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How Technology Spreads

The adoption of new technology is essential to long-term macroeconomic growth. In general, rich countries are on the technology frontier and rely on research and development to achieve further improvements in technical efficiency. Low-income countries, in contrast, have the option of adopting technologies already developed elsewhere. Yet not much is known about the process by which new technologies spread from one country to the others.

In **Cross-Country Technology Diffusion: The Case of Computers** (NBER Working Paper No. 8130), co-authors **Francesco Caselli** and **Wilbur John Coleman II** use cross-country panel data on computer imports from 1970–90 to analyze the determinants of technology diffusion. The idea is that for the many countries that do not have a domestic computer industry, computer imports are a measure of the flow of new computers installed in the country, and are therefore a good

proxy for computer adoption. The authors use three different datasets based on United Nations trade and production data: the first sample uses computer import data for all the countries with available information; the second excludes from

turing imports from OECD countries adopt computer technology more readily. Property rights protection, high investment per worker, a small share of government and agriculture in GDP, and a large share of manufacturing in GDP, are other variables

“Computer adoption strongly depends on having high levels of education of the labor force.”

that data the countries that report positive computer exports. The third sample estimates a proxy variable for computer adoption equal to computer production plus imports minus exports.

Caselli and Coleman find that computer adoption strongly depends on having high levels of education of the labor force, a result that supports the view that there is a skill-bias in technology adoption (at least for computers). Another important determinant is the source and type of trade with other countries: countries with large manufac-

that seem to accelerate computer adoption. In contrast, the share of the population that speaks English does not have a significant effect.

The authors use per-capita income and regional “dummy variables” as proxies for other unknown variables omitted by their model. Since these proxies are sometimes significant, the authors conclude that there still are undiscovered determinants of computer adoption that remain to be found.

— Noshua Watson

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Effects of Welfare Time Limits

One of the most controversial welfare reform measures of the 1990s was the imposition of time limits on cash aid to welfare recipients. It may represent the single greatest break from past policy. The new rule means that families generally can receive federally-funded benefits for no more than 60 months during their lifetime. Indeed, many states have imposed even shorter time limits.

NBER Research Associate **Jeffrey Grogger** examines the impact of this change in **The Effects of Time Limits and Other Policy Changes on Welfare Use, Work, and Income Among Female-Headed Families** (NBER Working Paper No. 8153). He finds that time limits account for about 12 percent of the oft-noted, dramatic decline in welfare use and about 7 percent of the rise in employment among single moms since 1993. However, time limits have had no significant effect on the earnings or income of these former-welfare families, Grogger finds.

Other reforms also have had an important impact on the welfare use and employment of female-headed families. The recent boost in the Earned Income Tax Credit (EITC), which provides a wage subsidy to the lowest-income workers, has been particularly important to the

recent decrease in welfare use and the recent increase in employment, labor supply, and earnings of welfare mothers. Grogger figures that “the EITC expansions have had substantial effects on almost all dimensions of behavior.”

Prior to welfare reform, poor single-parent families with at least one child under age 18 were entitled to receive cash assistance under the Aid to Families with Dependent Children (AFDC) program. With passage by Congress in 1996 of the Personal Responsibility and Work Opportunity Restoration Act, AFDC was replaced by the Temporary Aid to Needy Families (TANF) program with its time

mothers may want to leave welfare quickly in order to preserve their benefits for the future in case of they get laid off or if for some other reason they find themselves without work and needing income. Grogger’s study, using data from the annual Current Population Survey by the Census Bureau, confirms this. He finds that the average family whose youngest child is three reduces its welfare use in response to time limits by 6.6 percent points and increases its employment by 3.4 percentage points. These are sizable effects. The effect on labor supply and earnings are smaller, though; perhaps if time limits hasten the

“Time limits account for about 12 percent of the oft-noted, dramatic decline in welfare use and about 7 percent of the rise in employment among single moms since 1993.”

limits on aid. The effect of time limits should vary according to the age of the youngest child in the family, because eligibility for aid under TANF, as under AFDC, ends when the youngest child turns 18. Families whose youngest children exceed a threshold age, which is 13 under the federal five-year time limit, are unaffected by the imposition of time limits. Those 13-year-olds or older children will turn 18 before the welfare eligibility of their families runs out.

But for families with younger children, the time limit is relevant. The

search for a job by the mother, the result may be jobs that are both less long-lasting and less remunerative.

Grogger speculates that since time limits have substantial effects on welfare use but smaller effects on employment, they may be moving families who were previously combining work and welfare off the welfare rolls. The EITC, which curbed welfare use and boosted employment by similar amounts, may be moving non-working families into the work force.

— David R. Francis

School Style Can Raise Achievement

Though state curricular standards have proliferated since 1983, there remains a stunning lack of consensus about what comprises a good education, an inability to agree on how one measures it, and a lack of

evidence about whether particular teaching practices or school organizational forms do a superior job of imparting it. In **Do High Grading Standards Affect Student Performance?** (NBER Working Paper No. 7985), authors **David Figlio** and **Maurice Lucas** explore one of these

questions. After controlling for student and family effects, they find that, on average, elementary school students with teachers who are “tough” graders have fewer disciplinary problems and show greater improvements in their reading and math scores on the Iowa Test of

Basic Skills. High-achieving students in low-achieving classes, and low-achieving students in high-achieving classes appear to benefit most from tougher grading standards.

In the Alachua County Public Schools, a Florida school district, there are about 1800 students in each grade; students take the Florida Comprehensive Assessment Test (FCAT) and the Iowa Test of Basic

Comparing children's test score gains across years as their teachers change, Figlio and Lucas find that lowering student grades from A to B in some circumstances could lead to student test score gains of as much as one-third of a year or more. These estimated effects of increased grading standards are similar in magnitude to the relationship between test score gains and student poverty,

“Elementary school students with teachers who are ‘tough’ graders have fewer disciplinary problems and show greater improvements in their reading and math scores.”

Skills each year. The FCAT is scored using the Sunshine State Standards, the same state curricular standards on which student letter grades in Florida are supposed to be based. Yet differences between an individual's grade in a course and his grade on the FCAT suggest that many teachers grade less stringently than the state standards recommend.

The authors find that only 9 percent of all Alachua County students given an A by their teacher scored at the corresponding level on the FCATs. There was a closer correspondence between test scores and grades for students with teachers who were relatively tough graders: 65 percent of A students with tough graders for teachers attained a level 4 (a B) or above. Among those with teachers who were relatively “light” graders, “only 28 percent of A students attained level 4 or above.”

With a confidential dataset provided by the Alachua County School Board, Figlio and Lucas had access to information on almost every third, fourth, and fifth grader in the county between 1995–6 and 1998–9. Individual student records included teacher information, scores on the Iowa Test of Basic Skills and Florida Comprehensive Assessment Test (FCAT), report card grades, disciplinary records, race, ethnicity, sex, and disability status.

measured by free lunch eligibility.

In a related paper, **School Choice and the Distributional Effects of Ability Tracking: Does Separation Increase Equality?** (NBER Working Paper No. 8055), authors **David Figlio** and **Marianne Page** note that along with tougher grading standards, schools traditionally have sought to challenge high achievers by putting them in classes, or “tracks,” with peers of similar ability. Proponents of ability tracking argue that grouping students with similar abilities fosters learning by allowing teachers to fine tune instructional levels. Critics of ability tracking have argued that it deprives low aptitude students of positive peer effects arising from contact with more able students, that schools with tracking programs redistribute resources towards more able students, and that less capable teachers are assigned to low ability tracks. These criticisms, along with two decades of empirical studies that seem to suggest that ability grouping has benefited high-ability children and harmed low-ability ones, led to an estimated 7 percent drop between 1987 and 1993 in the number of gifted programs in the United States.

Figlio and Page however find no evidence that ability tracking harms disadvantaged students. If anything, they find that the effect of tracking is

“positive for members of the low ability group” and that tracked settings appear to do a better job of educating low achievers. Finally, their results suggest that gifted and remedial programs help schools maintain an economically diverse student body by attracting students from higher income families.

Previous studies of tracking were based on the assumption that students' enrollment decisions were not related to whether a school grouped students by their academic ability; these studies often used track placement as a proxy for academic ability. But there is substantial disagreement about what constitutes ability groupings, and schools that group students by ability do not use standard criteria to identify high and low achievers. As a result, previous estimates of the effect of ability tracking are compromised by the possibility that the differences in outcome attributed to tracking may in fact be a product of the variations in student ability that determined track placement in the first place.

Figlio and Page avoid these problems by using data from the National Educational Longitudinal Study of 1988 and from the Schools and Staffing Survey (three national samples of schools and school districts done in 1987–8, 1990–1, and 1993–4). The data on 7,676 individuals come from a nationally representative sample of public school students. The authors measure achievement using the change in an individual's raw score on a mathematics achievement test between 8th and 10th grade. Along with student track placement, the authors control for effects attributable to differences in family background and school characteristics with information on parents' education, income, and race as well as school student-teacher ratios, teacher salaries, and demographic composition.

— Linda Gorman

The Geographic Distribution of Housing-Related Tax Benefits

Much attention has been paid to the tax treatment of owner-occupied housing in the United States. For example, we know that the tax subsidy to homeownership – attributable to the rental value of living in the house not being taxed while mortgage interest and property taxes

tributed, the authors use data from the 1990 census to compute the difference in taxes currently paid and the taxes homeowners would pay if there were no preferential treatment for housing. They find that the subsidy is highly skewed geographically, with a few areas receiving large subsidies and most receiving small ones. The value of the tax subsidy nation-

ers. Even after accounting for program financing costs, California alone still receives a \$23 billion annual net benefit, more than the other 11 net positive beneficiary states combined.

Similarly, homeowners in just three large Consolidated Metropolitan Statistical Areas – Los Angeles-Riverside-Orange County, New York-Northern New Jersey, and San Francisco-Oakland-San Jose – receive more than 75 percent of the country's positive net tax subsidy benefits. And, within a number of the larger metropolitan areas, the top quarter of homeowners receives more than 70 percent of the total subsidy flow. The distribution within metropolitan areas also varies widely: in many smaller areas, especially in the interior of the country, the benefits tend to be distributed fairly evenly, but in larger, more populous areas, the benefits are skewed towards a small fraction of homeowners.

The results of this study help to explain why the current subsidy arrangement has persisted. Those who are worse off because of the subsidy program do not lose much, while those who benefit live mainly in major metropolitan areas and gain a great deal. — Les Picker

“Homeowners in just three large Consolidated Metropolitan Statistical Areas — Los Angeles-Riverside-Orange County, New York-Northern New Jersey, and San Francisco-Oakland-San Jose — receive more than 75 percent of the country's positive net tax subsidy benefits.”

are deductible – favors owners with high incomes and high house prices. However, little is known about the geographical distribution of these tax benefits. Do some areas of the country receive a greater annual share of this subsidy? Would resources flow from one area of the country to another, or would house prices in some areas be more affected, if there were a change in this tax benefit?

In **The Spatial Distribution of Housing-Related Tax Benefits in the United States** (NBER Working Paper No. 8165), authors **Joseph Gyourko** and **Todd Sinai** address these and other questions. To estimate how the tax subsidies are dis-

ally is quite large, totaling nearly \$164 billion in 1989.

If this revenue loss is netted out on a per-household lump-sum basis, fewer than 20 percent of states and 10 percent of metropolitan areas receive net positive subsidies. The metropolitan areas are located almost exclusively along the California coast and in the Northeast corridor between Boston and Washington, D.C. California is a good example of the disproportionate distribution of tax subsidies. Its owners receive 25 percent of the national aggregate subsidy flow, about \$41 billion, while being home to only 10 percent of the country's homeown-

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