Economics of Education Review 49 (2015) 1–14

Contents lists available at ScienceDirect

Economics of Education Review

journal homepage: www.elsevier.com/locate/econedurev

Do completed college majors respond to changes in wages?

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ARTICLE INFO

Article history:
Received 26 February 2015
Revised 2 July 2015
Accepted 29 July 2015
Available online 6 August 2015

JEL Codes:
J24
J31
I23

Keywords:
College majors
Occupations
Labor market wages

ABSTRACT

In an analysis connecting labor market earnings to college major choices, we find statistically significant relationships between changes in wages by occupation and subsequent changes in college majors completed in related fields of college study between 1982 and 2012. College majors (defined at a detailed level) are most strongly related to wages observed three years earlier, when students were college freshmen. The responses to wages vary depending on the extent to which there is a strong mapping of majors into particular occupations. We also find that women, blacks, Hispanics, and students with low test scores are less likely to respond to wage changes. These findings have implications for policy interventions designed to align students' major choices with labor market demand.

1. Introduction

The enormous effect of the Great Recession on the labor market and college budgets has heightened long-standing debates about the fields of study in which college students should major. Some contend that students do not sufficiently consider the economic consequences of their major choices and should be encouraged to pursue majors in high demand in the labor market (e.g., Olson, 2012; Singletary, 2012). The presumption here is that an insufficient student response to labor market cues may affect not only their own economic well-being but also the quality of jobs available to workers in the U.S. (Holzer, 2012).

There are several possible policy responses to address the potential that market failures lead to suboptimal student choices. One might, for instance, make the economic consequences of college major choice more explicit to students (Carnevale, Strohl, & Melton, 2011, 2012), or encourage students to pursue the 'right' majors by changing the relative price of different majors through differential tuition policies, targeted loans, or loan forgiveness. Some argue that majors with high labor market demand ought to be subsidized in order to encourage higher enrollment in those areas. Such a policy has been suggested by a blue ribbon task force on higher education reform in Florida, and advocated by Florida Governor Rick Scott.[1] Finally, colleges could react to the labor market by expanding departments that train students for high demand fields.

Whether or not such policy interventions may be justified, and the efficacy of different types of interventions, depends on the degree to which students are sensitive to the labor market returns associated with college majors.

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[1] Interestingly, however, in contrast to the idea of subsidizing in-demand majors, a number of higher education institutions have increased tuition in majors such as engineering and the physical sciences so as to better align tuition with the cost of instruction, and because students graduating in a high-demand major can afford higher tuition rates with their higher future salaries (Ehrenberg, 2012).

http://dx.doi.org/10.1016/j.econedurev.2015.07.007
0272-7757/

Interestingly, there is little empirical evidence on this basic labor market issue. We address this gap by estimating the response of completed college majors to changes in wages in occupations associated with those majors. We estimate these lagged responses using aggregated national Integrated Postsecondary Education Data System (IPEDS) and Current Population Survey (CPS) data from 1987–2011 and individual-level longitudinal data from the State of Washington from 2007–2012. Our null hypothesis is that completed majors in a particular field in year *t+y* have no relation to wages in associated occupations in year *t*, while the alternative hypothesis is that majors rise in year *t+y* in response to wages in in associated occupations in year *t*. Further, we assess whether: (1) majors respond to national and/or local labor market wages; (2) larger majors or majors more tightly connected to particular occupations are more responsive to wages; and (3) whether there is heterogeneity in response by student characteristics.

We find statistically significant relationships between wages and majors at both the national and state level and with majors defined at both detailed and aggregated levels. Bachelor's degrees produced in year *t* in detailed majors are most strongly associated with wages in year *t–3*, which suggests that college majors respond most to wages when students are (roughly) college freshmen.[2]

We also find that the response is stronger for those majors that have a tight connection to relatively few occupational choices, such as nursing. Our results from Washington State confirm the national analysis, and we also find more response to wages earned by recent graduates from public institutions in Washington than to wages earned by all bachelor's degree holders in the state or nationwide. Finally, we show that women, African–American and Hispanic students, and those with low SAT scores are less likely to respond to changes in local wages than other students: responses for women and those with low SAT scores are less than half of men and high-SAT students, respectively. Estimated responses of black and Hispanic students to wages are non-significant, small, and negative. We cannot say whether the lower response rates for these types of students are related to the types of labor market information those students receive or differences in preferences for major.

For an average sized major, an increase in that major's wages of 10% relative to the wages of other majors would lead the share of degrees earned in that major to increase from 2.07% to 2.21%, a figure which implies a world in which degree production does not align strongly with labor market demands. If policy goals entail a strong alignment, these results could act as justification for policy which guides student choice and/or elicits more institutional response. While many of the college majors which are at the center of policy interventions, in particular STEM majors, are among those with relatively stronger responses to wages already, some policy makers may consider the response to be still too weak.

2. Theoretical framework

The theory undergirding our analysis is simple: students should increase their likelihood of majoring in discipline *d* and colleges should expand access to majoring in discipline *d* if they anticipate that there are increasing economic rewards associated with majoring in discipline *d*. Further, students and colleges should gauge the economic rewards associated with majoring in discipline *d*, at least in part, based on the labor market outcomes for students who recently received degrees in this discipline.[3] This theoretical framework, which we detail below, illustrates the method we take to assign a market wage to each college major.

We illustrate this theoretical framework in Fig. 1. In this stylized example, the labor market demand curve in this graph is a weighted average of labor demand for employees in occupations associated with major *d*, with weights based on the share of workers who previously majored in *d* and are now employed in occupation *o*. Likewise, the labor supply curves in this graph is a weighted average of the labor supply curves for workers in the occupations associated with major *d*.

In Fig. 1, we show an increase in wages in occupations associated with major *d* due to an increase in labor demand in occupations associated with major *d*.

As long as informational deficiencies and frictions are not too severe (e.g. transaction costs associated with switching majors, university capacity constraints,[4] etc.), the increase in demand will increase the number of students training in the major and shift the short-run labor supply for related fields to SRS_∞. Further, a lack of perfect information or frictions in labor supply – such as if there are university capacity constraints or if some students lack the skills necessary to be successful in a particular major (and recognize this) – will yield a LRS with a positive slope.[5] The positive slope on the LRS means that the demand shock translates into a persistent increase in wages, a necessary finding in order to suggest that it is individually rational to respond to wage shocks. The thick line with arrows on Fig. 1 reflects the expected time path of wages moving from W_0 to the long-run W_∞.

We test whether we actually find persistence in wage increases by calculating wage impulse response functions (IRFs) for the 30 majors with the largest enrollments.[6] The degree to which wage shocks can be treated as persistent is reflected in these IRFs in Fig. 2.

[2] The median time to degree for 2008 bachelor's degree recipients was 4.33 years (Cataldi et al., 2011).

[3] While we focus on the short run connection between wage changes and academic major, we want to acknowledge that wages are not the only labor market outcome that students may care about. For instance, students and colleges might also respond to the relationship between college major and unemployment or to the stability of wages over a career (Carnevale et al., 2012). Students and colleges may also respond to the variance of current wages associated with a particular major. Unfortunately, the data do not permit us to delve into these issues in any detail.

[4] For example, it is argued that a shortage of nursing faculty thwart some students from pursuing undergraduate degrees in nursing (American Association of Colleges of Nursing, 2009). Institutional constraints may keep capacity from fully adjusting in the long run.

[5] For example, a student with very little mathematical skill will have little opportunity to successfully respond to an increase in wages for physics majors. See Goldin and Katz (2008) for a broader discussion of why we might see persistent wage premiums in some fields.

[6] To compute these IRFs, we computed the major's wage (using the methods and data we describe below in Section 4.1 that maps wages to majors) and ran a vector autoregression of W_t on three lags (W_{t-1}, W_{t-2}, and W_{t-3}) and then computed a forecast horizon to *t*+10. See www.stata.com/manuals13/tsirf.pdf.