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The effects of computers and acquired skills on earnings, employment and college enrollment: Evidence from a field experiment and California UI earnings records☆

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ABSTRACT

This paper provides the first evidence on the earnings, employment and college enrollment effects of computers and acquired skills from a randomized controlled trial providing computers to entering college students. We matched confidential administrative data from California Employment Development Department (EDD)/ Unemployment Insurance (UI) system earnings records, the California Community College system, and the National Student Clearinghouse to all study participants for seven years after the random provision of computers. The experiment does not provide evidence that computer skills have short- or medium-run effects on earnings. These null effects are found along both the extensive and intensive margins of earnings (although the estimates are not precise). We also do not find evidence of positive or negative effects on college enrollment. A non-experimental analysis of CPS data reveals large, positive and statistically significant relationships between home computers, and earnings, employment and college enrollment, raising concerns about selection bias in non-experimental studies.

1. Introduction

Although the returns to education have been studied extensively, the labor market returns to computers and the skills acquired in using them are not as well understood. A few recent studies find higher wages among workers with computer skills, but the evidence is not as clear as the evidence of positive returns to formal schooling (Card 1999; Dickerson & Green, 2004; Falck, Heimisch, & Wiederhold, 2016; Hanushek et al. 2015; OECD 2015).[1] Similar to concerns regarding estimating the returns to education, identifying the causal effects of computer skills on labor market outcomes is difficult because of unobserved heterogeneity.

This study takes a novel approach to estimate the labor market returns to computers and the acquired skills from using them by exploiting a randomized controlled trial (RCT) providing free personal computers for home use. The field experiment was conducted with entering community college students in Fall 2006, following them through their educational and early career labor market experiences. Previous findings from the experiment indicate that the treatment group receiving home computers had substantially better computer skills than the control group (Fairlie, 2012), and that the randomly provided home computers were found to have small, positive, short-run

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[1] Earlier research found that computer users at work had higher wages than non-computer users, arguably due to their computer skills (e.g. Krueger, 1993). But, whether this estimated computer-wage premium captures the returns to computer skills or simply unobserved worker, job, or employer heterogeneity has been questioned (e.g. DiNardo & Pischke, 1997).

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(1.5 year) effects on educational outcomes (Fairlie & London, 2012).[2] In this study, we collect new administrative data from three sources for all study participants, and build on these findings by examining short- to medium-term effects on earnings, employment and college enrollment. To analyze earnings and employment effects, we obtained confidential administrative earnings data collected by the California State Employment Development Department (EDD) through the Unemployment Insurance (UI) system for all study participants.[3] We also obtained restricted-access administrative data on college enrollment from the California Community College System and the National Student Clearinghouse for all study participants. The data on earnings, employment and college enrollment cover nearly a decade after the computers were randomly distributed, allowing for a rare analysis of medium-term experimental effects in addition to short-term effects. Furthermore, the use of administrative data eliminates concerns over follow-up survey attrition and item non-response, which are often problematic in RCTs and especially problematic for capturing longer-term outcome effects.

From the experiment and administrative data on earnings and college enrollment, we do not find evidence that computer skills have a positive effect on earnings. We do not find evidence of positive effects on the extensive or intensive margins of labor supply. We also do not find evidence that computers have a positive effect on college enrollment, which could explain the null effects on earnings if students delayed entry into the labor market. The findings across many different specifications, measures and subgroups are consistent in finding null effects. Although the results consistently show null effects, one limitation is that the estimates are not precisely estimated. In contrast, a supplementary, non-experimental analysis of CPS data suggest large, positive, and statistically significant non-experimental relationships between home computers and earnings, employment and college enrollment. These findings raise concerns about positive selection bias in non-experimental studies even including those using nearest neighbor and propensity score matching models.

The remainder of the paper is organized as follows. The next section describes the random experiment in detail. Section 2 reports estimates of treatment effects on earnings, employment, and college enrollment. Section 3 reports non-experimental estimates from the CPS. Section 4 concludes.

2. The field experiment

To study the earnings, employment and college enrollment effects of computers, we randomly assigned free computers to entering community college students who were receiving financial aid (see Fairlie & London, 2012 for more details on the experiment).[4] All of the students attended Butte College full-time in fall 2006 and were followed through 2013, capturing work while attending college and in the first several years of their careers. Butte College is a community college located in Northern California and is part of the California Community College system – the largest postsecondary system in the United States, comprised of 113 colleges, enrolling more than 2.1 million students, and serving one out of every five community college students in the United States (Chancellor's Office, 2016). In 2006, Butte College had a total enrollment of 15,709 students (Butte College, 2006).

The focus on workers who attended community colleges is important for examining computer returns for the middle- to high-end of the skill distribution. Community colleges provide a wide range of educational pathways, including workforce training and serving as a gateway to four-year colleges and universities (Bahr & Gross, 2016). Community colleges enroll about half of all students in public postsecondary institutions in the United States (Bahr & Gross, 2016).[5] Likewise, nearly half of students who complete a baccalaureate degree attended a community college at some point (National Student Clearinghouse, 2015). For community college students who do not transfer to a four-year institution, the returns to a community college education in many fields are high (see Bahr, 2014; Jepsen, Troske, & Coomes, 2014; Kane & Rouse, 1995, 1999; Leigh & Gill, 2007; Stevens, Kurlaender, & Grosz, 2015 for example). Thus, community colleges are an important educational environment in which to examine the returns to computers.

In addition, unlike many four-year institutions, community college students frequently live off-campus, commuting to school (Bahr & Gross, 2016). This limits their access to large computer labs and other on-campus computing resources, making personally owned computers potentially important for acquiring computer skills and knowledge.

The computers used in the study were provided by Computers for Classrooms, Inc., a company in Chico, California, that refurbishes computers.[6] To implement the study, we first obtained a list of all entering students in the fall of 2006 who received financial aid. In the fall 2006, there were 1042 financial aid students who were enrolled full-time. The Office of Financial Aid (OFA) at Butte College advertised the program by mailing letters to all of these full-time students on financial aid, and all subsequent correspondence with them was conducted through the OFA.

Participation in the experiment involved returning a baseline questionnaire and consent form releasing future academic records from the college for use in the study. Students who already owned computers were not excluded from participating in the lottery because their computers may have been very old, not fully functional, or lacking the latest software and hardware. The estimates of treatment effects on earnings, employment and education that we present below are not sensitive to the exclusion of these students, who represent 29% of the sample.

We received 286 responses with valid consent forms and completed questionnaires, and received enough funding to provide free computers to a randomly selected subset of 141 of these students.[7] Eligible students

[2] A growing literature examines the educational effects of home computers and generally finds mixed results (see Fuchs & Woessmann, 2004; Schmitt & Wadsworth, 2006; Fiorini, 2010; Malamud & Pop-Eleches, 2011; Vigdor, Ladd, & Martinez, 2014; Beuermann, Cristia, Cueto, Malamud, & Cruz-Aguayo, 2015; Fairlie & Robinson, 2013; Hull & Duch, 2017 for a few examples, and Bulman & Fairlie, 2016 for a review of the literature).

[3] Employment effects rarely have been examined in the literature because of the focus on computer use at work as a proxy for computer skills. One exception is Blanco and Boo (2010) who examine the effects of randomly listing ICT skills on a resume in two Latin American cities and find that it increases the probability of receiving a call back by roughly 1%.

[4] We did not provide Internet service as part of the experiment but found at the end of the study that more than 90% of the treatment group had Internet service. Estimates from the U.S. Census Bureau (2013) indicate similar level Internet subscription rates among computer owners in the United States (89–95% from 2007 to 2012).

[5] In California, the percentage is even higher, representing more than 70% of all public higher education enrollments in the state (Sengupta & Jepsen, 2006).

[6] The computers were refurbished Pentium III 450 MHz machines with 256 MB RAM, 10 GB hard drives, 17" monitors, modems, ethernet cards, CD drives, and Windows 2000 Pro Open Office (with Word, Excel and PowerPoint). Each system also came with a 128 MB flash drive for printing student papers on campus and a two-year warranty on hardware and software. Computers for Classrooms offered to replace any computer not functioning properly during the first two years after students received them.

[7] We compared administrative data for students who applied to the computer giveaway program to all students at the college who received financial aid and to all students enrolled at the college. We do not find large differences in racial composition or whether students' primary language was English. We do find gender differences, with women overrepresented among applicants to the computer giveaway program. The distributions of reported goal at college entry are very similar across groups. In sum, although study participants are a self-selected group of all students receiving financial aid, they do not appear to be very different in terms of observable characteristics from all students who received financial aid or the entire student body. Nevertheless, they may differ, however, along dimensions directly related to participation in the study, and these differences may have implications for our ability to generalize the results based on study participants to all community college students receiving financial aid. But, students with limited access to computers and financial resources are the population of most interest for any policy intervention involving the provision of free or subsidized computers. See Fairlie and London (2012) for more discussion.