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# College quality and hourly wages: Evidence from the self-revelation model, sibling models and instrumental variables



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## ABSTRACT

This paper addresses the recent discussion on confounding in the returns to college quality literature using the Norwegian case. The main advantage of studying Norway is the quality of the data. Norwegian administrative data provide information on college applications, family relations and a rich set of control variables for all Norwegian citizens applying to college between 1997 and 2004 ( $N = 141,319$ ) and their succeeding wages between 2003 and 2010 (676,079 person-year observations). With these data, this paper uses a subset of the models that have rendered mixed findings in the literature in order to investigate to what extent confounding biases the returns to college quality. I compare estimates obtained using standard regression models to estimates obtained using the self-revelation model of [Dale and Krueger \(2002\)](#), a sibling fixed effects model and the instrumental variable model used by [Long \(2008\)](#). Using these methods, I consistently find increasing returns to college quality over the course of students' work careers, with positive returns only later in students' work careers. I conclude that the standard regression estimate provides a reasonable estimate of the returns to college quality.

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## 1. Introduction

Because of the transformation to a mass system of higher education during the second half of the 20th century ([Trow, 1972](#)), studying horizontal stratification in higher education has become increasingly important ([Gerber and Cheung, 2008](#)). The enrollment rate has expanded dramatically and is exceeding 50 percent in many industrialized countries ([Schofer and Meyer, 2005](#)). The result is a situation where college education is a necessary, but no longer sufficient, condition to obtain advantageous positions in the labor market ([Halsey et al., 1997](#)). When competing for advantageous positions, differences between colleges, such as college quality, may play an important role. Colleges differ in several potentially important ways, such as the quality of the learning environments, the signaling value of the credentials they provide and the opportunities they provide for inclusion in useful social networks—all aspects of colleges' quality ([Gerber and Cheung, 2008](#)).

The economic returns to college quality became subject to empirical studies in the late 1960s ([Weisbrod and Karpoff, 1968](#)). The earliest studies relied in part on restrictive samples and insufficient controls for confounding ([Solmon, 1973](#); [Solmon and Wachtel, 1975](#); [Wachtel, 1976](#); [Wales, 1973](#); [Weisbrod and Karpoff, 1968](#); [Wise, 1975](#)). In the late 1980s, a second wave of studies estimated the returns to college quality using larger and more representative data sets and also controlled for confounding in a more rigorous manner. These studies mainly mirrored the findings from the earlier studies,

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finding positive, although sometimes small, returns to college quality (e.g., Daniel et al., 2001; Fox, 1993; Hoxby, 1998; James et al., 1989; Karabel and McClelland, 1987; Lee and Brinton, 1996; Loury and Garman, 1995; Monks, 2000; Mueller, 1988; Ono, 2004; Rumberger and Thomas, 1993; Smart, 1986; Thomas, 2000; Trusheim and Crouse, 1981, Zhang, 2005a,b).

However, after three decades of research demonstrating positive returns to college quality, a third wave of studies yielded mixed findings. Students enrolling in high-quality colleges may earn more not only because they have attended a high-quality college but also because they are better from the outset. The recent studies question whether the two first waves of studies are able to eliminate such confounding, and they use more advanced methods to identify the causal effect of college quality. The seminal paper of Dale and Krueger (2002) set the tone for these studies. By having information on students' college applications, they measure unobserved student characteristics, such as endowments and ambitions, using the selectivity of students' college applications. After controlling for the selectivity of students' college applications, Dale and Krueger (2002) find positive returns only for students from low-income families. Other studies identify the causal effect by including a more extensive list of covariates (Brand and Halaby, 2006), fixed effects on siblings (Lindahl and Regnér, 2005), instrumental variables (Long, 2008; Suhonen, 2013) or regression discontinuity designs (Hoekstra, 2009; Loyalka et al., 2012; Saavedra, 2009). The mixed findings in these studies cast doubt on whether college quality really yields positive returns (Gerber and Cheung, 2008).

Using a subset of the models that have rendered mixed findings in the literature, this paper investigates to what extent confounding biases the returns to college quality. I compare estimates obtained using standard regression models, similar to those used in the second wave of studies, to estimates obtained using the self-revelation model of Dale and Krueger (2002), a sibling fixed effects model (Lindahl and Regnér, 2005) and the instrumental variable model used in Long (2008). Because I use the same data and definitions to estimate all models, conclusions can be drawn with regard to the various models' ability to successfully avoid confounding. Hence, this paper provides new insights on the mixed findings in the literature.

Additionally, this paper investigates whether the returns to college quality change over the course of students' work careers. At the point of entry into the labor market, employers have yet to observe students' productivity. Employers learn about students' productivity over time (Arcidiacono et al., 2010). Hence, positive returns to college quality early in the work career suggest that employers use college quality to screen job applicants. Whereas increasing returns over the course of students' work careers, on the other hand, favor the human capital explanation, because it indicates that employers have learned about the productivity of students from colleges of different quality. Thus, this paper sheds some light on why college quality matters. And because previous research examines the returns at different points in students' work careers, this paper provides further insights on the mixed findings in the literature.

This paper uses the Norwegian case to investigate the returns to college quality. The main advantage of studying Norway is the quality of the data. I have access to administrative panel data, containing information on college applications, family relations and background variables for 141,319 students who applied to college between 1997 and 2004. For these students, I have information on wages between 2003 and 2010 (676,079 person-year observations). Hence, I can investigate how confounding biases the returns *and* how the returns change over the course of students' work careers. The disadvantage of studying Norway is the centralized wage bargaining system and small dispersion in college quality compared to the US, which arguably make the returns to college quality lower in Norway (see Section 3). Thus, Norway is a conservative test case of what we should expect to find in countries like the US.

## 2. Literature review

### 2.1. A typical study

The literature on the returns to college quality is vast. A number of different indicators, such as average SAT score, expenditure per student, faculty-student ratio, size of the student body, tuition costs and percentage of faculty with a PhD, have been employed to measure college quality. The studies also differ in terms of outcome variables (e.g., earnings, wages, occupational status, career mobility) and choice of control variables (for reviews, see Brewer and Ehrenberg, 1996; Gerber and Cheung, 2008; Pascarella and Terenzini, 2005, Zhang, 2005b).<sup>1</sup>

However, the studies in the second wave share some similarities. The typical study in the second wave employs a US data set and includes only those who attend college in the analysis sample. It uses the single indicator of average SAT score to measure quality and the log of hourly wages as the outcome variable (usually 1–5 years after graduation). The typical study in the second wave assumes selection on observable variables only and uses ordinary least squares to identify the returns to college quality. After controlling for variables such as gender, race, parental education, parental income and ability test scores, it finds positive returns to college quality. However, the returns are small, and it finds that college quality explains no more than 1–1.5 percent of the variations in the outcome variable (Gerber and Cheung, 2008).

<sup>1</sup> While all studies investigate between-college effects, they nevertheless label these effects differently. At least 50 percent call it college quality (Pascarella and Terenzini, 2005), but others adopt terms such as prestige, selectivity or competitiveness. For a discussion on the labeling of the between-college effects, see Pascarella and Terenzini (2005), Black and Smith (2006), Loyalka et al. (2012) and Broecke (2012). In this paper, I consistently use college quality when discussing all of these studies.

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