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# The costs of failure: Negative externalities in high school course repetition



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## ABSTRACT

Failure in US high school courses is common, but little is known about its effects. This paper investigates the extent to which course repeaters in high school mathematics courses exert negative externalities on their course-mates. Using individual and school-specific course fixed effects to control for ability and course selection, it shows that increasing the share of repeaters in a given course results in a moderate, significant increase in the probability of course failure for first-time course-takers. Results suggest that the negative effect is only evident when the share of repeaters reaches a threshold of five to ten percent of the total number of course-takers. The possibility that grading to a curve generates the effect cannot be ruled out, but is not fully supported in the data. Evidence is also presented that course repetition externalities may be distinct from low-ability peer effects.

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## 1. Introduction

The questions of whether low-achieving students should be retained in a grade or required to repeat a failed course are answered by the extent to which grade or course repetition affects the retained or repeating individual and the extent to which grade or course repeaters affect their classmates. An extensive literature has investigated the effect of grade retention on the individual, but there is less evidence on the potential effects of grade or course repeaters on their classmates.<sup>1</sup> This paper provides new evidence that course repeaters negatively affect their course-mates in US

high schools. Using unique longitudinal transcript data in which individual and school-specific course fixed effects control for ability and course selection, an increase in the share of repeaters in a given high school mathematics course causes an increase in the probability of course failure for first-time course-takers.

Many US students fail high school mathematics courses. Seven percent of students in the data used in this paper repeat a failed mathematics course in high school, and this increases to fifteen percent for students taking Algebra I. Furthermore, there has been a widespread push to raise standards in American high school education.<sup>2</sup> In the past decade, many US states have both

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<sup>1</sup> An important exception is Lavy, Paserman, and Schlosser (2012). They find that the share of students who are old for their grade (likely having been retained) is negatively correlated with the achievement of same-grade classmates in Israeli middle schools. This paper extends their empirical strategy to provide a course-specific rather than grade-level analysis in a US context.

<sup>2</sup> Organizations such as Achieve ([www.achieve.org](http://www.achieve.org)) have been promoting "college and career-ready" high school curricula since the mid-2000s. More recently, they partnered with the National Governors Association and the Council of Chief State School Officers to release the Common Core State Standards, a set of K-12 standards that have been adopted by and are currently being implemented in many states (albeit controversially).

increased the number of mathematics credits required for high school graduation and specified particular mathematics courses that need to be passed (Reys, Dingman, Nevels, & Teuscher, 2007). Tables 8 and 9 in the appendix summarize the mathematics requirements for high school graduation by state. The median state requires students to obtain three credits of high school mathematics and pass Algebra I in order to graduate. Media reports indicate that these requirements may have increased the likelihood of course repetition for students who fail high school mathematics courses, and, in particular, reveal diverse public opinion on whether Algebra I should be required for graduation (Hacker, 2012; Helfand, 2006). The effects of repetition in high school mathematics courses are clearly important to understand. The negative externalities exerted by repeaters on their classmates found in this paper suggest a cost to course repetition ignored by much of the previous analyses, and, to the extent that policies such as requiring Algebra I to graduate increase course repetition, a cost to minimum mathematics requirements that may have been overlooked by policy-makers.<sup>3</sup>

Understanding the externalities imposed by repeaters in high school mathematics courses may also inform the grade retention debate. This is because both grade retention and course repetition result in students being exposed to a set of low-achieving classmates who are likely to share similar characteristics.<sup>4</sup> To the extent that repeating and retained students exert similar externalities on their classmates, this paper suggests grade retention analyses should include effects exerted on classmates of the retained individual.

The paper uses a fixed effects strategy on longitudinal transcript data for multiple cohorts of US high school students to estimate the causal effect of course repeaters on their course-mates, students taking the same course but not necessarily in the same class. Essentially, the study compares the achievement of first-time course-takers in the same mathematics course (such as Algebra I) in the same high school in different years using

year-to-year variation in the share of repeaters in the course to identify the effect. It is assumed that unobserved year-specific shocks to education production in the previous year provide variation in the share of course repeaters in the current year. These may be classroom-specific shocks (such as increased teacher absenteeism in a specific course causing a higher course failure rate that year) or be caused by natural variation in cohort course aptitude.

The academic achievement of first-time course-takers is shown to be negatively correlated with the share of repeaters in the course that year. First-time course-takers are more likely to fail when exposed to greater shares of course repeaters, and this is particularly evident when the share of repeaters reaches a threshold of five to ten percent of the course.

Grading to a curve cannot be ruled out as a cause of the effect. It is possible that repeaters push a subset of first-time course-takers down a potentially fixed grade distribution, although it is argued that other features of the data are inconsistent with grading to a curve. The use of course failure rather than GPA as the outcome of interest is partly motivated by the consideration that even if effects are generated by a “nominal” rather than “real” phenomenon, course failure may have serious long-run consequences. Rose and Betts (2004) find that advanced high school mathematics courses have greater effects on students’ earnings a decade after graduation than less advanced courses, and Joensen and Nielsen (2009) establish a causal relationship between advanced high school mathematics and earnings, so to the extent that course failure determines the decision to enroll in advanced mathematics courses, the estimated course spillover may affect labor market outcomes. Course repetition externalities are therefore important irrespective of their cause and should be considered when thinking about high school course progression and failure policies.

Course repeaters may exert externalities on their course-mates in a variety of ways. These course composition effects can be grouped into two categories: general effects arising from repeaters being low-achievers and specific repeater effects not exerted by other low-achievers. Low-achieving students are likely to disproportionately extract teacher inputs or redirect teacher inputs away from first-time course-takers. They may need more time to understand concepts, slowing the pace of the class, and may also be more likely to misbehave in the classroom given that disruptive behavior is generally correlated with classroom ability, requiring teacher intervention. Low-achieving classmates may also be more likely to directly distract their classmates, lowering education production even without affecting teacher inputs.

In addition to these low-achiever effects, course repeaters may exert additional externalities specifically related to failing and retaking a course. They may be bored and inattentive when encountering course material for the second time, increasing the likelihood of disruptive behavior. Repeaters may also have a poor attitude or be uncooperative because they failed the course the previous

<sup>3</sup> There may, of course, be a benefit or cost experienced by the repeating individual. Goodman (2012a) uses state-specific policy reforms to find that increases in the mathematics requirements for high school graduation introduced in the mid and late-1980s increased subsequent earnings for black students. In an investigation of how increases in standards affect individual achievement, Goodman (2012b) shows little impact, which may be consistent with findings in this paper if potential gains to high-achieving students are offset by losses to low-achieving students who are both more likely to repeat failed courses and experience the negative externalities exerted by repeating course-mates. Betts and Grogger (2003) find that higher standards raise test scores throughout the distribution with gains being greatest for top achievers, and Figlio and Lucas (2004) argue that higher grading standards benefit students.

<sup>4</sup> The effects of grade retention and course repetition on the individual, however, are likely to differ along several dimensions. This is primarily because retained and repeating students are likely to be of different ages and maturities (retention typically occurs in junior and middle schools while course repetition typically occurs in high school). In addition, retained and repeating students are exposed to a different peer group shock (retained students repeat all courses associated with a particular grade so are exposed to a completely new set of peers while repeating students are only exposed to new peers in the course they repeat).

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