Minimum Grade Requirements for Economics Majors:

Effects on Enrollments and Student Learning

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Abstract: Many economics departments have adopted requirements that majors must achieve minimum grades, above the passing standard, in core classes in order to complete the major. These requirements provide students with an incentive to work harder and learn more in the classes with the requirements, but may also discourage students from pursuing the major. The latter may be helpful at departments that are being pushed beyond their capacity for teaching majors by recent increases in economics enrollments. This paper studies the adoption of such a policy at one college, looking at data on enrollments and grades in a ten year window, five years before and five years after the change of policy. The policy reduced the number of majors in the department by approximately 6%. This slowed the growth in majors in the department but did not eliminate it. The resulting reduction in enrollments was equivalent to approximately one-third of a full-time faculty member's teaching load. The fraction of grades of C- and D (which required a student to retake the course or change majors) dropped substantially after the implementation of the policy, while the fraction of grades of C (the minimum acceptable grade) did not change and the fraction of grades in the C+ to B range rose. A difference-in-differences analysis comparing these changes to grade changes in courses not part of the minimum grade requirement suggests that the policy was the cause of the shift in grades. Because C grades did not change and grades above that, as high as B, did increase, I conclude that the policy most likely worked by increasing effort by students who were both below and somewhat above the minimum performance standard, and not by causing professors to assign the minimum acceptable grade to avoid making students retake. The findings come from one school only, but to the extent that they might generalize to other schools, they suggest that minimum grade policies can increase student learning in core classes while inducing a small but not trivial reduction in demand for economics enrollments.

After declining during the Great Recession, the number of economics majors has resumed rising, both in absolute numbers and as a share of all degrees awarded. According to IPEDS completion data and the 2017 Digest of Education Statistics, the number of economics bachelor's degrees awarded rose from 27,994 in 2011-12 to 34,124 in 2016-17, an increase of 21.9% over five years, and from 1.56% of all bachelor's degrees awarded to 1.74%, an increase of 11.7% of the initial value. The rise has been greater at some schools than others. For example, Brown University saw a rise of 48.9% in concentrators in economics and math-economics between 2008 and 2013, though several other Ivy League schools saw little or no increase over the same years (Roose 2013).

This increase in majors has strained the ability of some colleges and universities to offer seats in economics courses to all students who want them (Sachs 2013). In response, many schools are adopting policies to decrease the number of students that major in economics. A survey of major requirements at top liberal arts colleges showed that 15 out of 32 colleges examined had some sort of policy limiting access to the economics major.[1] One of those schools requires students to apply to the economics major, and has an explicit cap on the number of students they will accept in each class. Most of the rest required economics majors to achieve minimum grades (higher than the lowest passing grade) in introductory courses or intermediate core courses, or both, in order to complete the major. Some universities with high demand for the economics major also have similar policies, such as the University of California at Berkeley, UCLA, Penn State, University of Massachusetts at Boston, and Florida State University, among many others.

Little is known about the effects of these policies, either how they change the number of economics majors or how they change student behavior within the major. For example, students who must receive

[1] This survey was conducted by the author and Eshragh Motahar as part of an external review of the department studied. Details are available on request. I thank Prof. Motahar for all of his excellent work on the survey.

a minimum grade of C in a core course might study harder to be sure of receiving at least a C grade, and hence might learn more than would be the case if the student could continue in the economics major with a grade of C- or D. There has been past research on how to increase the number of students majoring in economics, in response to earlier declines in the number of majors (e.g., Okoye 2011) but not as much on how to keep the number of majors within the capacity limits of individual departments.

In this article, I report on the experience of the economics department at one liberal arts college that implemented a minimum grade policy to reduce the pressure being placed on the department's capacity for majors. In 2013, this department adopted a requirement that students must have minimum grades of at least C in each of three core theory courses – intermediate microeconomics, intermediate macroeconomics, and econometrics – to complete the economics major. Students who receive a lower grade may retake each course once; if they do not achieve a C or better the second time, they cannot major in economics. The department adopted this policy because a sharp rise in the number of majors threatened to overwhelm the department's resources. In particular, nearly all courses in the department were enrolled at or over capacity, and many students could not get seats in the core courses.

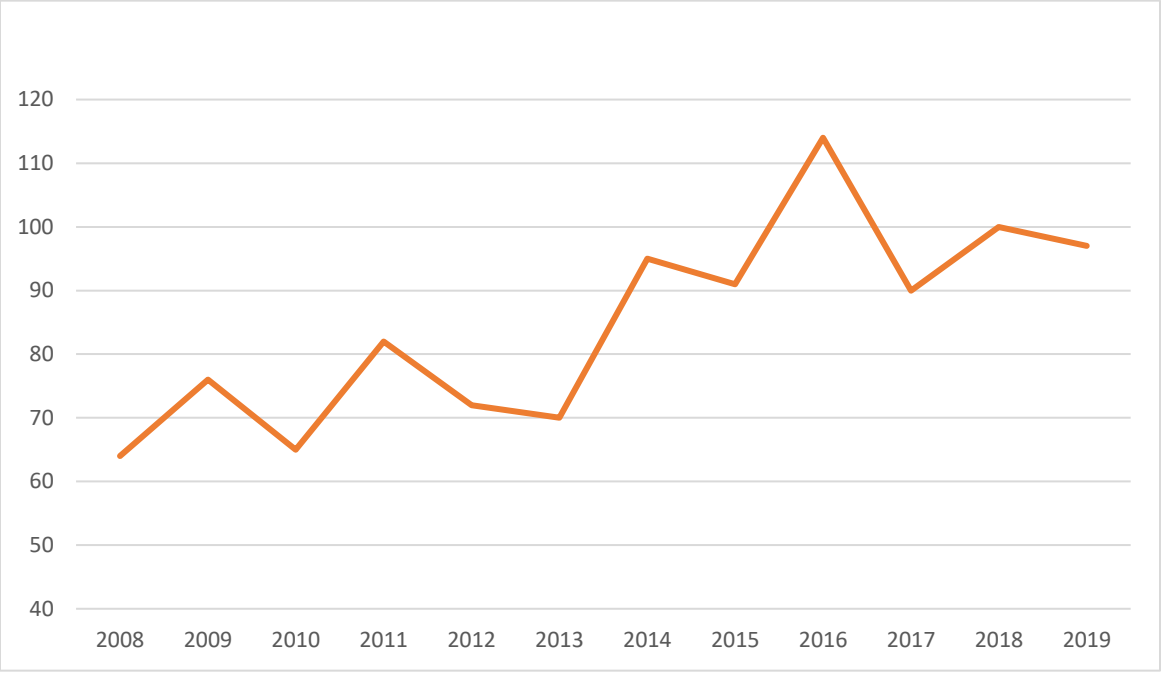
To evaluate the effects of the policy, I examine data on individual student enrollments and grades given in economics courses in the five years prior to the policy change and the five years after the policy change. These data allow me to count students who had to retake one or more core courses, and see whether they decide to retake a core course, and if they did, whether they succeeded, and whether they went on to become an economics major or not. I find that the policy reduced the number of majors by approximately 6 majors per year, which is slightly over 6% of the total number of majors. The large majority of students who retook a core course received a grade of C or higher and were able to continue through the major; despite this, the majority of students who received low grades chose not to retake. This suggests that students were able to evaluate their individual chances of success if they retook, based on their private knowledge about the reasons for their low performance in their first attempt.

Those students with a high probability of successful completion retook; those with low probabilities found other majors. In addition, using a simple differences-in-differences estimation, I find that students received significantly fewer grades of C- and D, and significantly more grades of B and C+. The increase in B grades, and the lack of change in C grades, suggests (though it does not prove) that the change was driven by greater student effort both above and below the C cutoff grade, rather than by a change in grading standards that gave marginal students the lowest acceptable grade, instead of a grade that would require them to retake the course.

The Core Course Grade Policy

In academic year 2011-12, the department had a sharp increase in demand for sophomore-level classes. The number of majors, which had historically been around 65-70 majors per year, rose to 95 in the class of 2014 and has subsequently averaged 97 majors per year (see Figure 1). It became difficult

Figure 1: Economics majors, classes of 2008-2019



for students to enroll in required intermediate level classes, and the department could not offer more sections of those classes because all other classes were also full to capacity. Students who were unable to enroll in required core classes were falling behind in progress through the major. More students wanted to sign up for economics classes than the department could accommodate with the number of faculty and acceptable class size limits, and the administration was not able to add enough faculty to the department to accommodate the increase.

The members of the department reasoned that if it had to deny access to the major to some students because of capacity limits, it was most appropriate to turn away students who had poor performance in early classes, who might learn more in a different major.[2] In addition, raising the average level of mastery of core material would create a better learning environment in upper level classes. Accordingly, the department created a requirement that students must achieve grades of C in each of three core classes – intermediate microeconomics and macroeconomics, and econometrics – in order to continue in the major. The policy applied to students with interdepartmental majors with economics as one half as well as to full majors. However, it did not apply to minors, who could still complete the minor with a grade of C- or D in a core course. Students that received a grade of C-, D, or F in one of those three courses could retake that course only once, and if they did not receive a grade of C or better, could not enroll a third time and hence could not complete economics major requirements. Students who withdrew from a class prior to the withdrawal deadline were not subject to the limits on retaking

[2] Students of economics might well ask why students who could learn more in a different major would choose to major in economics. Wouldn't a student's choice of major reveal her optimal major? One possible answer is that students lack complete information about the relationship between major, grade point average, and career prospects, and hence might not choose their best option. In particular, some students may feel that they "need" to major in economics, even if they got very low grades, in order to have access to certain careers, when in fact their career prospects could be better if they performed better in a different major.

classes, since a withdrawal might be due to personal circumstances or other factors not related to the student's ability in economics.[3] This policy took effect in fall 2013.

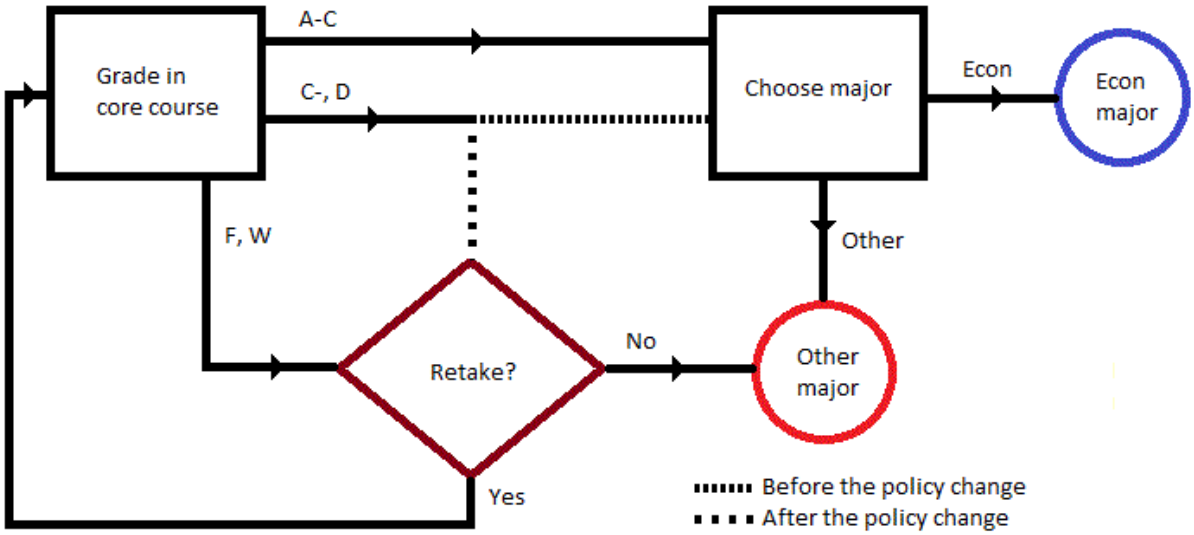
In fall 2018, the department evaluated the effects of the policy, looking at enrollments and grades given between fall 2008 and spring 2018 – five years before the policy change and five years after. It asked whether the policy was having the effect of reducing majors, and if so, by how much. It also asked how many students were retaking core courses (and hence increasing demand for enrollments) and whether the gain in reduced demand justified the cost of the retakes. It also asked how grade distributions in the core classes changed when the requirement was in place. Such changes might be due to changes in faculty grading standards, allowing students to receive C grades who under the earlier rules would have received C- or possibly D grades. This would undercut the purpose of the policy and inflate grades in the core courses. Alternatively, such changes might be due to increased student effort in order to learn the material well enough to be sure of receiving at least a C grade in the course, which would be very desirable but would also work against reductions in the number of economics majors.

Effects of the Policy on Number of Majors

Figure 2 shows how the policy changed student decisions about enrolling in core courses and completing the economics major. Students receive grades in each of the three core courses. Both before and after the policy change, a student who received a grade of C or better was able to major in economics if she chose, and a student who received a grade of F, or withdrew, had to retake the class in order to major in economics. The policy changed only the options of students who received grades of

[3] This could be used as a loophole; students anticipating a C- or D on the second attempt might withdraw in order to take a third attempt. However, only two students did so, and they may have had non-academic reasons for their withdrawals.

Figure 2: Student major decisions before and after the policy change



C- or D in one (or more) of the core courses. Prior to the policy change, they were like students who had received grades of C or better, and had the option of majoring in economics without retaking. After the policy change, they were like students who had received grades of F or withdrawn, and had to retake the course to major in economics. The department wanted to know how many of those students used to option to retake and how many chose to switch majors rather than try again. It also wanted to know how many of the retaking students got a grade of C or better on their second attempt and went on to major in economics; and how many either did not get a grade of C or better the second time and were forced out of the major, or got a successful grade the second time but nonetheless chose to major in something other than economics.

Table 1 shows the number of students following these paths, both before and after the policy change Between fall 2008 and spring 2013, prior to the policy taking effect, 183 students received grades of C- or D in the core classes. They went to 145 different students; 24 students received these grades in two core courses and 7 received these grades in all three. Of these 145 students, 99 of them (68.3%) chose

Figure 2: Student major decisions before and after the policy change

	Before	After
Students receiving C- or D grades	145	33
Majored without retaking	99	-
Retook, succeeded, and majored	-	5
Retook, succeeded, but did not major	-	3
Retook and did not succeed	-	3
Did not major	46	22

to major in economics and 46 of them (32.7%) did not. Some of these students minored in economics, and a few did not graduate from the college at all.

Students who entered the college after the policy took effect, in the graduating classes of 2018 and later, received 41 grades of C- or D in the core classes. They went to 33 different students, of whom 6 got low grades in two courses and 1 in all three. Of those 33 students, 5 (15.2%) successfully retook the course (or courses in one case) and completed the economics major. The other 28 (84.8%) did not; 22 of them did not retake the course, 3 did not get a C or better on the second attempt, and 3 successfully retook but did not graduate with a major in economics. If these 33 students had continued in the economics major without retaking, as they could have done prior to the policy change, they would have produced 22 economics majors (68.3% of 33) if they had majored in economics at the same rate as students who received the same grades prior to the change. Students who got grade of C- or D after the policy change were not selected by the same mechanism that selected them before the change, so the fraction of the two groups of majoring in economics might not be identical. However, the difference of 17 majors (22 who would have majored under the old policy and 5 who did under the new policy) is a reasonable estimate of the number of students who were discouraged from majoring in economics by the policy. Thus, the policy discouraged an average of about 6 majors per year. The number of majors in the department rose anyway, but not by as much as it would have risen if the policy had not been in

place.

The Number of Retaken Courses and Results

As noted above, 41 grades of C- or D were given in core courses to students bound by the policy change. The 33 students who received them had to retake those courses if they wanted to major in economics, some more than once. Only 11 of those students did so. Of the 11 retakes, 8 resulted in grades of C or better, for a success rate of 72.7%; the large majority of the retakes were successful and most of the retaking students went on to major in economics.

However, students who needed to retake did so in only one-third of the cases. The majority of students decided against retaking even though students who did retake usually succeeded. Why would this be the case? A few may have never intended to be economics majors – they might have been intending only to minor in economics and hence not needed to retake, or they may have been taking the class for reasons having nothing to do with major or minor plans. But the large majority of them, either based on a declared major or on information given when requesting enrollment in the core course, were at least considering being economics majors. We can explain these two facts if we assume that students have private information about the reasons for getting a C- or D in a core course on their first attempt. If so, then a minority of students who got a low grade for reason other than lack of ability, and believe they are likely to get a C or better in a second attempt, will retake and mostly succeed, whereas the majority of students who believe they are unlikely to succeed will not retake and will switch majors. If so, then the retake policy is doing a reasonably successful job of distinguishing between students who get low grades but have the ability to do better in a second attempt, and those who do not have that ability and would perhaps be better off in another major.

The cost of offering the retakes is very low; only about 4 students per year retake a core course. There is a net reduction in demand for economics class, since the 6 students per year who drop out of the major as a result of the policy would have produced many more enrollments than 4 if they had continued in the major. The average student who drops of out the major has taken 5.5 economics courses; they would have to take at least 6.5 courses more to complete the major, and some would do more. The net savings in enrollments per year is thus at least 39 courses from students who drop the major, less 4 enrollments for retakes, for a net savings of at least 35 enrollments.[4] This is about one-third of a typical professor's enrollment load. Thus, the policy is reducing the enrollment burden on the department by a significant though not extremely large amount.

Effect of the Policy on Grades

The minimum grade policy could have changed grades in the core courses in at least two ways. First, it might have change faculty grading; faculty might have given grades of C to students, so that they could continue in the major, who would otherwise have received grades of C- or D. Second, students who intend to major in economics, knowing they need to get a C and not a C- or D, might put more effort into the course to increase the chance of receiving a sufficient grade.[5] It is easy to compute the change in the grade distribution between the two periods; but this change may not be due to the policy. Other factors may have changed grade distributions besides the policy that are different between the two periods.

In order to address this policy, I use a differences-in-differences technique, comparing the change in the grade distribution in the three core courses to the change in the grade distribution in introductory

[4] This may be slightly offset if students who do not retake complete the economics minor; however, since the minor only requires six courses and these students have already taken an average of 5.5 courses, those who minor in economics will add only a few more enrollments.

[5] There are other possibilities, such as the possibility that the policy discouraged weak students from even considering economics as a major to begin with. However, these other possibilities seem likely to have relatively small effects, and so the analysis concentrated on the two possibilities discussed in the text.

economics in the same time periods.[6] Whatever broader trends are affecting grading at the college or in the department would hopefully have similar effects on grades in both courses. If the fraction of grades at a given level have changed by more in the core courses than they have in introductory economics, then it is more likely to be the case that the policy change caused the change in grades.

Figure 3 shows the changes in grade distributions over the periods in each type of course. The percentage of grades of C- or D dropped sharply in the core courses after fall 2013; before the policy change 10.5% of grades had been C- or D, while afterwards only 5.0% were. Grades of C were essentially unchanged, 10.5% before the change and 10.6% afterward. There was a small increase in grades of C+ and a larger increase in grades of B- and B. There was little change in grades of F or withdrawal; in particular, the reduction in grades of C- and D was not caused by students withdrawing from the course to avoid receiving those grades. In contrast, in introductory economics grades of C- and D changed only slightly; from 9.3% before the policy change to 9.1% after, with a small shift towards more Ds and fewer C- after. Higher grades were generally unchanged except for an increase in grades of B-. Whatever caused the reduction in low grades in the core courses in the later time period, it was something that did not have any effect on grades in the introductory courses.[7]

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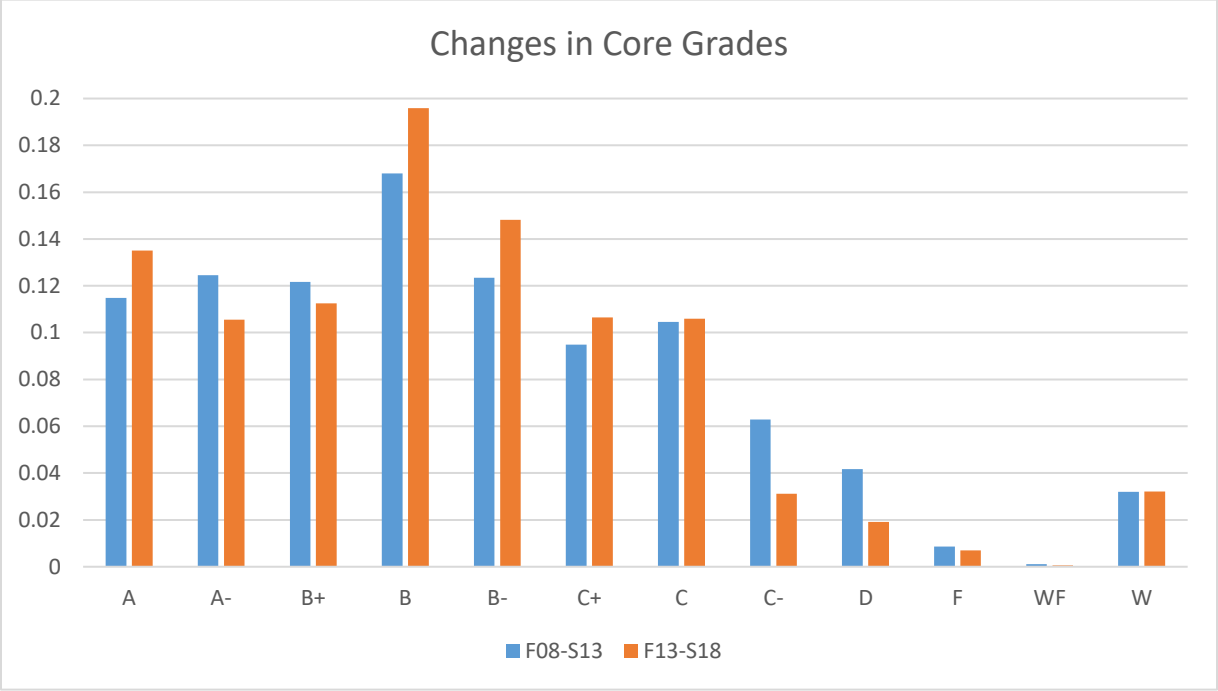
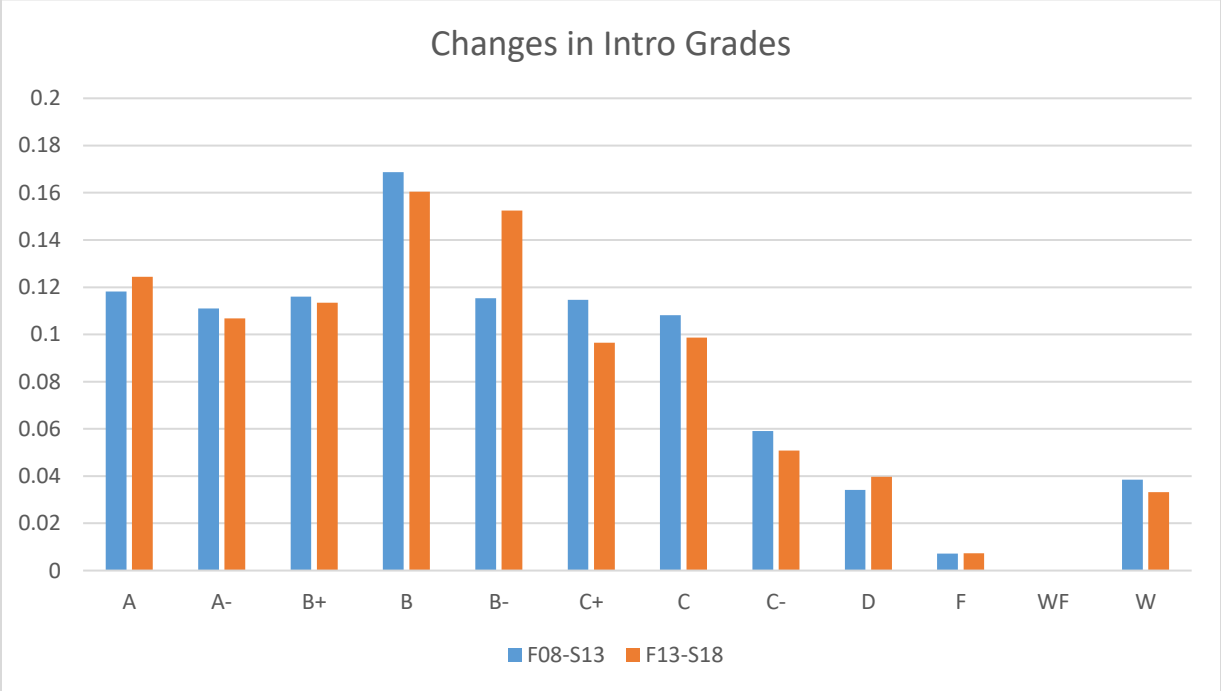
[6] I have also done a differences-in-differences using lower-level electives (courses with only introductory economics as a prerequisite), rather than introductory economics, as the control group. The results are broadly similar, and the conclusions about the core policy are the same, but the numerical results differ somewhat due to a change in the department that affected the number of As given in 200-level electives (which changed fairly sharply over the period in 200-level electives and not in any other type of course). For that reason, I show only the results using introductory economics as the control group here. I have also done the tests including faculty member fixed effects, to ensure that changes in the mix of professors is not causing the results. The tests are much less powerful since they identify the change using only the professors who taught both types of courses, which only six professors did. However, the changes in grades of D, in total grades of C- and D, and in grades of C+ remain significant when the faculty fixed effects are included. Very few of the faculty fixed effects are significantly different from zero. These results are available on request.

[7] For about two years after the policy changes, core courses contained a mix of students who were subject to the requirement and students who were not. To ensure that this isn't affecting the results, I have also done the differences in differences estimation using only the grades from fall 2015 to spring 2018, by which time all students in the core courses were subject to the requirement. The results are substantially the same as those described here; details are available on request.

Figure 3. Changes in Core Grades and Introductory Grades





A grade of WF indicates withdrawal after the deadline (equivalent to an F for GPA purposes)
Grades of P are not shown

Table 2. Test of significance of differences and differences-in-differences in grades

	Intro						Core						Difference in differences	
	Fall08 to Spring 13		Fall13 to Spring18				Fall08 to Spring 13		Fall13 to Spring18					
Grade	Number	Percent	Number	Percent	Diff	Std Err	Number	Percent	Number	Percent	Diff	StdErr	Diffs	StdErr
A	166	11.81%	169	12.44%	0.63%	1.24%	201	11.49%	269	13.51%	2.03%	1.09%	1.40%	1.65%
A-	156	11.10%	145	10.68%	-0.43%	1.19%	218	12.46%	210	10.55%	-1.91%	1.04%	-1.48%	1.58%
B+	163	11.60%	154	11.34%	-0.26%	1.21%	213	12.17%	224	11.25%	-0.92%	1.05%	-0.66%	1.61%
B	237	16.87%	218	16.05%	-0.82%	1.41%	294	16.80%	390	19.59%	**2.79%**	1.27%	***3.60%***	1.89%
B-	162	11.53%	207	15.24%	**3.71%**	1.29%	216	12.34%	295	14.82%	**2.47%**	1.13%	-1.24%	1.71%
C+	161	11.46%	131	9.65%	-1.81%	1.17%	166	9.49%	212	10.65%	1.16%	0.99%	***2.97%***	1.53%
C	152	10.82%	134	9.87%	-0.95%	1.16%	183	10.46%	211	10.60%	0.14%	1.01%	1.09%	1.53%
C-	83	5.91%	69	5.08%	-0.83%	0.87%	110	6.29%	62	3.11%	**-3.17%**	0.69%	**-2.35%**	1.11%
D	48	3.42%	54	3.98%	0.56%	0.72%	73	4.17%	38	1.91%	**-2.26%**	0.56%	**-2.82%**	0.92%
F	10	0.71%	10	0.74%	0.02%	0.32%	15	0.86%	14	0.70%	-0.15%	0.29%	-0.18%	0.43%
WF	0	0.00%	0	0.00%	0.00%	0.00%	2	0.11%	1	0.05%	-0.06%	0.09%	-0.06%	0.10%
W	54	3.84%	45	3.31%	-0.53%	0.71%	56	3.20%	64	3.21%	0.01%	0.58%	0.54%	0.91%
P	13	0.93%	22	1.62%			3	0.17%	0	0.00%				
C+ to B	560	39.86%	556	40.94%	1.08%	1.87%	676	38.63%	897	45.05%	**6.42%**	1.62%	**5.34%**	2.47%
D to C-	131	9.32%	123	9.06%	-0.27%	1.10%	183	10.46%	100	5.02%	**5.43%**	0.87%	**-5.17%**	1.41%

Results in **bold** are significant at 5% level, in ***italics*** at 10% level but not 5%.

To test for the significance of these changes, I test the hypothesis that the percentage of grades of each type is the same in two time periods, using a standard t-test for the difference of means in two groups. I then test the hypothesis that the change between time periods in the percentage of each grade is the same in both courses; the latter is the difference in differences estimate of the effect of the policy on grades. Table 2 shows these tests. For core grades, the reduction in grades of C- and D is statistically significant at the 5% level, and so are the increase in grades of B and B-. For introductory grades, only the change in grades of B- is statistically significant. For the difference in differences tests, the drops in C- and D grades are statistically significant at the 10% level, and the increase in B and B- are statistically significant at the 10% level but not the 5% level.

The last two lines of Table 2 show the results for two categories of grades, the first being C+ to B and the second being D to C-. There is no significant change in the percentage of grades in either category for the introductory course, but for core courses, grades in the C+ to B range rose by 6.42% and grades in the C- to D range fell by 5.43%, both statistically significant at the 5% level. The test statistic of the difference in differences test for the same change in these categories of grades in both types of courses is 3.97 for grades of C+ to D and -6.27 for grades of D to C-. Something changed grades in the core courses between these two time periods that had no effect on grades in the introductory course. The minimum core grade policy is the most plausible cause of this change.

Of the two causal mechanisms suggested above – faculty shifting grades above the threshold and students studying harder to get above the threshold – the evidence seems more compatible with the latter. If faculty were adjusting their grading to avoid taking students out of the major, this would affect only students whose grades were below the threshold. It should produce a reduction in grades of C- and an increase in grades of C as faculty move students over the threshold. This mechanism might cause some further adjustments, if students who would have gotten Cs have to be shifted up to C+ in order to give them a higher grade than the students who have been shifted from C- to C. But it seems unlikely

that this would result in a significant increase in grades as high as B, or that it would produce no net increase in the percent of C grades.

In contrast, if students put in more effort to be sure of getting a grade above the threshold, this affects students whose grades are both above and below the threshold. Students do not know what their grade will be when they decide how much effort to put into the course. A student who expects to receive a C- or D should certainly exert more effort; but even a student who expects a C or C+ knows that bad performance on the final exam could reduce their grade below the threshold. Thus, we would expect that both students below the threshold and those who are only somewhat above it might work harder and do better in the course as a result. If so, some students who would otherwise have earned grades of C- or D will move up into the C and C+ range, but some students who would otherwise have earned grades of C or C+ will move up into the B- or B range. The upper part of the grade range is less likely to be affected since students who are expecting grades of B+ or A- are unlikely to change their effort levels due to the minimum grade policy; they have little fear of getting an actual grade of C- or lower. If this is the mechanism at work, then we would expect:

1. A reduction in grades below the threshold as students work harder to avoid those grades;
2. Little change in grades immediately above the threshold, as some students move from below the threshold to above it, but some students who would have been barely above the threshold move higher;
3. An increase in grades some distance above the threshold, as students who would have been barely above the threshold move higher, and students who would have been comfortably above the threshold do not change their effort levels;
4. No change in grades at the top of the distribution.

And that is what I find; a decrease in C- and D grades, no change in C grades, an increase in grades from C+ to B, and no change above that level. Thus, the most plausible explanation of the evidence is that the requirement that students get at least a C grade in the core courses to major in economics encourages them to work harder if they expect to get a grade that is below or only some distance above the threshold. This results in students learning the material more thoroughly and receiving higher grades as a result. I cannot rule out that the other mechanism may be at work as well – faculty may be allowing students over the C threshold who might have gotten lower grades earlier – but it does not appear to be the dominant effect since grades of C do not change from the policy. And I can clearly rule out the hypothesis that students who would have gotten C- or D grades are given a C to allow them to stay in the major.

Conclusion

Rising demand for enrollments has caused many economics departments, having reached the limit of their capacity, to implement policies that limit access to the economics major. In this article I study the effects of one such policy implemented at a nationally ranked liberal arts college. I find that the policy is effective at reducing the number of economics majors at the college, though not powerful enough to prevent the number of majors from rising overall, and reduces the enrollment burden on the department. The majority of students who get a low grade in a course do not retake it, but most students who do retake succeed, suggesting that students who have overall ability in economics but who do badly in one course are able to remain in the major. The required minimum grade in the core courses appears to boost student effort in those courses, resulting in more grades of C+, B-, and B as well as fewer grades of C- and D. Overall, the policy appears to be effective at reducing demand for the economics major, at relatively low cost in terms of courses retaken, and in addition, it increases student

effort and student learning in those courses. Since the data are drawn from one school, it is not certain whether the policies adopted at other schools have similar effects. However, if policies at other schools have similar effects, then minimum grade requirements could be an effective tool for keeping demand for economics courses within capacity, while improving student learning in the major.

Such policies come with two caveats, however. First, while minimum grade requirements for majors may be an effective way to keep economics enrollment within department capacity and induce greater effort, they do this by denying access to the major to student who wish to major in economics and have earned passing, if low, grades in department courses. Faculty and administrators who feel that all students (who can earn passing grades) should be able to major in whatever subject they wish may challenge such policies. The department studied here has not been seriously challenged in this way, but this may be only because the department is so overburdened that it is obvious that accommodating all interested students is not possible in any event. Second, any standard for access to the major must be applied fairly and equitably to all students. Departments may need to take steps to ensure that all faculty teaching core courses have common standards for awarding grades that meet the minimum requirements for the major, so that access to the major does not depend on which faculty member a student happened to have for the required courses. This is not very difficult to do but it may require communication between faculty members, which may be a departure from current practices in some departments.