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Compressing instruction time into fewer years of schooling and the impact on student performance

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ABSTRACT

Is it possible to compress instruction time into fewer school years without lowering education levels? A fundamental reform in Germany reduced the length of academic track schooling by one year, while increasing instruction hours in the remaining school years to provide students with a very similar core curriculum and the same overall instruction time. Using aggregated administrative data on the full population of students, we find that the reform increases grade repetition rates and lowers final grade point averages, without affecting graduation rates. The results suggest adverse reform effects on student performance, but the economic significance of the effects appears moderate.

1. Introduction

High levels of education and early labour market entries are both important for the international competitiveness of economies, but there seems to be a trade-off between the two. This trade-off and the debate on the optimal number of school years is becoming increasingly important as general levels of education increase across OECD countries (OECD, 2015). A recent school reform in Germany provides novel insights into the possibility of educating children up to the same level of skills over a shorter period of time. German students were typically aged 19 or 20 and among the oldest students across all OECD countries to acquire the qualifications needed to study at university. Peers in the UK, the US and Japan typically earn the equivalent qualifications at age 17 or 18 (OECD, 2008, p. 498). In response to this situation, several German federal states reduced the number of years needed to earn the relevant qualification for university entrance (*Abitur*) at academic track schools from 13 to 12 years. Unlike straight reductions in years of schooling, the German reform sought to simultaneously maintain high levels of education by increasing the number of instruction hours in the remaining academic track school years. Consequently, students affected by the reform must cover a very similar curriculum and the same overall instruction time across their school career as before the reform to earn the school leaving certificate – despite having one year less of schooling. Affected students have longer school days in which they cover curriculum content that has been gradually brought forward from previously higher years.

In this study, we investigate the impact of this controversial and major education reform on student performance in school. Using aggregated administrative data covering the entire population of students in academic track schools across several cohorts, we analyse the impact on three important measures of overall student performance: grade repetition rates, graduation rates and final grade point averages (GPA). For the identification of effects, we use the fact that the reform was implemented at different points in time across the German federal states. Our difference-in-differences setting enables us to account for major concerns in the analysis of

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grade repetition rates, graduation rates and GPAs, such as differences between education systems across federal states, teacher grading biases and general time trends.

We find that the probability of repeating a grade throughout academic track schooling increases by 3.6 percentage points (26 percent), indicating students' problems with covering more content per school year during longer school days in the remaining school years. The effects are stronger for boys and concentrate in the final years prior to school completion. The reform also reduced the average GPA by about 4.4 percent of a standard deviation. Yet, we do not find evidence of reform effects on the proportion of students completing academic track schooling with the university entrance qualification. The results are robust to a variety of sensitivity checks. We neither find evidence of differential trends in the outcome variables between treatment and control states before the introduction of the reform, nor of changes in the student body due to the reform. Both results strengthen a causal interpretation of our findings.

This study links two strands of the literature on the role of time as an input factor in the educational production process. Previous studies either look at the impact of (i) changes in the amount of instruction time provided in a given school year, or (ii) changes in the number of years of schooling. The first strand finds that expansions in the number of days spent in school (e.g. Marcotte, 2007; Sims, 2008; Fitzpatrick, Grissmer, & Hastedt, 2011; Herrmann & Rockoff, 2012) or increases in the number of instruction hours provided in a given time period (e.g. Taylor, 2014; Cortes, Goodman, & Nomi, 2015; Lavy, 2015; Rivkin & Schiman, 2015; Huebener, Kuger, & Marcus, 2016) tend to improve student performance.

Regarding the second strand, there is a large economic literature on the benefits of additional years of schooling (e.g. Card, 1999, chap. 30; Lochner, 2011, chap. 2). The effects are often identified through changes related to minimum schooling requirements. The findings relate to students on the verge of early school dropout, who experience high monetary and non-monetary returns to additional years of schooling. However, it is not clear what these studies imply for students who are not on the verge of dropping out of school, i.e. students aiming at earning higher school leaving certificates. A policy experiment in Canada provides initial insights into the benefits of additional years of schooling for students bound for higher education. The Canadian reform shortened university preparatory high school by one year.[1] Morin (2013) and Krashinsky (2014) examine the impact of the reform on students' academic performance at university. Both studies find a strong negative effect on student performance ranging between 17 to 120 percent of a standard deviation, with larger reductions in student performance for lower-ability students. This suggests that the missing school year had indeed added substantial value to student performance.

While both more instruction time per school year and more years of schooling seem beneficial for student learning, it is not clear whether the effects of reductions in the number of years of schooling can be offset by compensating increases in instruction time over the remaining school years. The German academic track school reform is the first policy experiment providing us with insights into this question, which is particularly important in understanding the trade-off between high levels of education and early labour market entries. We find some evidence of adverse effects, though these effects appear moderate when compared to the findings of studies analysing the elimination of the final year of schooling without compensating instruction hour increases, such as in the Canadian case. Our findings complement the first set of important results by Büttner and Thomsen (2015), the only other economic study assessing the reform effect on student performance at the end of secondary school.[2] Büttner and Thomsen estimate the reform effect in one out of 13 treatment states for the first affected cohort, using survey data from students in twelve schools and a different econometric approach. They find that the reform resulted in lower final examination results in mathematics, but not in language arts.

We extend the existing literature in several dimensions. First, we examine three different measures of student performance. Second, we extend the analyses beyond the first affected cohort, and apply a difference-in-differences approach to estimate effects for subsequent treatment cohorts. This is an important refinement as the first treated cohort graduated under unusual conditions: It graduated from school in the same year as the last pre-treatment cohort. Therefore, students in the first treated cohort might have different performance incentives as they compete for limited resources at universities (e.g. available places, student-teacher-ratio) and for places in vocational training courses with the preceding cohort (Morin, 2015a, 2015b). Third, studying several treated cohorts allows us to analyse whether the reform effects are only of transitory nature or whether the effects also persist in the medium-run. Fourth, we investigate the reform effect across most treatment states, which allows us to control for cohort effects and other education policies. Fifth, we employ administrative data covering the entire underlying population of students.

Further, this study carries important implications for endogenous sample selection issues in the growing literature on the impact of this education reform on post-secondary education outcomes and on labour market outcomes. The reform effect on grade repetition rates implies that in each affected cohort, the share of students repeating a year is higher. Depending on the sample selection of the researcher, this affects the ability distribution in treatment and control cohorts, thus potentially posing challenges for an unbiased estimation of reform effects. This is less relevant for studies that sample students before grade 10, as we only find reform effects on grade repetitions in later grades. Further, the zero-effect of the reform on the graduation rate suggests that a compositional change in the group of students with the qualification for university entrance is not an important source for sample selection biases.

The remainder of this study is structured as follows. Section 2 provides information on the German education system and the reform analysed in this study. Section 3 describes the data, and Section 4 outlines the empirical strategy. Section 5 reports the main reform effects, followed by an analysis of effect heterogeneities in Section 6. Section 7 provides a broad range of sensitivity checks and Section 8 concludes.

2. Institutional background and the G8-reform

We derive the effects of compressing instruction time on student performance from a reform of German academic track schools. The German education system tracks students into different school types according to their ability after four years of primary school (when students are typically ten years old). The high-ability, academic track school *Gymnasium* prepares students

[1] The reform in Ontario also reorganised the curriculum in the remaining school years.

[2] Other studies evaluate the reform effect on non-cognitive skills (Thiel, Thomsen, and Büttner, 2014, find no effects; Dahmann and Anger, 2014, provide evidence for higher extraversion and lower emotional stability), on measures of crystalline and fluid intelligence (Dahmann, 2015, finds no general effect, but some evidence for improvements among males) and on student performance in ninth grade when the reform serves as a quasi-experiment to estimate the effect of increased instruction time (Huebener et al., 2016, find small positive average effects and stronger improvements among high-performing students). For overviews on recent findings on effects of this reform, see Huebener and Marcus (2015) and Thomsen (2015).