks?” *Industrial and Labor Relations Review*, vol. 58 (April), pp. 398-415.

Jorgenson, Dale W., Richard J. Goettle, Mun S. Ho, Daniel T. Slesnick, and Peter J. Wilcoxon (2007). “U.S. Labor Supply and Demand in the Long Run,” prepared for “Labor Supply in the New Century,” the 52nd Economic Conference of the Federal Reserve Bank of Boston, Boston, Mass., June 18-20, www.bos.frb.org/economic/conf/conf52.

Kane, Thomas J. (1994). “College Entry by Blacks Since 1970: The Role of College Costs, Family Background, and the Returns to Education,” *Journal of Political Economy*, vol. 102 (October), pp. 878-911.

Kane, Thomas J., and Cecilia Elena Rouse (1999). “The Community College: Educating Students at the Margin Between College and Work,” *Journal of Economic Perspectives*, vol. 13 (Winter), pp. 63-84.

Litan, Robert E., Lesa Mitchell, and E.J. Reedy (forthcoming). “Commercializing University Innovations: A Better Way,” in *Innovation Policy and the Economy*, vol. 8. Cambridge, Mass.: MIT Press.

Martin, John P., and David Grubb (2001). “What Works and For Whom? A Review of OECD Countries’ Experiences with Active Labour Market Policies,” *Swedish Economic Policy Review*, vol. 8 (Fall), pp. 9-56.

Mann, Catherine L. (2003). “Globalization of IT Services and White Collar Jobs: The Next Wave of Productivity Growth,” International Economics Policy Briefs PB03-11. Washington: Peterson Institute for International Economics, December, www.iie.com/publications/pubs.cfm.

Murnane, Richard J., and Jennifer L. Steele (2007). “What Is The Problem? The Challenge of Providing Effective Teachers for All Children,” *Future of Children*, vol. 17 (Spring), pp. 15-43, www.futureofchildren.org.

National Science Foundation (2007). “U.S. R&D Increased 6.0% in 2006 According to the NSF Projections,” NSF Report 07-317. Arlington, Va.: Division of Science Resource Statistics, National Science Foundation, April, www.nsf.gov/statistics/infbrief/nsf07317.

Rivkin, Steven G., Eric A. Hanushek, and John F. Kain (2005). “Teachers, Schools, and Academic Achievement,” *Econometrica*, vol. 73 (March), pp. 417-58.

Rockoff, Jonah E. (2004). “The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data,” *American Economic Review*, vol. 94 (May, Papers and Proceedings), pp. 247-52.

Rolnick, Art, and Rob Grunewald (2003). “Early Childhood Development: Economic Development with a High Public Return,” Federal Reserve Bank of Minneapolis, Fedgazette, vol. 2003 (March), <http://minneapolisfed.org/pubs/fedgaz/03-03/earlychild.cfm>.

Topel, Robert (1991). “Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority,” *Journal of Political Economy*, vol. 99 (February), pp. 145-76.

U.S. Census Bureau and U.S. Department of Labor, Bureau of Labor Statistics (2007). *Current Population Survey*. Washington: Census Bureau, www.census.gov/cps.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (2007a). *Digest of Education Statistics: 2006*. Washington: Department of Education, <http://nces.ed.gov/programs/digest/d06>.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (2007b). *The Condition of Education 2000-2007*. Washington: Department of Education, <http://nces.ed.gov/programs/coe>.

U.S. Department of Labor, Bureau of Labor Statistics (1996). "BLS Reports on the Amount of Formal and Informal Training Received by Employees," press release, December 19, www.bls.gov/news.release/sept.nws.htm.

U.S. Department of Labor, Bureau of Labor Statistics (2007). "Preliminary Multifactor Productivity Trends," press release, May 24, www.bls.gov/news.release/prod3.nr0.htm.