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ScienceDirect
Economics of Education Review 27 (2008) 517–535
Economics of Education Review
www.elsevier.com/locate/econedurev

College majors and the knowledge content of jobs

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Received 6 September 2005; accepted 17 July 2007

Abstract

College students select majors for a variety of reasons, including expected returns in the labor market. This paper demonstrates an empirical method linking a census of US degrees and fields of study with measures of the knowledge content of jobs. The study combines individual wage and employment data from the Current Population Survey (CPS) with ratings on 27 knowledge content areas from the Occupational Information Network (O*NET), thus providing measures of the economy-wide knowledge content of jobs. Fields of study and corresponding BA degree data from the *Digest of Education Statistics* for 1976–1977 through 2001–2002 are linked to these 27 content areas. We find that the choice of college major is responsive to changes in the knowledge composition of jobs and, more problematically, the wage returns to types of knowledge. Women's degree responsiveness to knowledge content appears to be stronger than men's, but their response to wage returns is weak.

JEL classification: J24; I21; J31

Keywords: Demand for schooling; Human capital; Salary wage differentials; Rate of return

1. Introduction

Approximately 1.4 million students obtain BA degrees at US colleges and universities each year. An additional 600,000 obtain post-graduate degrees.[1] Students' choices of major and fields of study have varied considerably over time. Much of the prior work by economists on college majors has attempted to identify the returns on alternative choices. Such work is typically based on microdata sets containing both an individual's current earnings and previous college major. A limitation of such data sets is that sample sizes of majors within detailed degree fields (if provided) are small. Such studies also contain no direct information on current degree choice among students. These limitations are unfortunate. There exist excellent

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[1]In the 2003–2004 academic year (the most recent data available in June 2007), there were 1,399,542 Bachelor's, 558,940 Master's, and 48,378 Doctor's degrees (US Department of Education, 2006; Table 252). Corresponding numbers in 1972–1973 were 922,362, 263,371, and 34,777 (US Department of Education, 2004; Table 255; US Department of Education, 1997; Table 18).

(*footnote continued*)

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doi:10.1016/j.econedurev.2007.07.004

US data on total degrees awarded by degree type (BA, MA, and PhD), detailed field of study, and degrees by gender from all 4-year institutions of higher education. These degree data go back more than 35 years. An obvious difficulty in using such data is that it is difficult to make a link between the areas of study chosen by students and the value of acquired knowledge in the labor market.

The purpose of this paper is to provide such a link, albeit an imperfect one. The link is formed by relating nationwide information on degree choices to data on the knowledge content, employment, and wages of jobs (occupations). The Occupational Information Network (O*NET) is a relatively new government database providing hundreds of job descriptors on highly detailed occupations. A subset of O*NET descriptors (27 are used in our analysis) include content areas for which knowledge is required on the job, everything from philosophy and religion to physics to economics, finance, and accounting. The O*NET information on the knowledge content of jobs can be matched to the approximately 500 detailed occupations in the Current Population Survey (CPS), household surveys with large sample sizes stretching back into the 1970s (and earlier). Merged CPS–O*NET files thus provide information on the knowledge requirements by field in the US labor market across a long time period, with changes being determined by changes in occupational employment and wages over time. At the same time, specific college majors or fields of study can be linked to the 27 O*NET knowledge descriptors. The question then arises: Do degrees by field of knowledge increase as the corresponding knowledge content area is more widely utilized and more highly rewarded in the labor market?

For a variety of reasons, our method linking a near-census of US post-secondary degrees (majors) to labor market employment opportunities and returns is far from ideal. We will argue, however, that this novel approach provides insight into the degree choice process and makes possible a direct link between the knowledge content of jobs and student choices of college major.

2. Previous literature

There exists a sizable literature on the choice of college major. Emphasis has been on the determinants of degree choice and the relationship between student majors and expected lifetime earnings (utility).[2] The choice of degree depends not only on market differentials across fields, but on differences in individuals' expected work lives and career plans, individual preferences, and relative abilities (i.e., sorting). Several articles in this literature have focused on sex differences in college major and how these have changed over time.[3] Some studies have focused on how enrollments, particularly at community colleges, vary with the business cycle.[4] A largely distinct literature examines the effect of tuition and financial aid on college attendance and choice.[5]

Much of the literature on choice of major utilizes individual data, with multinomial logit used to estimate choices among a limited number of broad fields of study. Such studies are valuable, but have inherent shortcomings. Because of estimation difficulties and sample size limitations, these studies only consider a small number of very broad fields of study. Even then, the sample sizes within each field are not large and the surveys are for selective (and sometimes dated) years based on the particular data source.

Our analysis follows the spirit of the previous literature in that it links choice of college majors to their expected relative benefits (net of costs). We are unaware of previous studies, however, that explicitly link the choice of college major to changes in the *knowledge content* of jobs.[6] Besides being an interesting topic in its own right, our approach

[2]Studies include Fiorito and Dauffenbach (1982), Berger (1988), Rumberger and Thomas (1993), Montmarquette, Cannings, and Mahseredjian (2002), Black, Sanders, and Taylor (2003), Finnie and Frenette (2003), Arcidiacono (2004), and Boudarbat (in press).

[3]An oft-cited study is Turner and Bowen (1999). Earlier papers include Polachek (1978), Blakemore and Low (1984), Daymont and Andrisani (1984), and Paglin and Rufolo (1990). For a recent paper, see Boudarbat and Montmarquette (2007).

[4]For example, see Betts and McFarland (1995).

[5]The general finding in this literature is that financial aid has a large impact on what school is chosen (including a 2- versus 4-year institution), but a modest affect on overall college-attendance. For a recent paper, see Abraham and Clark (2006). Dynarski (2002) provides a nice discussion of the identification issue, along with evidence on the Georgia HOPE scholarships.

[6]The approach most similar to our own is a paper by Fiorito and Dauffenbach (1982) in which the authors link male baccalaureate degrees in engineering and the sciences to employment and wages in pertinent fields. They emphasize the importance of non-economic factors on degree choice. A related but rather different question is whether skills acquired in one's college major are used on the job (Robst, 2007).