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Measuring inflation in grades: An application of price indexing to undergraduate grades[☆]

Rey Hernández-Julián[a,*], Adam Looney[b]

[a] Metropolitan State University of Denver, Denver, Colorado, USA
[b] The Brookings Institution, Washington, DC, USA

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ABSTRACT

Rising average grades at American universities have prompted fears of "grade inflation." This paper applies the methods used to estimate price inflation to examine the causes of rising grades. We use rich data from a large public university to decompose the increase in average grades into those components explained by changes in student characteristics and course choices, and the unexplained component, which we refer to as "inflation." About one-quarter of the increase in grades from 1982 to 2001 was driven by changes in the courses selected by students; enrollment shifted toward historically 'easier-grading' departments over time, mechanically increasing average grades. An additional one-quarter of the increase is attributable to increases in the observable quality of students, such as average SAT scores. Less than half of the increase in average grades from 1982 to 2001 appears to arise from the unexplained factors, or "inflation." These results add to the evidence suggesting that differences in relative grades across departments discourage students from studying in low-grading departments, like math, physics, or engineering.

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1. Introduction

Average grades at many American universities have increased significantly over the past 50 years, from about 2.5 in 1960 to 3.1 in 2006 (on a 4 point grading scale), raising concerns about what is often termed grade inflation (Rojstaczer, 2016). The use of the word "inflation"—borrowed from the language of consumer prices—reflects a common belief that today's faculty are assigning higher grades for what was once ordinary work (Rojstaczer, 2016). However, as with consumer prices, average grades may also rise because of improvements in quality or changes in the composition of the basket of consumer choices. At many top colleges, admissions has become more competitive, plausibly increasing the quality of student work, while student enrollments have tended to shift from harder to easier grading classes, changing the composition of the basket. Rojstaczer and Healy (2010) show that grades in the broad categories of humanities, social sciences, and engineering are higher than those in the natural sciences; if enrolment in these categories increases over time, then so would the mean earned grade. Understanding the importance of these factors is relevant for understanding the costs associated with rising grades and for designing policies to address grade inflation. However, the role of these factors is uncertain because the appropriate data and empirical methods have yet to be applied to measure these sources of rising grades.

In this paper, we propose applying the tools used to construct quality-adjusted price inflation indices to measure the inflation component of rising grades. These methods provide both a new measure of grade inflation as well as a way to decompose overall increases in grades into those components explained by changes in student characteristics and their course choices.

We apply these methods to rich individual student-level data from Clemson University. Our data includes 20 years of exact transcript information (such as courses attended and grades received) and student characteristics (such as SAT scores, age, and gender) which we use to measure grade inflation controlling for school-wide changes in both student characteristics and course choices. The transcript data contain over 2.5 million individual grades earned by almost 90,000 students, making it the largest dataset used to analyze grade inflation. Over the sample period, average grades increased 0.32 grade points (from 2.67 to 2.99), similar to increases recorded at other national universities (Rojstaczer, 2016). At the same time, average SAT scores increased by about 34

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* Corresponding author.
E-mail addresses: rherna42@msudenver.edu (R. Hernández-Julián), alooney@brookings.edu (A. Looney).

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points (or roughly 9 percentile points on math and 5 percentile points on verbal sections).[1]

In order to compare the grades of students taking the same (or very similar) classes at different points in time, we matched classes based on end-of-sample course titles and descriptions with those from earlier course catalogs. Over the 20-year period, in departments where grades were historically high, enrollment increased—particularly in the humanities and certain career-oriented fields—while enrollment fell in historically low-grading departments like math, physics, and engineering.

Although the fact that expected grades affect enrollment choices has been well documented (Bar, Kadiyali, & Zussman, 2009; Sabot & Wakeman-Linn, 1991), the literature has not examined how changes in course enrollment affected measured grade inflation over time. We propose to measure grade inflation using standard hedonic regression techniques that underlie many quality-adjusted price indices. These methods also allow us to decompose the average increase in grades into those components explained by changes in student characteristics, changes in the distribution of classes selected by students, and unexplained factors, which, as in the price literature, we describe as "inflation." In essence, this analysis attempts to form the counterfactual "what would grades have been in 2001 if those students took the same classes and had the same characteristics and qualifications as students in 1982?" using the DiNardo, Fortin, and Lemieux (1996) reweighting technique. This technique has been widely applied in other contexts, particularly relating to changes in wages, but has never before been used to analyze changes in the distribution of grades.

According to these analyses, more than half of the increase in average grades from 1982 to 2001 at Clemson University arises because of changes in course choices and improvements in the quality of the student body. The shift to historically easier classes increased average grades by almost 0.1 grade point. Increases in SAT scores and changes in other student characteristics boosted grades by almost another 0.1 grade point. Nevertheless, almost half of the increase in grades is left unexplained by observable characteristics of students and enrollment—a figure that suggests the assignment of higher grades plays a large role in the increase.

2. Rising grades

A number of studies document the increase in average undergraduate grades over the last half century. For example, Rojstaczer and Healy (2010, 2012) find that average grades have increased by roughly 0.1 per decade (on a 0 to 4 scale) since the 1960s, or roughly 0.7 at private universities and 0.5 at public universities from 1960 to 2006. Similarly, Babcock (2010) cites results from the National Postsecondary Student Aid Study, reporting that GPAs for full-time students rose from 2.83 to 2.97 between 1993 and 2004. Though the magnitude of grade inflation varies across data sources, the evidence taken together suggests that grades rose somewhere around 0.1 grade points per decade between the 1960s and 2000s, except during the 1970s when average grades stayed relatively constant.

A common explanation for rising grades is 'inflation' in the sense of faculty assigning higher grades for equivalent work. For instance, Rosovsky and Hartley (2002) provide a list of possible contributors to rising grades whose central theme is summarized as an upward shift in grades without a corresponding increase in student achievement that is driven by a number of potential factors: incentives to grant higher grades due to the Vietnam War draft; a response to student diversity; new curricular or grading policies; responses to student evaluations; adjunct faculty; or a growing consumer culture. Some theorize that competition among colleges to place students in better jobs also encourages grade inflation (Chan, Hao, & Suen, 2007; Tampieri, 2011). Institutional and resource constraints may also matter. DeWitte, Geys and Solondz (2014) argue that giving public schools additional resources may also lead to grade inflation, while Wikström and Wikström (2005) show that higher level of competition among secondary schools dampens the magnitude of grade inflation in Sweden. International comparisons show that institutional traits, such as school autonomy, centralized exams, and competition from private schools, matter more than resource differences when predicting grade increases in the math and sciences (Wößmann, 2003).

A number of studies have also examined how grades influence student choices. First, it is clear that there are large and persistent differences in grades across departments (Achen & Courant, 2009). In addition, Johnson (2003), Sabot and Wakeman-Linn (1991), and Bar et al. (2009) show that students are responsive to the incentives in grading and seek out easier-grading departments and classes. These studies, and related research (Rojstaczer & Healy, 2010) suggest an important role of shopping by students for classes to improve their grades. Similarly, Hernández-Julián (2010) shows that grade-dependent scholarships may lead students to seek out easier-grading classes to maintain the required GPA. Bar et al. (2009), in particular, examine a change in policy that provided information on median course grades and find that this policy change encouraged students to migrate to courses with higher grades and show that these changes in course selection increased grades.

Our analysis contributes to existing research on rising grades by applying a framework drawn from the price literature to examine grading trends over time, by using that framework to measure the contribution of different factors to rising grades, and through the use of the richest set of student-level data yet examined. When measuring trends in grades over time, almost all research refers to changes in overall mean grades. Because the courses students are taking over time may be changing towards those course that give the higher grades, a comparison that uses mean grades does not follow an unchanging set of courses over time. Our analysis is the first in the literature that decomposes the increase in grades to three component parts: changes in course choices, changes in student traits, and "inflation" proper.

3. Data

Our analysis uses data from Clemson University, a large, selective, public, primarily residential, research institution ranked among the top 100 national universities by *U.S. News and World Report*, covering the period from 1982 to 2001. The transcript data contain over 2.4 million individual grades earned by more than 86,000 students over the course of 40 academic semesters starting in the fall of 1982 and ending in the summer of 2002. Throughout the analysis "years" refers to school years starting with the fall semester (i.e. 2001 corresponds to fall 2001, spring 2002, and summer 2002). Each grade is matched to records of students' demographic characteristics, including age, gender, and date of university enrollment. For over three-quarters of these students, we also observe SAT scores.[2] The analysis focuses on the sample of students for whom all demographic information and SAT scores are available, although the overall pattern of average grades,

[1] SAT scores were re-centered by the College Board in April 1995; SAT scores for students entering prior to 1996 have been re-centered using a conversion table (College Board, 2012).

[2] Our dataset includes ACT score data for some students but it is not a useful substitute for SAT scores, since 94 percent of students with missing SAT scores also have missing ACT scores.

enrollments, and other characteristics appears to be the same as in the full sample and does not appear to affect the results.[3]

A key challenge in our analysis is ensuring an apples-to-apples comparison of classes over a 19-year period in which courses and departments changed, sometimes considerably. While most departments, especially larger departments with the highest enrollment retained the same name over time (e.g. English, Philosophy, Spanish, Mathematical Sciences, Physics, Computer Science), a few departments were eliminated or renamed (e.g. Zoology and Botany were subsumed into other departments, like Biology), new departments formed (e.g. Packaging Science; Environmental and Natural Recourses; Women's Studies), and the content of classes within departments changed. Courses at Clemson are assigned a course number (e.g. Physics 200), in which the first digit generally corresponds to courses directed to first year students (100-level), second year students (200-level), etc. This numbering convention is unchanged overtime.

The goal of our analysis is to compare the grades assigned in the same courses and departments at different points in time. To match past classes to their current versions, we use course descriptions from historical course catalogs from the 1985, 2000, and 2001academic years.[4] Many classes have the same number, title, and course description in all years. However, the content of many courses has changed, and other courses have been eliminated or created. Therefore, as an initial step, we categorized courses based on their department and level of courses. Because most department's names did not change and the course numbering convention was the same, it is possible to assign a consistent department and course-level for essentially all courses and all students over the entire sample.

In addition, we also attempted to produce an exact course-by-course match using the descriptions of individual courses within each department. (See Appendix 3 for a detailed description of how we matched departments and courses over time.) In our analysis we felt comfortable exactly matching about 64% of courses offered in 1985 to the exact courses offered in 2001. For courses that have no exact match, a concern is that students may be substituting easier for harder courses within a department/level (i.e. taking the easier 200-level math class). However, the robustness checks in our analysis suggest that most differences in grading (and course selection that affects overall average grades) are occurring across departments and to a lesser extent, across course levels (100 level, 200 level etc.) rather than across specific classes within a department. Matching courses based on their departments and levels appears to capture most of the variation in selection over time.

Table 1 summarizes the basic statistics from the sample and illustrates how characteristics of students and their course choices have changed over the sample period. The average grade in 1982 was 2.67 and rose to 2.99 in 2001. Over the same period of time, female enrollment increased by 4 percentage points and average SAT scores rose by 29 and 15 points on the math and verbal sections, respectively (an increase of about 9 percentile points on math and 5 on verbal).

Table 2 shows that the courses selected by students changed significantly over time. It lists the average grade in the ten departments that experienced the largest increases in enrollment and the ten that experienced the largest decreases over the sample period. Column A presents the percentage of enrolment from the entire sample period, column B presents the percentage of enrolment in 1982, and column C the enrolment percentage in 2001. Column D is the change in the percentage in enrolment between 2001 and 1982. Of the ten departments that grew the most in popularity between 1982 and 2001, two are humanities (Spanish and Philosophy), and five are departments geared toward preparing students for specific careers following graduation (Marketing, Speech & Communications, Graphic Communications, Education, and Parks, Recreation & Tourism Management). Two are technical or scientific (Computer Science and Health Science). Column E shows the difference in the mean grade generated by the department compared to the overall university mean grade. Column E shows, eight out of ten of these departments assigned grades that were, on average, substantially above the mean for the sample period. Of the ten departments that declined the most in popularity, on the other hand, six are science and engineering disciplines. In eight of these ten departments, grades were below the mean.

We can estimate the contribution of the change in enrollment in a given department to the overall rise in average grades between 1982 and 2001 by multiplying the percentage-point change in enrollment in that department by the number of grade points by which grades in that department exceed or fall below the average in the sample as a whole. For example, since enrollment in Education rose by 0.9 p.p. between 1982 and 2001, and average grades in that department exceeded the whole-school average by 0.76 grade points, the overall contribution of enrollment in that department to the rise in average grades is about $0.009 * 0.76 = 0.007$. Summing the individual contributions over the 20 departments listed in this table, we estimate that changes in enrollment among these departments together created a 0.051-grade-point increase in average grades, or about 16% of the overall rise in average grades over the sample period.

This table presents evidence in support of our motivating idea: typical grade inflation estimates that are based on a comparison of a university's mean grades will include information not just on how grades are increasing in individual courses, but also how grades are increasing due to students' course choices changing over time.

4. Empirical methods

This paper quantifies the causes of rising grades by drawing on empirical methods underlying quality-adjusted price indices, like the consumer price index. Specifically, our index adjusts for the quality of incoming students measured by SAT scores and demographic characteristics using hedonic pricing methods, controlling for the "market basket" of classes taken by students, and estimating inflation using the simple dummy variable method (Dunn, Doms, Oliner, & Sichel, 2004; Griliches, 1971; Tripplet, 2004).

The estimating equation is:

$$g_{iyc} = \alpha_y + \ \beta Dept_d + \delta SATM_i + \delta SATV_i + \ \zeta X_i + e_{iyc}$$

where g_{iyc} is the grade received by student i in school year y in course c, α_y represents school-year fixed effects, $Dept_d$ is a set of department and course-level fixed effects[5], $SATM_i$ is student i's math SAT score, $SATV_i$ is student i's verbal SAT score, X_i is a vector of demographic controls for race, sex, and age, and e_{iyc} is an error term. Observations are weighted by the number of academic

[3] The demographic characteristics of the Clemson student body, compared with the nation, is in Appendix 1. A comparison of the characteristics of our regression sample with the sample as a whole is provided in Appendix 2. Some students take the ACT instead of the SAT; for others SAT scores are simply missing.

[4] 2000 is the earliest year for which course catalogs are available on the Internet. We tried to obtain hard copies of course catalogs for earlier years, but 1985 was the only year the Registrar was able to provide.

[5] For this set of fixed effects, an indicator variable is included for every department and course-level combination that appears in the sample, where a course level is defined by the first digit of the three-digit course number. Chemical Engineering 201, for example, is a 200-level course in the Chemical Engineering department, and shares a fixed effect with all other 200-level Chemical Engineering courses.

Table 1
Summary statistics.

Student characteristics	(A) 1982–2001	(B) 1982	(C) 2001	(D) Change (C-B)
Grade	2.83	2.67	2.99	0.32
	(0.003)	(0.01)	(0.01)	(0.01)
SAT math	563	550	579	29
	(0.29)	(0.73)	(0.70)	(1.04)
SAT verbal	551	545	560	15
	(0.30)	(0.79)	(0.68)	(1.03)
Male	0.55	0.59	0.55	−0.04
	(0.002)	(0.005)	(0.004)	(0.006)
Age	21.0	20.2	20.2	0.0
	(0.02)	(0.005)	(0.03)	(0.05)
Number of students	86,306	11,347	15,274	3927
Number of courses attended	2,443,497	105,231	137,948	32,717

Standard errors are presented in parentheses below the mean. SAT, gender, age, and grade summary statistics represent course-credited weighted averages for the indicated sample periods. The number of courses attended is the sum of total fall, spring, and summer classes enrolled by all students in each school year. Over the whole sample, each unique student registered for an average of 20.7 courses. Differences may not be exact due to rounding.

Table 2
Changes in course enrollment and the contribution to rising grades.

Departments by increasing and decreasing enrollment	(A) Percentage of all curse credits in department 1982–2001	(B) 1982	(C) 2001	(D) Change in enrollment (C-B)	(E) Department Relative grade (Mean difference)	(F) Contribution to change in GPA (D*E)
Departments with increasing enrollment						
Speech & Communications	1.8	1.1	3.0	1.9	0.38	0.007
Spanish	1.9	1.2	2.8	1.5	0.20	0.003
Graphic Communications	0.5	0.1	1.1	1.0	0.32	0.003
Education	4.3	3.4	4.3	0.9	0.76	0.007
Philosophy	1.1	0.2	1.1	0.9	0.03	0.000
Parks, Recreation and Tourism Management	1.8	1.3	2.2	0.9	0.26	0.002
Nursing	1.6	0.8	1.6	0.8	0.28	0.002
Computer Science	3.0	3.0	3.7	0.7	0.10	0.001
Theater	0.3	0.0	0.7	0.6	0.51	0.003
Finance	1.7	1.2	1.8	0.6	−0.28	−0.002
Total	*17.9*	*12.5*	*22.2*	*9.7*	*0.26*	*0.027*
Departments with decreasing enrollment						
Mathematical Sciences	9.8	11.5	8.5	−2.9	−0.41	0.012
Management	4.1	5.6	3.4	−2.2	0.14	−0.003
Electrical and Computer Engineering	3.0	3.9	2.2	−1.7	−0.07	0.001
Economics	3.4	4.5	3.1	−1.4	−0.15	0.002
Accounting	3.0	3.4	2.2	−1.3	−0.44	0.005
Physics	2.7	3.4	2.3	−1.1	−0.39	0.004
Engineering Mechanics	1.4	1.8	0.9	−0.9	−0.41	0.004
Mechanical Engineering	1.9	2.4	1.5	−0.9	−0.10	0.001
English	9.4	9.5	8.8	−0.7	0.10	−0.001
Design	1.1	1.3	0.7	−0.6	0.34	−0.002
Total	*39.7*	*47.3*	*33.7*	*−13.7*	*−0.14*	*0.024*
Overall Change in Grades 1982–2001						*0.32*

Note: Department relative grade is the mean GPA in the department in 1982 minus the overall GPA in 1982.

credits earned in each course.[6] This strategy attempts to answer the question, "how did grades change over time holding fixed the characteristics of students and the courses they selected?" This formulation allows a decomposition of the contribution of changes in average grades over time into the part "explained" by changes in courses and changes in demographics.

To examine how the distribution of grades changed because of changes in underlying characteristics, we apply a reweighing technique developed by DiNardo et al. (1996). DiNardo, Fortin, and Lemieux provide a method to analyze the effect of changes in covariates on the distribution of some outcome, such as wages. This approach provides an estimate of what the distribution of grades would have been in the 1982 school year had student demographics and course choices matched those of the 2001 school year. To do this, we reweight each 1982 course grade observation according to the relative likelihood of observing the combination of control variables for that observation in 2001 instead of in 1982. The

[6] While 73 percent of courses earn 3 credits, some provide greater or fewer hours. Students are required to accrue a certain number of course credits to graduate. Moreover, when calculating GPAs grades are weighted according to course credit (e.g. a course worth 3 course credits matters three times as much as a course worth 1 course credit in the calculation). Weighting the data by course credit reflects the practices of the university so that the average grades we calculate match those calculated by the university.

control variables are the same ones used in the regressions above (excluding race): the gender, age, and SAT scores of the student receiving the grade, and the department and course level for which the grade was given. We estimate the likelihoods of observing the various combinations of control variables in 2001 relative to their likelihoods in 1982 using a probit model. Specifically, we limit our sample to observations from 1982 and 2001 and estimate the following specification:

$$P(Year_y = 2001 \mid X_{iyc}) = \Phi\left(X'_{iyc}\beta\right)$$

where **X** is a vector of control variables for student i taking course c in year y: a *male* indicator, age, SAT verbal score, SAT math score, and set of department and course-level indicator variables. As above, we weight observations by the number of course credits for the course. To generate the counterfactual distribution of grades in 1982 we then reweight each 1982 course grade observations using the factor:

$$\frac{P(Year_{iyc} = 2001 \mid X_{iyc})}{P(Year_{iyc} = 1982 \mid X_{iyc})} \times coursecredits_{iyc}$$

where $P(Year_{iyc} = 2001 \mid \boldsymbol{X}_{iyc})$are fitted values from the estimated probit model, and $P(Year_{iyc} = 1982 \mid \boldsymbol{X}_{iyc})$ is simply one minus the corresponding 2001 probability. The resulting probability distribution of grades (A, B, C, D, or F) represents the 1982 counterfactual given 2001 course choices and demographics.[7]

5. Results

Table 3 provides results from the hedonic regression. In the first column, which excludes covariates, the coefficients on the year variables simply indicate the increase in average course grades relative to 1982. In the regression sample, grades averaged 2.65 in 1982 and rose 0.32 points between then and 2001. Column 2 adds department-plus-course-level fixed effects. These fixed effects control for changes in the composition of classes attended by students over time. Column 3 adds controls for math and verbal SAT scores and student gender and age. For each one percentile increase in math or verbal SAT scores students' grades rise by about 0.01, on a 4.0 grade point scales. Older students perform better and women earn grades about 0.25 points higher than those of men.

Moving from column 1 to column 2, and column 2 to column 3, the coefficients on the year dummies fall, indicating that after controlling for the distribution of class and the characteristics of students, the "unexplained" component of rising grades, which we interpret as inflation, falls significantly. First, including the course fixed effects reduces the coefficient on the year 2001 dummy from 2.98 to 2.90, indicating that controlling for changes in the composition of courses selected by students over time "explains" roughly a quarter of the increase in grades over time.

Similarly, looking at the third column, the coefficients on student characteristics suggest changes in student characteristics and aptitude help explain more of the increase in grades over that time period. For instance, the increase in average SAT scores accounts for a sizable share of the increase in grades: Average math SAT scores increased almost 9 percentile points between 1982 and 2001, implying a roughly 0.08 GPA-point contribution to the increase, while the 5 percentile points increase in verbal scores implies a 0.021 GPA-point contribution.

Women outperform men by an average of about 0.25 conditional on test scores and course selection. While female enrolment increased by roughly 4 percentage points at Clemson, the direct effect on aggregate grades from rising female share is modest. However, the increase in female enrollment at Clemson is somewhat smaller than the increase nationwide. According to the National Center on Educational Statistics female enrollment at degree-granting institutions increased from about 41% to 56% between 1970 and 2000.[8] If the relative performance of female students were the same nationally as at Clemson, this increase alone would tend to boost GPAs by 0.04 grade points, or almost 15% of the nationwide increase in grades over that period reported in Rojstaczer and Healy (2010, 2012). (In addition, female students tend to enroll in greater numbers in easier-grading departments, which suggests that rising female enrollment also contributes to changes in the composition of courses toward easier-grading departments.)

Table 3
The contribution of course choices, demographic characteristics, and SAT scores to rising grades.

Covariate	(1)	(2)	(3)
1982	2.65	2.65	2.65
	0.007	0.007	0.007
1983	2.67	2.67	2.66
	0.007	0.007	0.006
1984	2.71	2.70	2.69
	0.007	0.007	0.006
1985	2.68	2.67	2.66
	0.007	0.007	0.006
1986	2.69	2.68	2.66
	0.007	0.007	0.006
1987	2.71	2.70	2.68
	0.007	0.007	0.006
1988	2.73	2.71	2.68
	0.007	0.006	0.006
1989	2.73	2.71	2.67
	0.006	0.006	0.006
1990	2.77	2.73	2.70
	0.006	0.006	0.006
1991	2.79	2.74	2.71
	0.006	0.006	0.006
1992	2.81	2.75	2.72
	0.006	0.006	0.006
1993	2.84	2.77	2.73
	0.006	0.006	0.006
1994	2.84	2.77	2.72
	0.007	0.007	0.006
1995	2.87	2.79	2.73
	0.007	0.006	0.006
1996	2.87	2.80	2.73
	0.007	0.007	0.006
1997	2.88	2.80	2.72
	0.007	0.007	0.006
1998	2.91	2.84	2.76
	0.006	0.006	0.006
1999	2.91	2.84	2.76
	0.007	0.006	0.006
2000	2.94	2.86	2.78
	0.006	0.006	0.006
2001	2.98	2.90	2.81
	0.006	0.006	0.006
SAT math percentile			0.01
			0.00013
SAT verbal percentile			0.01
			0.00012
Male			−0.25
			0.005
Age			0.02
			0.0009
Course, level & race FEs		Yes	Yes
Observations	2,195,288	2,195,288	2,195,288
R-squared	0.875	0.889	0.897

Standard errors adjusted for clustering on the student reported below the estimates.

[7] For a complete discussion of this method see DiNardo (2002) or Fortin, Lemieux, and Firpo (2011).

[8] U.S. Department of Education, National Center for Education Statistics (2011).

Table 4
Decomposition of change in average grade 1982–2001.

Covariate	(1) Coefficient	(2) Change (1982–2001)	(3) Contribution (1)*(2)
SAT math percentile	0.009	7.03	0.064
SAT verbal percentile	0.005	3.71	0.019
Male	−0.246	−0.04	0.009
Age	0.022	0.16	0.003
Race FEs			−0.008
Course & level FEs			0.082
Total contribution of covariates			0.17
Memo: Total change in Grades 1982–2001			*0.32*

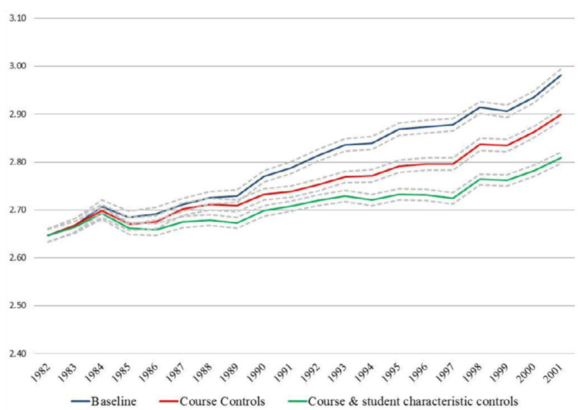


Fig. 1. A Decomposition of rising grades
Note: Figure illustrates the actual increase in grades from 1982 to 2002 (the top line), the increase after controlling for the course selections of students (the middle line), and the increase after controlling for course selections, the demographic characteristics of students, and their math and verbal SAT scores (the bottom line). 95% confidence intervals are shown in grey. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Overall, controlling for course selections, demographic characteristics, and SAT scores reduces the coefficient on year 2001 from 2.98 to 2.81, suggesting that controlling for those factors accounts for more than half of the increase (0.17 out of 0.32) in average grades between 1982 and 2001.

To examine the contribution of changes in student characteristics and course choices to increases in grades, Table 4 provides a decomposition of the 1982 to 2001 change in average grades. In particular, the table uses the regression coefficients from column 3 of Table 3 (presented in column 1) and the change in average student characteristics between 1982 and 2001 (column 2) to estimate how those changes would affect average grades (column 3).

As column 3 shows, rising SAT scores account for slightly more than 0.08 grade-point increase in GPAs and changes in course choices account for a similar amount. These two factors account for most of the predicted increase from changing observable characteristics. All told, changes in observable characteristics account for 0.17 of the 0.32 grade-point increase, or 53%.

These results are visualized in Fig. 1. The top (blue) line shows average grades at the university each year. On average, average GPAs increased by about 0.018 grade points per year and the increase in grades accelerated somewhat starting after 1989. The middle (red) and bottom (green) lines plot the coefficients on year fixed-effects from Columns 2 and 3, respectively, in Table 3.

As is apparent, controlling for the distribution of classes substantially reduces the residual increase in grades. Hence, changes in the distribution of classes have contributed about 0.1 grade points to average GPAs over the 20-year period. Adding controls for demographics reduces the residual grade inflation by roughly another 0.1 grade points. In short, after controlling for both course selection and the characteristics of students, the average increase in grades is roughly half the unconditional increase.

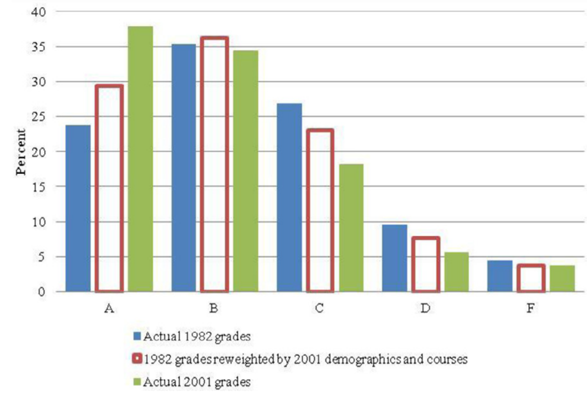


Fig. 2. Changes in the distribution of grades
Note: Figure illustrates the distribution of actual course grades assigned in 1982 (blue/left) and in 2001 (green/right). The bars outlined in red (in the middle) represent actual grades assigned in 1982 reweighted to represent the demographic characteristics, SAT scores, department and course selections of the actual 2001 students. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Fig. 2 examines how the distribution of grades changed between the beginning and ending of the sample period using the reweighting technique detailed above. The dark, solid blue bars illustrate that in 1982 about 24% of grades were As, 35% Bs, 27% Cs, 9% Ds, and 4% Fs. By 2001—the lighter, solid green bars in the chart—the proportion of As had increased to 38% and Bs, Cs, and Ds, had fallen to 34%, 18%, and 6%; Fs were about unchanged. Reweighting the 1982 data to match the student characteristics and course enrollment patterns of 2001 (the middle, hollow red bars) suggests that a substantial portion of the increase in grades is accounted for by changes in observable characteristics. For instance, according to this analysis about 30% of students in 1982 would have received As if they had the SAT scores and other characteristics of students in 2001 and if they had the same enrollment patterns as did students in 2001. In this counterfactual, 30% of 1982 students would have received As, 37% Bs, 23% Cs, 7% Ds, and 3% Fs.

Overall, in this analysis, changes in characteristics and course choices account for a bit more than half of the increase in average grades over time, and for slightly less than half of the increase in the proportion of students receiving As. Notably, the increased proportion of As assigned is the most difficult to explain using changes in student characteristics and their course choices. This increased propensity to assign A grades, above and beyond predicted by observable covariates by itself would tend to boost overall grades by about 0.11 grade point—most of the residual 'unexplained' component of rising grades.

Of course, in addition to the contributions of student quality and course selection, our findings suggest that a large portion of the increase in grades is "unexplained" and that a relaxation of grading standards may also be an important contributor to rising grades. However, our analysis is unable to assess whether the rigor of course material has changed or whether student effort has changed over time. Evidence suggests that grades have been rising over a period when student inputs, measured by time spent studying, has fallen (Babcock and Marks, 2011).[9]

[9] Appendix 4 provides additional regression results including additional controls and interactions to show that these results are robust to variations in specification.

6. External validity

While the methods used to assess grade inflation implemented above could be applied to data from other schools, an important question is whether the results from this analysis are representative of rising grades at other institutions. There are good reasons to think that they are.

Clemson University is a nationally ranked and well-known university whose average grades have increased at roughly the same pace as selective institutions more generally (as measured in Rojstaczer & Healy, 2010) and which has experienced an increase in the selectivity of its students similar to that at other universities in top institutions since the late 1970s. Caroline Hoxby (2009) shows similarly-ranked institutions (as measured by U.S. News and World Report or average SAT and ACT scores) have tended to become more selective over the relevant time period, as measured by their SAT or ACT scores.

Moreover, most existing research focuses on the most highly ranked and increasingly selective schools. For instance, Johnson (2003) uses data from Duke University; Bar et al. (2009), Cornell University; and Sabot and Wakeman-Linn (1991), Williams College. Even within the 90 institutions included in Rojstaczer's online database (gradeinflation.com) and analyzed in Rojstaczer and Healy (2010), the median rank of institutions is 76 out of more than 1800 institutions evaluated by U.S. News and World Report. (In the 1990s, U.S. News had ranked Clemson in the 70s.) While Clemson falls into the middle of the range of institutions examined by Rojstaczer and Healy (2010), it is less selective than institutions examined by other authors. Hence, similar changes in student quality are occurring at other nationally recognized institutions.

Beyond changes in student quality, it is also likely that changes in course selection have contributed to rising grades at other institutions and at other points in time. Bar et al. (2009) find that course selection contributed to rising grades at Cornell, but do not provide an estimate of changing selection to increases in grades in a longer historical context. During the Vietnam era period at Harvard University, when low grades could cause students to be draft eligible, the share of students concentrating in hard sciences fell by 30%; most of those students shifted to easier-grading humanities concentrations. (See Appendix 6 for more details of this analysis.)

Although Clemson's student body may be changing in different ways than other institutions, and the major composition at Clemson may not be typical, we present evidence of a pattern in student choices that is likely present in other places. In absence of a national sample of detailed student traits, course choices, and earned grades, the magnitudes of the estimates presented cannot be confirmed to be nationally representative. However, this study presents evidence that the nation-wide estimates of grade inflation include information on more than the typical grade earned in a typical course. These measures also capture information on changing course choices and student bodies.

7. Conclusion

This paper applies the empirical methods used in the measurement of price inflation to measure inflation in grades at a large, public university. These methods allow for a decomposition of increases in grades into those components explained by changes in course selection and student characteristics and an unexplained component. The results of this decomposition indicate that changes in the characteristics of the student body and the courses students select can explain a substantial fraction of the rise in average grades from the early 1980s to the early 2000s at one major university in the U.S. The simplest way to interpret the residual rise in grades after controlling for student characteristics and course choices is as grade inflation, in the sense of higher grades for students in the same courses with the same measured aptitude. However, since our analysis cannot control for the difficulty of content within individual courses or for the unobserved effort of students, changes in such factors could also contribute to higher rates of inflation.

The results of the decomposition suggest that an important contributor to rising grades is differences in average grades across departments, which increases enrolment in the higher-grading departments. Such differences in policies across departments may be of particular concern to those concerned about 'grade inflation' not only because of the implications for rising grades (such as dilution of information for employers and students) but also because students use the grade information in their enrolment decisions. As students enroll in the higher grading course—either because they believe they have higher ability in the subject or because they are pursuing the higher grade—they opt against courses that they might be qualified or interested in or which may have greater returns in the labor market.

On the other hand, the fact that changing characteristics of the student body contributed to rising grades suggests that efforts to slow grade inflation could impose unforeseen inequities across students. For instance, a large share of rising grades appears to be due to the fact that schools enroll more women and students with higher SAT scores. Placing a limit on overall GPAs could mean that equally-qualified students doing equal work would need to receive lower grades than peers in previous classes.

Appendix 1. Demographic characteristics of student body compared with nation

In the table below, we compare demographic characteristics of the student body studied in this paper with statistics on students enrolled at 4-year, degree-granting institutions across the country, using data from the National Center for Education Statistics and the College Board. At the school we study, in 2009, men made up about an 11% higher share of the student body than at other 4-year schools. The student body is also less diverse than the national average, with white students comprising about 82% of students, compared with 65% among all 4-year schools. As one would expect from a college that ranks among the top 100 in *U.S. News and World Report's* national college rankings, a much higher-than-average share of the student body is enrolled full time, and entering freshmen earn higher SAT scores than the national average.

	Clemson[a]	Nation[b]
Percent full-time	93.6	78.6
Percent male	54.4	43.8
Race (percentages)		
White	82.2	64.8
Black	7.2	13.7
Hispanic	1.5	9.6
Asian	1.6	6.5
SAT verbal 25th-75th percentile range	550–640	420–580
SAT math 25th-75th percentile range	580–670	430–600

Sources: Common Data Set for the university studied; National Center for Education Statistics' Digest of Education Statistics, 2011, Tables 202 & 238 [http://nces.ed.gov/programs/digest/index.asp]; College Board's 2009 College-Bound Seniors Total Group Profile Report [http://www.clemson.edu/oirweb1/FB/factBook/CommonDataSet2009.html.]

[a] Demographic statistics represent degree-seeking undergraduate students. SAT score ranges represent first-time, first-year degree-seeking students enrolled in Fall 2009.

[b] Demographic statistics represent undergraduates at 4-year degree-granting institutions, except race data, which also includes post-baccalaureate students. SAT score ranges represent 2009 college-bound seniors.

Appendix 5 replicates the analysis using an ordered probit model rather than a linear regression, showing very similar results.

Table 2A
Reasons for observation exclusion.

	Num. of obs. in sample		% of sample with missing:			
School Year	Full	Regression	SAT/ACT Scores	Gender	Age	Race
1982–2001	2443,497	2,195,292	9.9	0.2	0.2	0.7
1982	105,231	93,265	8.0	0.4	0.4	5.4
2001	137,948	126,360	8.5	0.1	0.1	0.1

Table 2B
Summary statistics: full versus regression sample.

School year	1982		2001		1982–2001	
Sample	Full	Reg.	Full	Reg.	Full	Reg.
SAT math	551	552	580	580	565	566
SAT verbal	546	547	561	561	552	553
Male	0.59	0.58	0.55	0.54	0.56	0.55
Age	19.7	19.3	19.8	19.5	20.1	19.6
Grade	2.66	2.65	2.97	2.98	2.81	2.81

Appendix 2. Comparison of full sample with regression sample

The raw data we received from the university contains about 3.1 million course observations. From the outset, we drop observations of graduate courses and observations missing either school year information or grade information, leaving us with a sample of about 2.4 million undergraduate-level course observations.

In the regression sample, we exclude the roughly 10 percent of undergraduate course observations that are missing values for one or more of the control variables. In about 80 percent of these cases, the observations are missing SAT or ACT scores. The SAT and ACT requirement is waived for transfer students who make up the majority of these observations; the remainder is likely graduate students who enroll in undergraduate courses, but who do not have an SAT or ACT score on record. In many cases the observation is also missing information on race, age, or gender. (See Appendix Table 2A.) There is little trend in the availability of most covariates between 1982 and 2001. Race, however, is missing in almost 5 percent of the sample in 1982.

In Appendix Table 2B we compare means for a number of characteristics of the regression sample with means for all observations in the full sample for which data is available. The differences in means between the regression sample and the available data in the full sample are negligible for grades, SAT scores, and gender. The only characteristic for which the regression sample and full sample differ meaningfully is student age: The course-credit-weighted average age of a student in the regression sample is 0.5 years younger than the average in the full 1982–2001 sample.

Appendix 3. How we matched courses over time

Each course offered each year was assigned a department and level that corresponded to the department and level in 2001. For example, the university once had an independent Zoology department offering classes like Zoology 222: Human Anatomy. Today, that course is offered as Biological Sciences 222: Human Anatomy; in our dataset, Zoology 222, and all other Zoology classes, are matched to their equivalents in the Biological Sciences department throughout the sample period. As another example, the Structural Steel Design course had the number 302 in the Civil Engineering department in 1985 but later became Civil Engineering 406; we assign it to the permanent label of a 400-level Civil Engineering class throughout the sample. Using this technique, we are able to match 97% of courses in 1985 to a department and level that exist in 2001. This means we are able to closely track the evolution of grades within narrowly defined departments and course levels over the entire 20-year period. However, the ability to exactly match individual courses over time within departments is more challenging given how departmental offerings change and course descriptions evolve over time. Many courses remain exactly the same or almost the same over time. For instance, in 1985, Accounting 200, or Basic Accounting, is described as “a general survey of accounting for the student requiring only a basic knowledge of principles and concepts,” while in 2001, the same course is described as a “general survey of accounting for students requiring only a basic knowledge of principles and concepts.” However, some classes and departments evolve more significantly, so the matching process necessarily is more subjective. We provide some examples below drawn from historical course catalogs that illustrate some of these challenges and how they were addressed. To refine the matching based on the course catalogs, we also looked directly at the enrollment data to see if there are sudden changes in enrollments from year to year within departments and courses to check for unusual patterns and to improve our matching process.

Example: Chemical engineering

The left panel provides the course titles and descriptions from the 1985–1986 course guide; the right panel provides the same material from the 2001 course guide. For certain classes (e.g. Introduction to Chemical Engineering) the title and description match perfectly. In other cases, for example Unit Operations Theory I in 1985 and Fluid Flow in 2001, the match is more subjective and the match is made based on the sequence of classes and the similarity of the course description.

Chemical Engineering, 1985

201 Introduction to Chemical Engineering 3(2,2) An introduction to the concepts of chemical engineering and a study of PVT relations for gases and vapors, material and energy balances, equilibria in chemical systems, and combined material and energy balances. *Preq:* CH 112, ENGR 180.

220, H220 Chemical Engineering Thermodynamics I 3(3,0) A first basic course in static equilibria. Topics include the first and second laws of thermodynamics, real and ideal gases, thermodynamic properties of fluids, phase changes, and heats of reaction . *Preq:* CHE 201 and MTHSC 206

301 Unit Operations Theory I 3(3,0) The general principles of chemical engineering and a study of the following unit operations: Fluid Flow, Fluid Transportation, Heat Transmission and Evaporation. Special emphasis is placed on theory and its practical application to design. *Preq:* CHE 201, MTHSC 206.

302 Unit Operations Theory II 3(3,0) A study of selected unit operations based on diffusional phenomena. Primary attention will be given to differential contact operations such as absorption, humidification, and gas-liquid contact. *Preq:* CHE 301, 352.

306 Unit Operations Laboratory I 2(1,3) Laboratory work in the unit operations of fluid flow, heat transfer, and evaporation. Stress is laid on the relation between theory and experimental results and on report writing. *Preq:* CHE 301.

Chemical Engineering, 2001

211 Introduction to Chemical Engineering 4(3,2) Introduction to fundamental concepts of chemical engineering, including mass and energy balances, PVT relationships for gases and vapors, and elementary phase equilibria; problem-solving and computer skills are developed in lab. *Preq:* CH 102; ENGR 120, PHYS 122.

220 Chemical Engineering Thermodynamics I 3(3,0) Topics include first and second laws of thermodynamics, ideal gases, PVT properties of real fluids, energy balances with chemical reactions, and thermodynamic properties of real fluids. *Preq:* CH E 211 and MTHSC 206.

307 Unit Operations Laboratory I 3(2,3) [O.1] [W.1] Laboratory work in the unit operations of fluid flow, heat transfer, and evaporation. Stress is on the relation between theory and experimental results and the statistical interpretation of those results and on report preparation and presentation. *Preq:* CH E 311, E G 209. *Coreq:* EX ST 411 or MTHSC 302.

311 Fluid Flow 3(3,0) Fundamentals of fluid flow and the application of theory to chemical engineering unit operations, such as pumps, compressors, and fluidization. *Preq:* CH E 211, MTHSC 206.

312 Heat and Mass Transfer 3(3,0) Study of the basics of heat transmission and mass transport. Special emphasis is placed on theory and its application to design. *Preq:* CH E 220, 311.

Selected additional course match examples

1985 course	2001 course
Accounting 405: Corporate taxation tax planning and research. Income taxation with emphasis on special problems applicable to corporations, partnerships, estates, and trusts. *Preq:* Junior standing.	**Accounting 406: Business taxation:** Provides an introduction to the importance of taxation in business decision making; emphasizes the interrelationship of taxes, the choice of business form, and various business transactions; exposes students to the breadth of business decisions which are affected by the Federal Income Tax. *Preq:* A grade of C or better in ACCT 301.
Computer science 120: Introduction to information processing systems: Introduction to the techniques, principles and concepts of modern information processing systems, intended primarily for nontechnical majors. Topics include information processing packages and application, usage of typical information processing packages, digital computers, programming fundamentals and languages, and implementation of computer programs.	**Computer science 120: Introduction to information technology:** Investigation of ethical and societal issues based on the expanding integration of computers into our everyday lives. Historical background, terminology, new technologies and the projected future of computers are considered. Practical experience with common computer software technologies is included. Will not satisfy computer science requirements in any computer science major.
Political science 422: Public policy analysis: Selected views of public administration and the problems involved. *Preq:* POSC 101 or consent of instructor.	**Political science 421: Public policy processes:** Introduction to public policy process, analysis, and evaluation. Topics include examination and comparison of policymaking models, policy analysis and decision-making techniques, and approaches to program evaluation. *Preq:* PO SC 101, Junior standing, or consent of instructor.
Zoology 201: Invertebrate zoology: A survey of the phyla of invertebrate animals, including their taxonomy, morphology, development, and evolution. *Preq:* BIOL 111 or consent of instructor.	**Biological sciences 302: Invertebrate biology:** In-depth survey and comparison of free-living invertebrate animals emphasizing functional anatomy, development, and evolutionary relationships. *Preq:* Introductory two-semester biology sequence with laboratory. *Coreq:* BIOSC 306.

Table A4
Alternative specifications and sample selections.

Covariate	(1)	(2)	(3)	(4)	(5)	(6)
1982	2.65	2.65	2.65	2.65	2.59	2.59
1983	2.66	2.66	2.67	2.66	2.62	2.61
1984	2.69	2.69	2.69	2.69	2.64	2.63
1985	2.66	2.67	2.66	2.66	2.62	2.59
1986	2.66	2.67	2.66	2.65	2.62	2.58
1987	2.68	2.68	2.68	2.66	2.65	2.60
1988	2.68	2.69	2.68	2.67	2.67	2.61
1989	2.67	2.69	2.67	2.66	2.67	2.60
1990	2.70	2.71	2.70	2.68	2.70	2.61
1991	2.71	2.72	2.71	2.70	2.72	2.64
1992	2.72	2.73	2.72	2.71	2.76	2.66
1993	2.73	2.74	2.73	2.72	2.76	2.66
1994	2.72	2.73	2.72	2.71	2.76	2.64
1995	2.73	2.75	2.73	2.72	2.79	2.66
1996	2.73	2.75	2.73	2.71	2.79	2.66
1997	2.73	2.74	2.73	2.70	2.80	2.65
1998	2.77	2.78	2.77	2.74	2.84	2.70
1999	2.76	2.78	2.76	2.74	2.83	2.69
2000	2.78	2.80	2.78	2.76	2.86	2.71
2001	2.81	2.83	2.81	2.79	2.91	2.74
SAT math percentile	0.009	0.009	0.009	0.009		0.011
	0.0001	*0.0001*	*0.0002*	*0.0001*		*0.0001*
SAT verbal percentile	0.005	0.005	0.006	0.005		0.005
	0.0001	*0.0001*	*0.0002*	*0.0001*		*0.0001*
Male * SAT math			0.0003			
			0.0003			
Male * SAT female			−0.0009			
			0.0002			
Male	−0.25	−0.23	−0.20	−0.24		−0.26
	0.004	*0.004*	*0.016*	*0.005*		*0.005*
Age	0.02	0.02	0.02	0.02		0.02
	0.001	*0.001*	*0.001*	*0.001*		*0.001*
Class size		−0.007				
		0.0004				
Course load		0.02				
		0.0004				
Race FEs‘	Yes	Yes	Yes	Yes		Yes
Department & level FEs	Yes	Yes				
Class FEs				Yes		Yes
Always offered sample					Yes	Yes
Observations	2258,543	2258,543	2258,543	2258,543	1476,547	1476,547
R-squared	0.897	0.898	0.897	0.902	0.865	0.891

Standard errors in italics.

Appendix 4. Robustness to alternative controls and sample restrictions

This section provides additional regression results assessing the robustness of the results in the main text to alternative controls and sample selection. These alternative specifications are presented in Appendix Table A4 below.

Column 1: For comparison, the first column presents the primary specification in column 3 of Table 3 in the main text.

Column 2: Class size and course load controls This column adds additional controls for class size (the number of students in each class each semester reported in hundreds of students) and the course load on each student (the number of course credits attempted by each student in each semester). The coefficient on class size is negative, implying that larger classes assign lower grades, but the coefficient is small in magnitude, suggesting that a 100 person increase in class size reduces the average grade by 0.007 grade points. A one-credit increase in course load, meanwhile, is associated with a 0.02-point higher course grade. Largely because average course load decreased slightly over the sample period, controlling for these variables actually makes the remaining time trend slightly larger: The coefficient on the 2001 dummy is almost 0.02 higher with a course load control included that without. It is unclear how to interpret the course load control, since it seems unlikely that a heavier course load would, in itself, lead to a student to earn higher grades. What seems more likely is that the course load control is capturing some unobserved component of student ability.

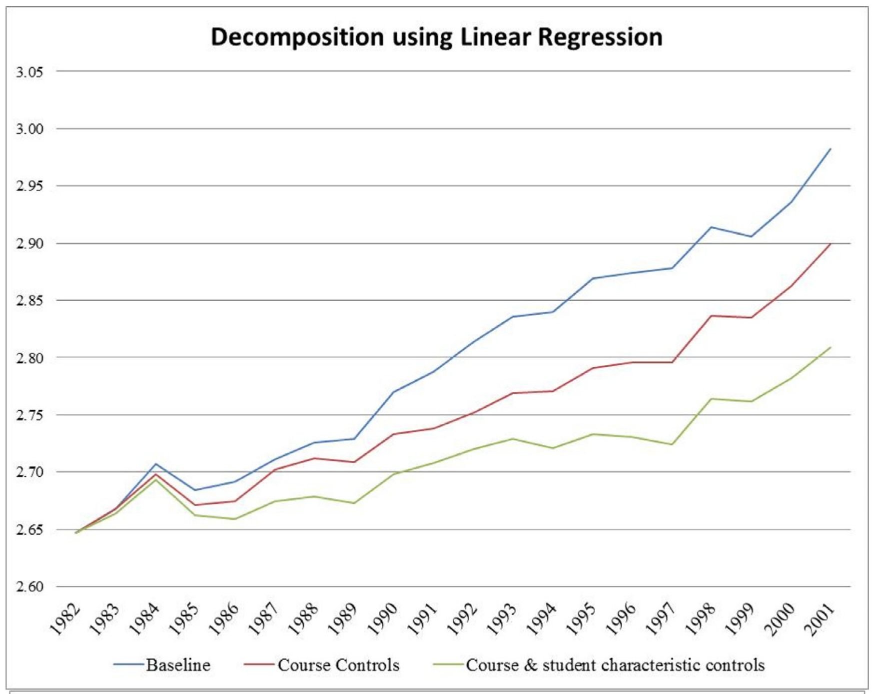
Column 3: Gender X SAT score effects. One potential concern is that the increase in female enrolment was concentrated among lower-scoring individuals, or reduced the share of higher-scoring male students. We find no evidence of such effects. Column 3 includes additional SAT percentile score X male effects. Those coefficients are small in magnitude and either not statistically significant (for math) or marginally significant (for verbal). The addition of these covariates has little effect on the year dummy variables.

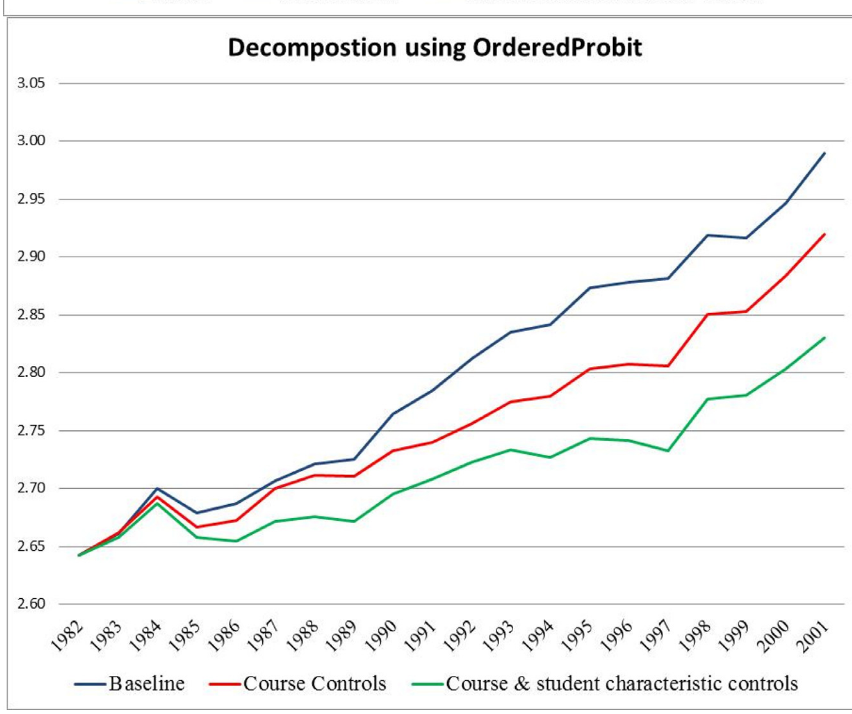
Column 4, 5, 6: Individual class controls and balanced panel of classes. We test the robustness of the department and course-level fixed effects in the baseline model by replacing these controls with a set of fixed effects for individual courses. Column 4 repeats the primary regression replacing the department and course-level fixed effects with fixed effects for individual courses. These course-level controls have little effect on the year dummy variables.

Many courses are not observed for all years within the sample period. (Courses may be missing either simply because they are introduced or cancelled at some point between 1982 and 2001 or because they changed department or number but were not matched to their new department or number due to any imperfections in our matching process.) In column 5, we restrict the sample only to a balanced panel of courses that are offered through the sample period from 1982 to 2001. Roughly 35% of course grade observations are excluded from this balanced sample. The results in column 5 show that within this sample, the overall increase in grades—roughly 0.32 grade points—is very similar to the overall increase in the sample at large. Moreover, in column 6, which replicates the specification in column 4 (the primary specification including exact class fixed effects), the residual increase in grades, as measured by the coefficients on the year dummy variables, is reduced substantially. In fact, the proportion of the overall increase in grades within this restricted sample that is 'explained' by changes in course selection and student characteristics, is 56 percent about the same as is explained within the full sample.

Appendix 5. Ordered probit

This appendix replicates the analysis presented in Fig. 1 (and the regression specifications in Table 3) using an ordered probit model rather than linear regression. The first figure below presents the original Fig. 1. The second figure presents the same analysis using an ordered probit. The results are very similar. Because the linear regression model provides a simple and transparent means to assess how changes in covariates affect mean grades, we continue to rely on the regression analysis in the main text.



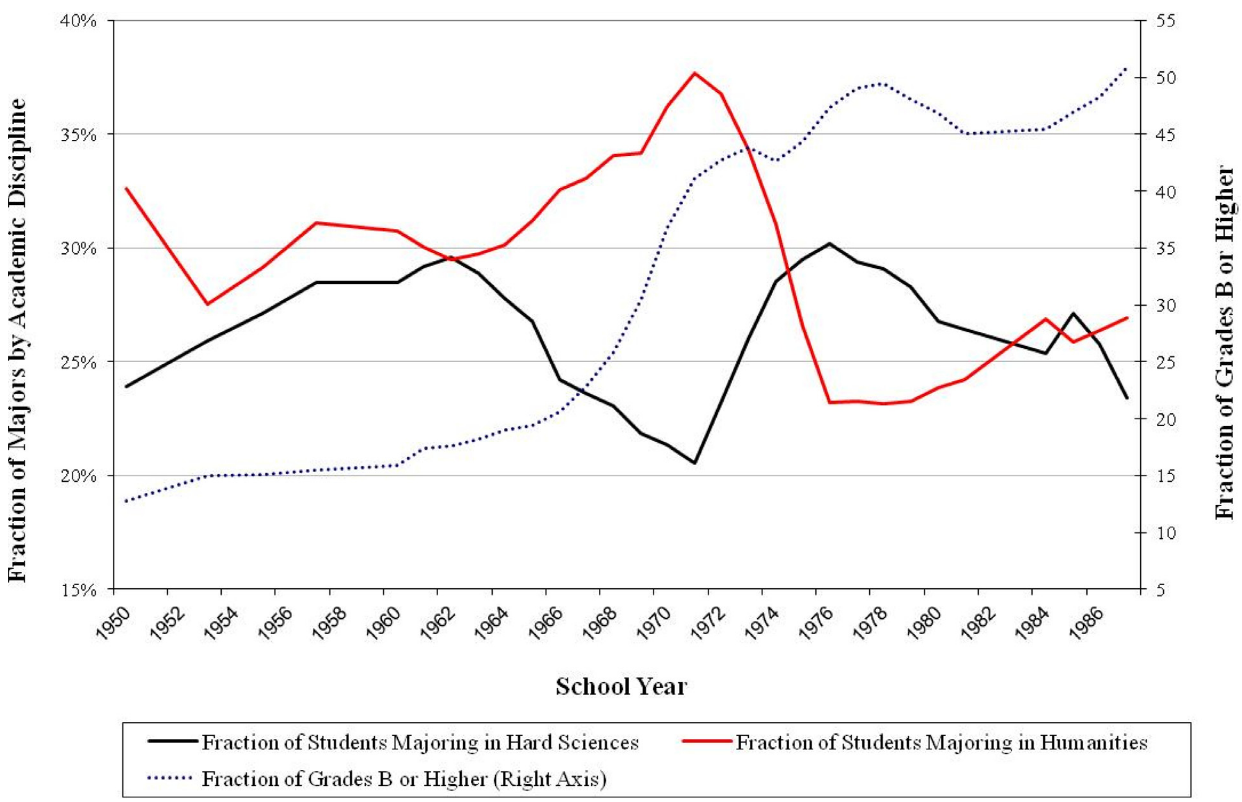


Appendix 6. Rising grades and changing enrollment at Harvard University

Though the bulk of the analysis in this paper is devoted to the analysis of student-level data, this appendix provides evidence from Harvard College that is consistent with evidence that changes in course choice contributed to rising grades. The well-documented increase in average grades that occurred at Harvard in the late 1960s and early 1970s was accompanied by a swift decline in the number of students who majored in the hard sciences with a corresponding increase in the number majoring in the humanities. At the same time these students found new course offerings in humanities and social sciences in part because of the creation of thirteen new departments. (Indeed, as this shift unwound after the Vietnam War grades declined, albeit not to their earlier levels.)

As seen in the figure below, the share of students graduating with degrees in hard sciences decreased by 10 percentage points—almost 30%—while degrees in humanities increased more than 7 percentage points (social sciences make up the remainder). At the same time, average grades increased, suggesting that the change in enrollment pattern was associated with rising grades as one expects given that humanities have historically been easier-grading departments. Indeed, after 1972, as enrollments began to reverse, average grades declined slightly. (However, they remained above the level of the early 1960s, suggesting that course choice could explain only part of the increase.) The number of academic departments also increased rapidly, from 32 in 1963 to 46 in 1975, with most of the increase between 1966 and 1972. Most of these new departments were in the humanities. Hence, students faced increased choices of departmental offerings—often in easier-grading fields—at exactly the same time they were presented with increased incentives to raise their grades in order to defer their draft eligibility.

Grade Inflation and Departmental Choices at Harvard University



Note: Graph illustrates fraction of students majoring (or "concentrating") in hard sciences (the black line) and humanities (the red line) each school year and the fraction of grades assigned each year that were either As or Bs ("group I and II".) Source: Harvard College. "Report of the President of Harvard College and Reports of Departments." Various years.

This change in the distribution of departments and class enrollment may have been an important driver of average grades during the Vietnam War, and would have been caused by changes in students' behavior rather than a relaxation of grading standards. Although the magnitude of the increase in grades is unlikely to be explained entirely by the shift in course selection, it is plausible that it made up a meaningful component of the increase.

Harvard College. "Report of the President of Harvard College and Reports of Departments." Various years.

References

Achen, A. C., & Courant, P. N. (2009). What are grades made of? *Journal of Economic Perspectives, 23*(3), 77–92.

Babcock, P. (2010). Real costs of nominal grade inflation? New evidence from student course evaluations. *Economic Inquiry, 48*(4), 983–996.

Babcock, P., & Marks, M. (2011). The falling time cost of college: evidence from half a century of time use data. *Review of Economics and Statistics, 93*(2), 468–478.

Bar, T., Kadiyali, V., & Zussman, A. (2009). Grade information and grade inflation: The cornell experiment. *Journal of Economic Perspectives, 23*(3), 93–108.

Chan, W., Hao, L., & Suen, W. (2007). A signaling theory of grade inflation. *International Economic Review, 48*(3), 1065–1090.

College Board. (2012). *SAT equivalence tables* [http://professionals.collegeboard.com/data-reports-research/sat/equivalence-tables].

De Witte, K., Geys, B., & Solondz, C. (2014). Public expenditures, educational outcomes and grade inflation: Theory and evidence from a policy intervention in the Netherlands. *Economics of Education Review, 40*, 152–166.

DiNardo, J. (2002). *Propensity score reweighting and changes in wage distributions*. University of Michigan Unpublished Manuscript.

DiNardo, J., Fortin, N., & Lemieux, T. (1996). Labor market institutions and the distribution of wages, 1973-1992: A semiparametric approach. *Econometrica, 64*(5), 1001–1044.

Dunn, W., Doms, M., Oliner, S., & Sichel, D. (2004). *How fast do personal computers depreciate? concepts and new estimates* NBER Working Paper 10521.

Fortin, N., Lemieux, T., & Firpo, S. (2011). Decomposition methods in economics. *Handbook of* labor economics, *4*(4).

Griliches, Z. (Ed.). (1971). *Price indexes and quality change*. Cambridge, Mass.: Harvard Univ. Press.

Hernández-Julián, R. (2010). Merit-based scholarships and student effort. *Education Finance and Policy, 5*(1), 14–35.

Hoxby, C. M. (2009). The changing selectivity of American colleges. *Journal of Economic Perspectives, American Economic Association, 23*(4), 95–118.

Johnson, V. (2003). *Grade inflation: A crisis in college education*. New York: Springer Marklein, Mary Beth. 2002. "A call for an end to grade inflation." *USA Today*, February 5. [http://www.usatoday.com/life/health/2002-02-05-grade-inflation.htm].

Rojstaczer, S. (2016). *Grade Inflation at American Colleges and Universities*. www.gradeinflation.com. Accessed November 4, 2016.

Rojstaczer, S., & Healy, C. (2010). *Grading in American colleges and universities* Teachers College Record.

Rojstaczer, S., & Healy, C. (2012). *Grading in American colleges and universities* Teachers College Record.

Rosovsky, Henry, & Harley, M. (2002). Evaluation and the academy: Are we doing the right thing? *American Academy of Arts and Sciences*.

Sabot, R., & Wakeman-Linn, J. (1991). Grade inflation and course choice. *Journal of Economic Perspectives, 5*(1), 159–170.

Tampieri, A. (2011). *Grade inflation, students' social background, and string-pulling* Quaderni DSE Working Paper no. 801.

Triplett, J. (2004). *Handbook on hedonic indexes and quality adjustments in price indexes: Special application to information technology products* STI working paper 2004/9.

U.S. Department of Education, National Center for Education Statistics. (2011). *Digest of education statistics* 2010 (NCES 2011-015), Chapter 3.

Wikström, C., & Wikström, M. (2005). Grade Inflation and school competition: An empirical analysis based on the Swedish upper secondary schools. *Economics of Education Review, 24*(3), 309–322.

Wößmann, L. (2003). Schooling resources educational institutions, and student performance: The international evidence. *Oxford Bulletin in Economics and Statistics, 65*(2), 117–170.