



# The information value of central school exams<sup>☆</sup>



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## ABSTRACT

The central vs. local nature of high-school exit exam systems can have important repercussions on the labor market. By increasing the informational content of grades, central exams may improve the sorting of students by productivity. To test this, we exploit the unique German setting where students from states with and without central exams work on the same labor market. Our difference-in-difference model estimates whether the earnings difference between individuals with high and low grades differs between central and local exams. We find that the earnings premium for a one standard-deviation increase in high-school grades is indeed 6% when obtained on central exams but less than 2% when obtained on local exams. Choices of higher-education programs and of occupations do not appear major channels of this result.

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## 1. Introduction

A key question of educational governance is how to organize school exit examinations. Historically, exams were designed and graded by local school teachers, but today centralized exams at the end of secondary school play an important role in many education systems around the world. Supporters argue that centralized eval-

uations are desirable because they raise student achievement by favorably affecting the incentive structure of stakeholders in the education system. Empirical evidence largely supports such a positive effect of central exams on student achievement.<sup>1</sup> But externally validated credentials may also have important repercussions on the labor market. By increasing the informational content of grades, central exams could affect school-to-work transitions, college admissions, and hiring costs and hiring policies of firms – and, by implication, the incentive structure in schools in the long run. However, whether grades obtained in central exams indeed allow an improved sorting of students by productivity remains an open question.

This paper tests empirically whether grades in central exams have higher information value on the labor market than grades in local exams. The key empirical challenge consists in estimating the counterfactual relationship between high-school grades and productivity. Wages provide a measure for productivity that is readily available in many surveys of the labor force, but information on

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<sup>1</sup> For example, Bishop (1997, 2006), Woessmann (2003, 2005), Jürges, Schneider, and Büchel (2005), Jürges and Schneider (2010), and Jürges et al. (2012); see Hanushek and Woessmann (2011) for a review of the extensive cross-country evidence.

high-school grades is typically not. More importantly, the extent to which wages proxy for productivity in different countries may differ due to different labor market institutions, making cross-country comparisons difficult to interpret. However, any within-country approach typically lacks variation in the centrality of exam systems.

In this paper, we exploit the institutional setup in Germany in the 1990s for identification. At that time, almost half of the German states tested students in state-wide administered central exams at the end of high school, while the other half did not. While individual states in Germany are largely responsible for their education systems, labor market institutions are largely determined at the federal level. Thus, we can compare individuals who compete on the same labor market, but part of whom obtained their high-school grades in states with central exams and part of whom in states without central exams.<sup>2</sup>

We use the dataset of a German university graduate survey whose participants graduated from university in the late 1990s. We observe their labor-market outcomes five years after graduation, in 2003. By surveying their high-school grades and following them into the labor market, this unique dataset for the first time allows us to convincingly estimate whether grades obtained in central exams indeed allow an improved sorting of students by productivity.

We test this hypothesis in a difference-in-difference framework. Identification is based on comparing earnings of individuals with high and low high-school grades depending on whether they obtained their grades in central or local exam states. Based on cross-sectional models, we estimate an earnings function with state fixed effects and focus on the interaction of an indicator for central exam states with standardized high-school grades. The hypothesis is that high-school grades are more closely associated with earnings when obtained in a central rather than local exam.

We find that a grade improvement by one standard deviation translates into approximately 6% higher earnings when grades are obtained in central exams, compared to 1.6% when grades are obtained in local exams. We interpret this finding in light of a simple measurement-error model in which grades proxy for productivity with classical measurement error. If local exam grades provide a more noisy measure of productivity compared to central exam grades, the resulting difference of more than 4 percentage points reflects the higher information value of central school exams.

This finding is robust to different sample selection criteria and alternative model specifications. Results hold for different subgroups of the overall sample. In line with economic intuition, the relationship between central exam grades and earnings is largest when we restrict the sample to individuals employed in the private sector. Controlling for several post-secondary schooling variables suggests that choices of higher-education programs and of occupations are no major channels driving our results.

The theoretical foundation for our analysis is laid in the literature on signaling educational performance, which builds on the seminal contributions by Spence (1973), Stiglitz (1975), and Arrow (1973). In models such as Bishop and Woessmann (2004) and Bishop (2006), central examinations change students' incentive structure relative to autonomous local examinations. By creating comparability to an external standard, central examinations improve the signaling of academic performance to advanced educational institutions and to potential employers. These institutions will thus give greater weight to educational performance when making admissions and hiring decisions. In consequence, their de-

isions become less sensitive to other factors such as family connections, the momentum of a twenty-minute job interview, performance relative to a class mean, or aptitude tests that measure innate ability more than overall educational performance. As students' rewards for learning grow, students respond by increasing their learning efforts. The idea that central exams increase the extrinsic rewards for learning is, however, an assumption in these models that has not yet been tested. It is one key contribution of this paper to provide the first empirical test of this assumption.

Our paper also directly contributes to the empirical literature on estimating labor-market returns to cognitive skills (see Hanushek & Rivkin, 2012 for a summary). For Germany, Hanushek, Schwerdt, Wiederhold, and Woessmann (2015) report estimates of 24% for the earnings effect of a one standard deviation increase in test scores. Compared to this finding, our estimates of the relationship between earnings and school grades are small. The difference may arise from the restriction of our sample to successful university graduates, but it may also be an indication that school grades measure productive skills with substantially more noise than results of direct tests of the cognitive skills of the adult population.

Finally, our findings inform educational policy makers about repercussions on the labor market that a centralization of evaluation systems in schools may entail. Not only may central exam systems act as an effective accountability device raising student achievement (see Hanushek & Woessmann, 2011 for an overview of the international evidence) and overall labor-market productivity (Piopiunik, Schwerdt, & Woessmann, 2013). They also allow an improved sorting of students by productive skills. In the long run, this may increase overall welfare also in other ways. For example, central exams may facilitate the matching process between vacancies and workers (e.g., Petrongolo & Pissarides, 2001). Additional descriptive evidence on the relationship between the type of evaluation system in schools and applications, interviews, and job offers during the initial job search supports this conjecture. Central exams may also lower firms' costs of filling a vacancy because firms are less dependent on their own costly screening devices such as assessment centers. Finally, grades on school leaving exams are officially used to assign places at German universities when there is oversubscription in a subject or faculty. Thus, the matching process between scarce places in higher education programs and students with adequate skills may become more efficient. This may not only raise overall welfare, but also fairness in the access mechanism to the higher education system.

In what follows, Section 2 provides a simple conceptual framework for the information value of central exam grades on the labor market. Section 3 describes the examination systems at the end of high school in German states, introduces the dataset, describes the sample, and provides descriptive statistics. Section 4 presents our empirical strategy. Sections 5 and 6 report our basic results and robustness tests. Section 7 tests to what extent university and job characteristics are channels of the effect. Section 8 presents supporting evidence on the higher information value of central exams based on the number of applications, interviews, and job offers during the initial job search. Section 9 concludes.

## 2. Conceptual framework on the information value of exams

### 2.1. Theoretical background

Our specific analysis of the information value of grades obtained in central school exams builds on the more general theoretical literature on signaling educational performance. The basic idea of job market signaling is that high-ability workers differentiate themselves from observationally identical workers of lower ability by acquiring an educational signal that is observed by potential employers (Spence, 1973). If higher ability individuals find

<sup>2</sup> Note that this is a different kind of variation from comparing U.S. states with and without minimum competency exams or differing graduation requirements (e.g., Baker & Lang, 2013; Bishop & Mane, 2001; Dee & Jacob, 2007), as all German states have such graduation requirements. Here, we are able to hold the existence of graduation requirements constant in order to test whether the external character of examinations has particular information value.

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