Timing Matters

Evidence from College Major Decisions

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ABSTRACT

People rely on their experiences when making important decisions. In making these decisions, individuals may be significantly influenced by the timing of their experiences. Using administrative data, we study whether the order in which students are assigned courses affects their choice of college major. We use a natural experiment at the United States Military Academy in which students are randomly assigned to certain courses either during or after the semester in which they are required to select their college major. We find that when students are assigned to a course in the same semester as they select a major, they are more than 100 percent more likely to choose a major that corresponds to that course. Despite low switching costs, approximately half of the effect persists through graduation. Our results demonstrate that the timing of when students are assigned courses has a large and persistent effect on college major choice. We explore several potential mechanisms for these results and find that students' initial major best fits an availability bias framework, and the persistence of the effect until graduation is consistent with status quo bias.

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I. Introduction

People rely on their experiences when making decisions. However, minor and seemingly unimportant changes to the timing and order of when experiences occur may significantly influence individuals' choices. We examine how the timing of experiences influences the choice of college major.

Choosing a college major is one of the most influential, long-lasting, and complicated decisions a student makes. In addition to large differential returns in earnings for college majors, a college major can affect a student's career choice, geographic location, and lifestyle.[1] Despite potentially large long-term effects of a major, small changes to when majors are experienced during a college career may impact students' choice of major. In particular, if students are uncertain about the value of majors, have limited information about certain majors, or recall and evaluate experiences differently depending on when they occur, then minor changes to the timing of students' college experiences may influence their choice of major and therefore the direction of their lives.

We test whether students' college major choices are influenced by changes in the timing of when students take courses by exploiting random variation in student schedules at the United States Military Academy (USMA) at West Point. Specifically, we use the random assignment of USMA students to certain required courses during or after the semester in which they must select a college major. We find that students assigned to a course in the semester when initial major decisions are made (the first semester of sophomore year) are 109 percent (2.6 percentage points) more likely to choose a major that corresponds to the course than students who are assigned the same course in the following semester (the second semester of sophomore year). This result is robust to a number of specifications, including those that use faculty fixed effects and fixed effects for the complete roster of scheduled sophomore courses.

We explore several potential mechanisms for this result, including a response to new information, ambiguity aversion, and exposure effects. We find that certain patterns in the data are inconsistent with a response to new information, ambiguity aversion, or models of exposure. First, a response to new information would suggest that students would be less likely to choose a major when they receive information that decreases their valuation of that major. However, among students who have negative course experiences—measured using within- and between-student academic performance and course evaluations—we find that being assigned a course in the semester when major decisions are made has a large, positive effect on choosing a corresponding

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1. For example, see Altonji, Blom, and Meghir (2012); Altonji, Kahn, and Speer (2014); Chevalier (2011); Hastings, Neilson, and Zimmerman (2013); Kirkeboen, Leuven, and Mogstad (2016); Webber (2014); Patnaik et al. (2020)

major. Second, if students are ambiguity averse—preferring clear prospects to vague ones—this could lead them to prefer majors corresponding to courses they are currently taking over unseen majors. While our estimates are imprecise, we find that previously taking a college-level course in a subject, which likely decreases the ambiguity of a major, does not reduce the effect of semester assignment on major choice. Lastly, if our findings are explained by exposure to new majors, this suggests prior experience or interest would reduce the effects of semester assignment. Alternatively, we find that the effect of semester assignment on major choice does not decline among students who have expressed interest in the major prior to attending USMA. Although we cannot rule out mechanisms related to new information, ambiguity aversion, or exposure effects, the patterns we observe suggest other factors may explain the relationship between timing and major choice.

One additional mechanism for our results we explore is availability bias. With availability bias, individuals conflate the availability of a choice—how easily it comes to mind—with the value of that choice. Thus, the more salient and recent the experience, the more likely an individual is to select a choice corresponding to that experience. Availability bias is consistent with our findings that assignment to a course in the same semester as college majors are initially chosen increases the likelihood that a student chooses a corresponding major even when a student has a negative experience in the course, has already taken a course in the subject, or previously expressed interest in the major. Additionally, we observe that the way major choices relate to freshman course ordering is broadly consistent with an availability bias framework but is not as easily explained by a response to new information or exposure effects. The less time between when a student is assigned a course and chooses a major, the more likely they are to choose a corresponding major.

We also find that a large portion of the effect of semester order persists through graduation. Students are 39 percent (1.4 percentage points) more likely to graduate in a subject they were assigned during the first semester of their sophomore year (the semester of initial major choice) than a subject they were assigned in the second semester of their sophomore year. This occurs despite apparently low costs to switching majors during sophomore year; students in the sample do not start major-related courses until their junior year and only need two signatures to switch majors. One plausible explanation for this result is status quo bias. Taken together, our findings show that exposing students to a subject in the semester they choose a major increases the probability that they initially choose and eventually graduate in a major related to that subject. Generally, these results suggest that small differences in the timing and order of experiences can meaningfully influence important decisions.

This work relates to research in economics and psychology that documents how the timing of experiences influences how those experiences are weighed in the decision-making process. Broadly, this work relates to evidence from behavioral economics that suggests that individuals overly value current experiences and information when making decisions for the future.[2] More specifically, our findings relate to psychological models of availability that suggest that individuals conflate how readily attributes of a good come to

2. For example, models of present-biased preferences (for example, Laibson 1997; O'Donoghue and Rabin 1999) suggest that individuals overly weigh current consumption when making decisions for the future, and models of projection bias (for example, Loewenstein, O'Donoghue, and Rabin 2003) suggest that individuals are overly influenced by current physical or emotional states when making decisions for the future. Both of these models are supported by a significant body of empirical evidence.

mind and the qualities of that good (for example, Menon and Raghubir 2003; Tversky and Kahneman 1973; Tybout et al. 2005; Schwarz et al. 1991). Our work provides supportive evidence for models that incorporate availability by demonstrating that seemingly small changes in the timing of courses has a significant impact on students' major choices.

Our findings also relate to research that explores factors that influence college major choice. Despite the role course timing may play in choosing a major, there is limited evidence on the causal effect of timing on a student's major choice.[3] This is likely because students typically endogenously choose which courses to take, when to take them, and when to select a major, making it difficult to identify the causal effects of course timing on major choice. However, a growing body of research studies how information and learning influence major choice.[4] In particular, our findings inform how exposure to courses influence student beliefs (Wiswall and Zafar 2014), major choices (Fricke, Grogger, and Steinmayr 2015; Stinebrickner and Stinebrickner 2013; Joensen and Nielsen 2016), and student outcomes (Malamud 2011). The exogenous variation in semester ordering in our sample provides a unique opportunity to identify the causal link between semester ordering of courses and major choice.

Finally, this study complements research that investigates policies intended to drive students toward particular majors, such as those in the areas of science, technology, engineering, and mathematics (STEM). Recent studies offer evidence on policies that increase certain college majors, but many of these effective policies are financially costly, structurally challenging to execute, or both. For example, changes to financial resources (for example, Castleman, Long, and Mabel 2018), financial incentives (for example, Denning and Turley 2017; Stange 2015), and the gender and racial composition of instructors (for example, Bettinger and Long 2005; Carrell, Page, and West 2010; Fairlie, Hoffmann, and Oreopoulos 2014) can influence major choice. Our study suggests low-cost policy tools that could nudge students toward certain majors.

The remainder of the paper is structured as follows. In Section II, we describe our study environment and data. In Section III ,we describe our empirical strategy and report our primary results. In Section IV, we explore the potential mechanisms for our findings. In Section V, we conclude.

II. Study Environment and Data

Data for this study come from administrative records at the United States Military Academy (USMA) at West Point, which include 35,097 student–course observations from 8,777 sophomores between the years 2003 and 2015.[5] USMA is a

3. Related studies include that by Joensen and Nielsen (2016), who find that a policy change that increased exposure to math courses in high school increased the likelihood that students majored in math-related fields of study in college, and Fricke, Grogger, and Steinmayr (2015), who find that students in a Swiss business school who are randomly assigned to write a significant research paper in economics or law prior to selecting a major are more likely to select economics or law majors, respectively. Malamud (2011) finds that increasing the amount of time students spend in college prior to making a major choice increases the probability that students select a career that matches their major.

4. For example, Arcidiacono et al. (2016); Avery et al. (2018); Bordon and Fu (2015); Malamud (2010); Zafar (2011).

5. Our sample was constructed based on graduating year groups and includes seven students who are sophomores in 2000 and 28 students in 2002. Our results are not sensitive to the exclusion of these students.

Table 1
Summary Statistics

	Mean	SD
Female	0.14	0.34
Asian	0.06	0.24
Black	0.07	0.25
Hispanic	0.09	0.29
White	0.75	0.43
Prior military service	0.18	0.38
Prior college attendance	0.17	0.37
USMA Preparatory Academy	0.15	0.36
Division I athlete	0.34	0.47
Age	19.8	0.96
Number of courses	5.25	0.49
SAT Verbal	628	64.4
SAT Math	649	60.9

Notes: Includes characteristics from all 8,778 students in our primary sample. This sample includes sophomores that attended the United States Military Academy between the years of 2001 and 2015. This sample excludes students who are not assigned one of the two standard orders for the following sophomore courses: American Politics, Economics, Geography, and Philosophy.

four-year undergraduate institution with an approximate enrollment of 4,400 students. In total, USMA offers 39 majors within science, engineering, humanities, and social science. USMA provides all students with the equivalent of a "full-ride" scholarship, but requires students to attend all assigned classes, graduate within four years, and complete a five-year service commitment in the United States Army.

Despite USMA's unique attributes, credit requirements for majors,[6] the admissions rate, student-to-faculty ratio, class size, racial composition, and standardized test performance are similar to selective liberal arts colleges, such as Williams College, Davidson College, and Washington and Lee University (Carter, Greenberg, and Walker 2017). USMA admits approximately 10 percent of all applicants, has a student-to-faculty ratio of 7:1,[7] and typically limits class sizes to 18 students.[8] The racial composition of the sample, shown in Table 1, is 75 percent white, 9 percent Hispanic, 7 percent Black, and 6 percent Asian. The standardized test performance in the sample reflects the selectivity of USMA, with average SAT math and verbal scores of 649/800 (86th percentile) and 628/800 (86th percentile), respectively.[9] While in many ways the student population is similar to other

6. Majors at USMA require students to complete between 11 and 18 major-related courses.
7. Source: https://nces.ed.gov/collegenavigator/?q=united+states+military+academy&s=all&id=197036 (accessed January 25, 2023).
8. Source: https://www.westpoint.edu/admissions/frequently-asked-questions (accessed January 25, 2023).
9. Percentiles based on 2011 SAT score distributions. Source: http://media.collegeboard.com/digitalServices/pdf/SAT-Percentile_Ranks_2011.pdf (accessed January 25, 2023).

selective liberal arts colleges, some characteristics are unique. Only 14 percent of USMA students are female, 18 percent have prior military service, 17 percent have prior college experience, 15 percent previously attended a military preparatory academy, 34.1 percent are Division I athletes, and students come from every state in the United States.[10]

In comparison to other colleges, students' schedules are structured more strictly at USMA. Student schedules during the first two years consist of required courses in basic science, humanities, and social science. Unlike students at most colleges, USMA students do not set their own schedules. Instead, the registrar's office assigns the semester, time, day, and instructor for each course. Many of these assignments—including the semester ordering of certain courses—are made independently of student characteristics. Within the years of the sample, students are required to declare a major in a four- to five-week window during the first semester of their sophomore year[11] and are not allowed to officially declare a major prior to this window.[12] Finally, students are typically unable to take major-specific courses until the first semester of their junior year.

The structured nature of the first two years for students at USMA has several characteristics that make this context ideal for testing the relationship between the semester timing of courses and major choice. Since all students must take or test out required courses, students have nearly identical schedules. Figure 1 outlines these required courses and the semesters they are assigned.[13] In this figure, the six courses highlighted in yellow are assigned to students in either the first or second semester of the corresponding year. This rigid scheduling allows us to compare outcomes among students who take the same courses, with the only difference being the semester in which they are assigned certain courses. Since students are unable to manipulate the timing of when they take courses or when they initially declare a major, this setting provides a unique opportunity to identify how the semester timing of courses affects major choice.

Particularly important to our analysis are the four required courses that are randomly assigned to be taken during either the first or second semester in a student's sophomore year—Economics, American Politics, Geography, and Philosophy.[14] The default approach of the registrar's office is to assign students to take a combination of American Politics and Geography (APol/Geo) in one semester and Economics and Philosophy (Econ/Phil) in the other. Among these students, the registrar fills sections to create roughly equal portions of students taking (i) APol/Geo in their first semester then Econ/Phil in their second and (ii) Econ/Phil in their first semester then APol/Geo in their second. Of all students enrolled at USMA, 57 percent take one of these default combinations of courses. The remaining 43 percent either test out of one of these courses, test out of another required course that modifies the order in which they take courses,[15] or

10. This diversity is driven by a rule that places a limit on the number of students that can come from each congressional district.

11. USMA tradition is to refer to freshman, sophomores, juniors, and seniors as Plebes, Yearlings, Cows, and Firsties, respectively. We use the more common terminology for clarity.

12. The major selection window is typically open for four to five weeks, opening between August 27 and September 11 and closing between September 29 and October 11.

13. See Online Appendix Table A.1 for a list of required liberal arts courses and corresponding majors.

14. See Online Appendix C for a detailed description of each of these courses.

15. For example, students can test out of a required freshman or sophomore course that enables them to take three of these courses in the first semester of their sophomore year.

TYPICAL ACADEMIC PROGRAM

FRESHMAN YEAR		SOPHOMORE YEAR	
Term 1	**Term 2**	**Term 1**	**Term 2**
MA 103 - 4.0 Math Modeling/Intro to Calculus	**MA104 - 4.5** Calculus I	**MA205 - 4.5** Calculus II	**MA206 - 3.0** Prob & Stats
CH101 - 3.5 Chemistry I	**CH102 - 3.5** Chemistry II	**PH201 - 3.5** Physics I	**PH202 - 3.5** Physics II
EN101 - 3.0 English Composition	**EN102 - 3.0** Literature	**Lx203 - 3.5** Foreign Language	**Lx204 - 3.5** Foreign Language
HI10_ - 3.0 History	**HI10_ - 3.0** History	**SS201 - 3.5** Economics	**SS202 - 3.5** Political Science
PL100 - 3.0 General Psychology	**IT105 - 3.0** Intro to Computing and Information Technology	**PY201 - 3.0** Philosophy	**EV203 - 3.0** Physical Geography

Figure 1

Typical USMA Schedule in First Two Years

Notes: Shaded courses may be assigned to students in either first or second semester of the respective year. Students must complete or test out of all courses listed.

have a scheduling conflict that requires a different configuration.[16] Online Appendix Table A.2 reports the differences in student characteristics between the analysis sample and the excluded sample. The two most apparent differences are that students in the excluded sample have higher test scores and are more likely to have previously attended college. Our analysis focuses on the 57 percent of students who are unlikely to influence the order of their courses. Our estimates, however, are robust to the inclusion of all students, as reported in Online Appendix Table A.3.

The key assumption in our identification strategy is that students in the sample are randomly assigned to either APol/Geo or Econ/Phil in the first semester of their sophomore year. The practice of the registrar's office is to make this assignment independent of any information about the student, which supports the assumption of randomization. However, we formally test for balance across course schedules in Panel A of Table 2. We compare observable characteristics between students assigned to APol/Geo in their first semester against those assigned to Econ/Phil in their first semester, where each observation is at the student level. In Column 4 of Table 2, we report t-test p-values for differences in each individual characteristic across semester assignments. Among 17 observable characteristics only one—whether a student is Black—significantly differs across semester assignment (p-value < 0.05). For a subset of 5,615 students between 2005 and 2012, we are able to observe results from a survey taken the summer prior to freshman year that includes questions about students' interest in potential majors. We find that assignment to Econ/Phil in the first semester is uncorrelated with students' expressed interest in Economics or Philosophy and is also uncorrelated with expressed interest in American Politics or Geography.[17] When we jointly test the significance of all 17 variables, we recover a statistically insignificant F-test p-value of 0.99.[18] Together these patterns support the description by the registrar's office that the semester order of courses is randomly assigned.

In Panel B of Table 2, we compare outcomes for the choice of college major for those assigned to either APol/Geo or Econ/Phil in the first semester of their sophomore year. These comparisons preview our main results. Those assigned Econ/Phil in their first semester initially select an Economics or Philosophy[19] major 10.6 percent of the time, while those assigned APol/Geo in their first semester only select an Economics or Philosophy major 5.9 percent of the time (p-value < 0.01). Conversely, those assigned Econ/Phil in their first semester only initially select Political Science or Geography 3.9 percent of the time, whereas those assigned APol/Geo in their first semester select Political Science or Geography 10.1 percent of the time (p-value < 0.01). The differences in majors shrink by approximately 60 percent by graduation, but remain statistically different at the 1 percent level. We formally test whether semester assignment affects major choice as outlined below in our discussion of methods.

16. For example, athletes might take a reduced course load during one semester and then a heavier course load the following semester.

17. One concern is that expressed interest is uncorrelated with major choice. However, we find that students who express interest in a major are approximately three times more likely to graduate in that major (p-value < 0.01; see Column 1 of Table 6).

18. A joint F-test p-value for the 13 characteristics observed for all students in all years is a statistically insignificant 0.42.

19. Art, Philosophy, and Literature is the major that most closely corresponds to Philosophy.

Table 2
Balance Table

	First Semester Classes			
	Economics/ Philosophy	American Politics/ Geography	Difference	*p*-value
Panel A: Demographics				
Female	0.138	0.135	0.003	0.72
Age	19.771	19.747	0.024	0.24
Asian	0.059	0.065	–0.006	0.31
Black	0.074	0.060	0.014	0.01
Hispanic	0.090	0.089	0.001	0.85
White	0.745	0.751	–0.006	0.50
SAT verbal	628	628	0.338	0.81
SAT math	649	649	–0.659	0.61
Entering class rank	602	602	–0.521	0.68
Prior military service	0.182	0.170	0.012	0.13
Prior college attendance	0.165	0.169	–0.004	0.66
USMA Preparatory Academy	0.159	0.149	0.010	0.22
Division I athlete	0.342	0.338	0.004	0.69
interest in APol/Geo	0.208	0.214	–0.006	0.60
Interest in Econ/Phil	0.150	0.147	0.003	0.76
Prior Econ AP course	0.030	0.029	0.001	0.97
Prior APol/Geo AP course	0.087	0.094	–0.007	0.32
Panel B: Outcomes				
Initial major Econ/Phil	0.106	0.059	0.047	0.00
Initial major APol/Geo	0.039	0.101	–0.062	0.00
Graduating major Econ/Phil	0.094	0.075	0.019	0.00
Graduating major APol/Geo	0.060	0.097	–0.037	0.00
N	4,405	4,372		

Notes: Interest-in-subject variables come from a smaller subset of 5,630 students who responded to a survey prior to beginning their coursework at USMA. AP course variables come from the 5,925 students who begin attending USMA after AP test scores are collected (2006). The joint F-test (16; 2,824) for all variables is 0.38 with a p-value of 0.99. The joint F-test (12; 8,765) for the full sample of students (excluding interest and AP test variables) is 1.02 with a p-value of 0.42.

III. Methods and Results

A. Methods

In our main analysis, we examine whether students randomly assigned to a course during the semester they initially select a major are more likely to choose and graduate in a corresponding major than students assigned to the same course in the semester after

they make an initial major choice. As previously outlined, students in the sample are randomly assigned to take American Politics, Economics, Philosophy, and Geography (APol/Geo or Econ/Phil) in either the first or second semester of their sophomore year, the semester in which they make an initial major choice or the following semester, respectively. This random assignment enables us to estimate the causal effect of course order on major choice for these four courses with the following equation:

$$(1) \quad Y_{icjt} = \beta T_{ict} + \delta_1 X_i + \delta_2 \frac{\sum_{k \neq i} X_{kcts}}{n_{cts} - 1} + \delta_3 R_{it} + \gamma_c + \phi_j + \lambda_t + \varepsilon_{cjt}$$

where Y_{icjt} is an indicator of whether individual i in course c with professor j in year t chooses to major in a corresponding subject. T_{ict} is an indicator of whether the course is assigned in the first semester of a student's sophomore year. X_i is a vector of student characteristics, including age, sex, race/ethnicity, SAT math and SAT verbal test scores, and leadership scores. $\frac{\sum_{k \neq i} X_{kcts}}{n_{cts} - 1}$ is a vector of the average characteristics of a student's peers in course section s. We also include a roster fixed effect (R_{it}) that is a fixed effect for the particular combination of courses students take during their sophomore year.[20] Additionally, γ_c is a course code fixed effect,[21] ϕ_j is an instructor fixed effect, and λ_t is a year fixed effect. The parameter of interest is β, which measures the effect of being assigned a course during the first semester of sophomore year on the probability of selecting a major in that course's corresponding subject. We estimate this equation with ordinary least squares, clustering standard errors by both student and course section.

Random assignment of semester course order allows us to estimate unbiased effects without the controls outlined above. However, we successively add these controls to the estimates to test whether they are sensitive to the inclusion of various controls.

B. Results

Our primary research question is whether the timing of when students take courses affects college major choice. A motivating pattern for this question is shown in Figure 2, which shows that students are more likely to choose majors that correspond to courses taken in the semester that initial major choices are made than majors that correspond to courses taken before or after. This pattern is not necessarily causal, since courses offered during the semester of initial major choice might be the most popular regardless of if and when they are offered, but it is consistent with the semester timing of courses mattering in major choice.[22]

20. All students are required to complete or test out of all assigned freshman- and sophomore-year courses. Several courses have honors sections that students are admitted into by either (i) having high academic qualifications or (ii) expressing strong interest in majoring in the subject. To avoid selection into testing out of certain courses or taking honors sections biasing our results, we include a fixed effect for each combination of courses that students take. One caveat is that we treat all language courses as the same course, since students have the most discretion regarding which language to take and including all combinations of languages and courses would approximate an individual fixed effect.

21. Honors and nonhonors sections are treated as different courses.

22. Courses assigned prior to the semester when majors are selected include courses in chemistry, English, History, Information Technology, and Math. Courses assigned during the semester when majors are selected include Foreign Language courses and Physics courses. Courses assigned after the semester when majors are selected include legal studies and international relations. Figure 2 excludes American Politics, Economics,

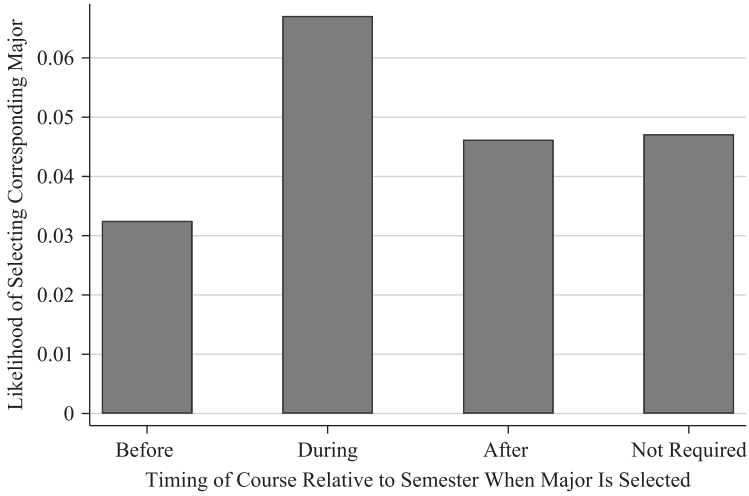

Figure 2

Likelihood of Selecting a Corresponding Major

Notes: Per-course averages reported. Subjects assigned prior to the semester when majors selected include Chemistry, English, History, Information Technology, and Math. Courses assigned during the semester when majors are selected include Foreign Language courses and Physics courses. Courses assigned after the semester when majors are selected include Legal Studies and International Relations. Figure 2 excludes American Politics, Economics, Geography, and Philosophy because they are the focus of our primary analysis. Online Appendix Figure A.1 includes these courses and generates a similar pattern.

To formally test whether the timing of course assignment influences major choice, we estimate Equation 1 and report the coefficients in Table 3. In Panel A we report the effects of being assigned to a course in the first semester of sophomore year (that is, the semester when an initial major choice is made) on initial major choice. In Panel B we report the effects of first-semester assignment on graduating major. Column 1 of Panel A, which includes no controls, indicates that assignment to a course in the first semester of sophomore year increases the probability that a student will initially choose a corresponding major by 2.9 percentage points, or 110 percent. This result is highly precise and is significant at well beyond the 1 percent level. Column 2 adds course fixed effects, year fixed effects, and demographic characteristics. Columns 3 and 4 add classmate demographic characteristics and instructor fixed effects, respectively. None of these controls substantively change the estimates from Column 1. In Column 5, including sophomore course schedule fixed effects[23] has no effect on the magnitude or precision of our estimates, allowing us to rule out path dependency in coursework as a mechanism for our results. All results in Table 3 are robust to including all sophomore

Geography, and Philosophy because they are the focus of our primary analysis. Online Appendix Figure A.1 includes these courses and generates a similar pattern.

23. The sophomore course schedule fixed effect includes a fixed effect for every combination of courses taken by students over the course of their entire sophomore year.

Table 3
Effects of Semester Order on Major Choice

	(1)	(2)	(3)	(4)	(5)
Panel A: Initial Major Choice					
First semester	0.0287***	0.0295***	0.0293***	0.0283***	0.0284***
	(0.0024)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
N	35,097	35,097	35,097	35,097	35,097
R^2	0.0054	0.0239	0.0243	0.0373	0.0656
Control group dependent variable mean	0.026	0.026	0.026	0.026	0.026
Demographic controls	N	Y	Y	Y	Y
Peer demographic controls	N	N	Y	Y	Y
Teacher FE	N	N	N	Y	Y
Schedule roster FE	N	N	N	N	Y
Panel B: Graduating Major					
First semester	0.0144***	0.0153***	0.0149***	0.0138***	0.0138***
	(0.0025)	(0.0023)	(0.0024)	(0.0023)	(0.0024)
N	35,097	35,097	35,097	35,097	35,097
R^2	0.0013	0.0220	0.0228	0.0337	0.0579
Control group dependent variable mean	0.035	0.035	0.035	0.035	0.035
Demographic controls	N	Y	Y	Y	Y
Peer demographic controls	N	N	Y	Y	Y
Teacher FE	N	N	N	Y	Y
Schedule roster FE	N	N	N	N	Y

Notes: Significance: *$p<0.10$, **$p<0.05$, ***$p<0.01$. Each specification represents results for a regression where the independent variable is being assigned to a course in the first of two semesters (fall vs. spring semester) in students' sophomore year. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. Columns 2–5 include course and year fixed effects, with 2003 being the omitted year. Robust standard errors are clustered at the individual and section-by-year levels. Inclusion of teacher fixed effects in Columns 3 and 4 lead to six singleton observations, and inclusion of schedule roster fixed effects leads to one additional singleton observation. As a result, Columns 3 and 4 are identified from 35,091 observations, and Column 5 is identified from 35,090 observations.

Table 4
Effects of Semester Order on Adding and Dropping Major

	All Courses	American Politics	Economics	Geography	Philosophy
Panel A: Add Major after Third Semester					
First semester	–0.0071***	–0.0015	–0.0129***	–0.0165***	–0.0008
	(0.0013)	(0.0013)	(0.0029)	(0.0031)	(0.0030)
N	35,090	8,556	8,556	8,555	8,553
R^2	0.0307	0.0327	0.0501	0.0434	0.0646
Control group dependent variable mean	0.018	0.004	0.024	0.024	0.018
Panel B: Drop Major after Third Semester					
First semester	0.0055***	0.0057***	0.0098***	0.0068***	0.0000
	(0.0009)	(0.0015)	(0.0026)	(0.0021)	
N	35,090	8,556	8,556	8,555	8,553
R^2	0.0323	0.0422	0.0492	0.0321	
Control group dependent variable mean	0.004	0.002	0.009	0.004	0.000

Notes: Significance: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Each specification represents results for a regression where the independent variable is being assigned to a course in the first of two semesters (fall vs. spring semester) in students' sophomore year. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. All specifications include an indicator for being a recruited athlete and for the year, with 2003 being the omitted category. Column 5 of Panel B is omitted because we do not observe any students dropping a Philosophy major in our sample. Robust standard errors are clustered at the individual and section-by-year levels.

students (Online Appendix Table A.3) and conditional logit specifications (Online Appendix Table A.4).[24]

Panel B of Table 3 shows the effect of being assigned a required course in the first semester of the sophomore year on a student's graduating major. In Columns 1–5 of Panel B, the effects of first-semester assignment on graduating major are large and statistically significant (p-value < 0.01) but about half the magnitude of the effects on initial major. First-semester assignment increases the probability that students select a corresponding major by between 1.4 and 1.5 percentage points (34–40 percent). The reduction in magnitude relative to the effect of semester assignment on initial choice comes from two sources—students assigned to a first-semester course are less likely to later add a corresponding major and more likely to drop a corresponding major. We report the effect of first-semester assignment on adding and dropping majors in Table 4.

24. One caveat to our conditional logit estimates is that they do not report clustered standard errors. We are unable to cluster our standard errors in the same way as Table 3 because these clusters are not nested within the conditional logit fixed effects. With this caveat, our estimates are large in magnitude and more statistically precise than our ordinary least squares estimates.

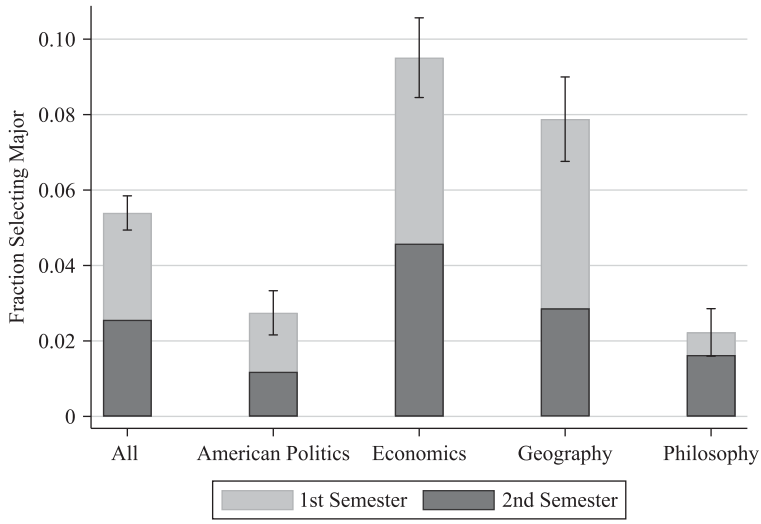

Figure 3

Subject-Specific Effects of Semester Order on Initial Major Choice

Notes: Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to Column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. The dark bar shows the fraction of students who are assigned a course in the second semester of their sophomore year and select a corresponding major. The light bar adds the estimated effect of first-semester assignment on major choice (that is, baseline mean + first-semester effect). The whiskers represent the 95 percent confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

In Column 1 of Table 4, Panel A, we find that students assigned to a course in the first semester of their sophomore year are 0.71 percentage points (17 percent) less likely to add the corresponding major after their first semester (p-value < 0.01). In Columns 2–4 of Panel A, we find that these patterns are consistent across each of the four majors we examine. In Column 1 of Panel B, we find that students assigned to a first-semester section of a course are 0.55 percentage points (135 percent) more likely to drop the corresponding major (p-value < 0.01). In Columns 2–4 of Panel B, we find that these effects are driven by American Politics, Economics, and Geography, but not Philosophy, which is not dropped by any students in our sample.

One question is whether the main effects in Table 3 are driven by a particular course. In Figures 3 and 4, we examine the effects of semester order of American Politics, Economics, Geography, and Philosophy courses on initial and graduating major choice.[25] We find that assignment to a first-semester section of American Politics increases the probability that individuals initially major in political science by 1.6 percentage points, or 130 percent. Assignment to a first-semester section of Economics increases the probability that individuals initially major in Economics by 4.9 percentage points, or 107

25. Online Appendix Table A.5 reports the results of Figures 3 and 4 numerically.

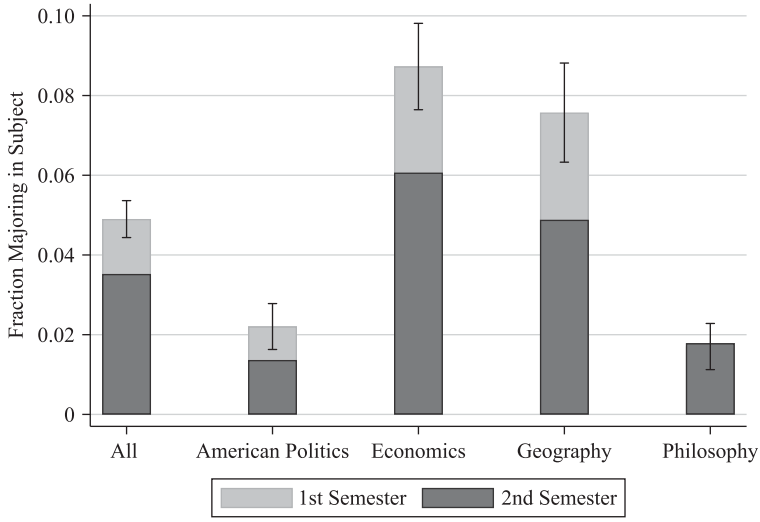

Figure 4

Subject-Specific Effects of Semester Order on Graduating Major

Notes: Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to Column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. The dark bar shows the fraction of students who are assigned a course in the second semester of their sophomore year and select a corresponding major. The light bar adds the estimated effect of first-semester assignment on major choice (that is, baseline mean + first-semester effect). The whiskers represent the 95 percent confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

percent. Assignment to a first-semester section of Geography increases the probability that individuals initially major in Geography by 5.0 percentage points, or 173 percent. Lastly, assignment to a first-semester section of Philosophy increases the probability that individuals initially major in arts, Philosophy, and literature by 0.61 percentage points, or 38 percent. These results suggest that although effects vary across subjects, the estimates are positive and significant for each course,[26] with no discernible pattern in the effects. In Figure 4, more than half of the effect of first-semester assignment persist to graduation and remains statistically significant (p-value < 0.01) for American Politics, Economics, and Geography, but dissipates by graduation for Philosophy.

Another question is whether the effects of first-semester assignment vary across demographic characteristics. In Figure 5, we estimate the effects of first-semester assignment by sex, race, and academic ability. We find that first-semester assignment significantly increases the probability that male, female, Black, Hispanic, white, low-SAT, high-SAT, low first-year GPA, and high first-year GPA students initially select a corresponding major. Furthermore, we do not find that the effects of first-semester assignment

26. Estimates are significant at the 1 percent level for American Politics, Economics, and Geography and significant at the 10 percent level for Philosophy.

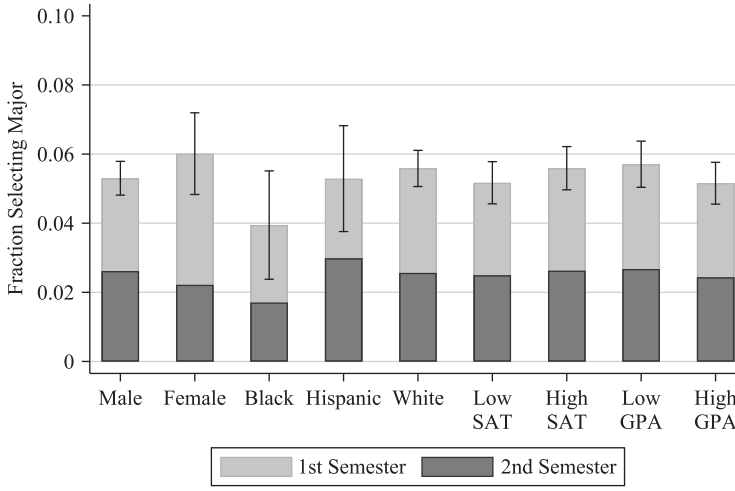

Figure 5

Effects of Semester Order on Initial Major Choice by Demographic Subgroup

Notes: Differences are estimated from regressions that include a subset of demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects separately for each subgroup and are analogous to Column 5 of Table 3. The dark bar shows the fraction of students who are assigned a course in the second semester of their sophomore year and select a corresponding major. The light bar adds the estimated effect of first-semester assignment on major choice (that is, baseline mean + first-semester effect). Robust standard errors are clustered at the individual and section-by-year levels.

significantly vary by sex, race, or academic ability. In Online Appendix Figure A.2, we estimate the impact of semester assignment on graduating major and again find that the effects of semester order do not significantly vary by sex, race, or academic ability. Additionally, in Online Appendix Table A.6, we find that the demographic characteristics of graduating majors in American Politics, Economics, Geography, and Philosophy do not differ by the semester students were assigned a corresponding course. These results suggest that students' major decisions are likely to be affected by the timing of courses regardless of their backgrounds.

Finally, in Figure 6, we explore whether assignment to either APol/Geo or Econ/Phil broadly affects the type of majors students select.[27] Specifically, we estimate the effect of first-semester assignment to APol/Geo on the type of majors students select. However, random assignment to either APol/Geo or Econ/Phil means that the effects of first-semester assignment to Econ/Phil will have an equal and opposite effect on major choice. We find that students assigned to a pairing of APol/Geo in the semester they choose a major are significantly more likely to major in either American Politics or Geography and significantly less likely to major in either Economics or Philosophy.

27. Ideally, we would identify the substitution patterns for each major in our study. For example, when students are induced to major in Economics, we would like to know whether these students are coming from STEM, Behavioral Science, Humanities, Language, or other majors. However, since students are randomly assigned to a pair of courses, we are only able to identify the overall effect of the paired treatment assignment on major choices.

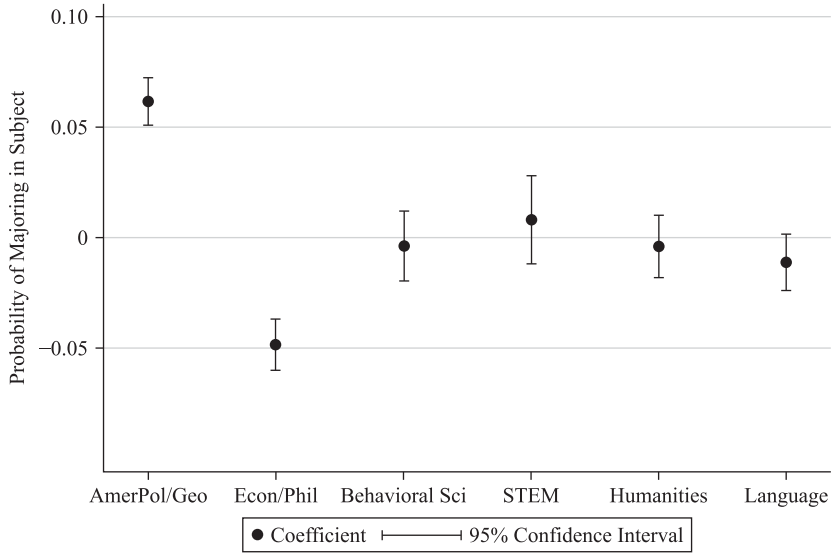

Figure 6

Effects of First-Semester Assignment to American Politics and Geography on Initial Major Choice

Notes: 95 percent confidence intervals shown. Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to Column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. Robust standard errors are clustered at the individual and section-by-year levels. Behavioral Science majors include all majors from the Behavioral Science and Leadership department: Management, Engineering Management, Psychology, Sociology, and Engineering Psychology. STEM majors include: Chemistry, Chemical Engineering, Civil Engineering, Computer Science, Environmental Engineering, Environmental Science, Mathematics, Mechanical Engineering, Nuclear Engineering, Operations Research, Physics, Systems Engineering, and Space Science. Humanities majors include: Comparative Politics, European History, International Relations, Legal Studies, Military History, and World History. Language majors include: Arabic, Chinese, English, French, German, Persian, Portuguese, Russian, and Spanish.

However, first-semester assignment to APol/Geo does not appear to broadly affect the type of majors students select. Assignment to APol/Geo does not affect whether students select a major in Behavioral Sciences, STEM, or Humanities.[28] First-semester assignment to APol/Geo might decrease the probability that students major in a language course by approximately one percentage point. These patterns on the broader selection of majors

28. Behavioral Science majors include all majors from the Behavioral Science and Leadership department: Management, Engineering Management, Psychology, Sociology, and Engineering Psychology. STEM majors include: Chemistry, Chemical Engineering, Civil Engineering, Computer Science, Environmental Engineering, Environmental Science, Mathematics, Mechanical Engineering, Nuclear Engineering, Operations Research, Physics, Systems Engineering, and Space Science. Humanities majors include Comparative Politics, European History, International Relations, Legal Studies, Military History, and World History. Language majors include Arabic, Chinese, English, French, German, Persian, Portuguese, Russian, and Spanish.

are consistent with three potential explanations for what majors APol/Geo and Econ/Phil draw from to generate a positive effect for first-semester assignment: (i) APol/Geo draws solely from Econ/Phil, and vice versa; (ii) APol/Geo and Econ/Phil draw similarly from other majors because they are similar course bundles; or (iii) first semester-courses draw broadly from various majors regardless of which courses are taken during the first semester.

C. External Validity

USMA is a unique environment to study student behavior because students have rigid academic schedules and graduates commit to five years of active duty Army service. These unique differences bring up important questions about generalizability. Despite these differences, there is growing evidence that students at service academies behave similarly to students in other academic settings. A variety of findings at service academies have been duplicated in external settings, including those on peer effects (Carrell, Fullerton, and West 2009; Sacerdote 2001), student and instructor matches (Carrell, Page, and West 2010; Hoffmann and Orepoulous 2009), and the relationship between fatigue and student outcomes (Haggag et al. 2018; Pope 2016).

One specific concern with external validity is that USMA requires students to declare a major in their third semester, delays major-specific coursework until students' junior year, and requires students to graduate within four years. This unique setting may lead to differences in the timing of major choice or switching patterns. However, in spite of these differences, major choice and switching patterns among students who choose a major corresponding to one of the treatment courses look quite similar to students outside of USMA. Specifically, Online Appendix Figure A.3 shows that 64 percent of these USMA students keep the major they declare in their third semester, 29 percent of students switch majors in their fourth semester, and only 7 percent of students switch majors at any point thereafter. In a sample of 401,314 first-time, full-time students from 2000–2008 at 41 four-year institutions, Venit (2016) finds that 65 percent of students make their last major declaration within their first four semesters (that is, they do not switch after their fourth semester), 24 percent make their last major declaration during their fifth semester, and only 11 percent make their last major declaration after their fifth semester. Compared with when students make their last major declaration in the United States, the distribution at USMA is shifted to the left by about one semester and has a slightly thinner right tail.

Perhaps more importantly for generalizability, are major decisions at USMA driven by considerations similar to those made at other institutions? While some of the factors influencing major choice at USMA may differ from those at other institutions (for example, a five-year Army service commitment), we argue that USMA students face many of the same trade-offs as other students.[29] First, Zafar (2013) finds that enjoyment of coursework and gaining parent approval are the most important determinants of college major choice—factors that are likely to also apply at USMA.[30] Second, a number of studies identify student–subject match as an important factor in major choice (for example, Arcidiacono 2004; Stinebrickner and Stinebrickner 2013; Wiswall and Zafar 2014). For USMA graduates, the assignment to both career type (branch) and first long-

29. See Patnaik et al. (2020) for a review.

30. Similarly, Malgwi, Howe, and Burnaby (2005) find that interest in subject is the most important determinant of major choice.

term assignment location is determined by a matching process that prioritizes those with high GPAs.[31] As a result, students have strong incentives to select a major where they can perform well. Third, while military occupation is only indirectly affected by college major, it is still possible that major choice affects Army career preferences and placements. Online Appendix Table A.7 shows that economics majors are much more likely to work in a combat-oriented position than philosophy majors, geography majors are nearly twice as likely to be engineers than American politics majors, and American politics majors are more than twice as likely to work in military intelligence than geography majors. Fourth, long-run outcomes both differ by major and are likely to be influenced by major choice. Specifically, Online Appendix Table A.7 shows most USMA graduates in the majors we consider (63 percent) leave the Army within ten years and that economics majors are much less likely to stay in the Army than American politics, geography, or philosophy majors. Furthermore, nearly half of USMA graduates attain graduate degrees (47 percent)—a path that is likely to be influenced by undergraduate choices. Finally, due to USMA's unique teaching model, 7 percent of USMA graduates from these majors, or 19 percent of those who stay in the Army at least ten years, return to teach at USMA. The prospect of teaching at USMA may be an important factor in major choice for a significant fraction of USMA graduates. Altogether, these patterns suggest that while major choices are different at USMA than at other institutions, USMA student choices are likely to be guided by the same concerns about tastes, ability, and long-run career goals as are other student choices.

IV. Mechanisms for Results

In this section, we outline and test several potential mechanisms for our results. First, we explore the potential mechanisms for why course order affects students' initial choice of major. Specifically, we discuss three mechanisms—a response to new information, exposure effects, and models of salience and availability. We find that certain patterns in the data are somewhat inconsistent with a response to new information or models of exposure. We then develop a simple framework of availability that may fit these patterns better. Second, we discuss potential mechanisms for why the effect of first-semester assignment on initial choice of major persists through college to graduation. We find that students appear to face small explicit cost to switching majors and that status quo bias might explain the persistence of the effects of semester assignment.

A. Mechanisms for the Effect of Course Order on Initial Major Choice

1. Updating beliefs

One explanation for our results is that students are updating their beliefs about the value of each major. Prior to taking a course, students might have biased beliefs or a high degree of uncertainty (that is, diffuse priors) about the value of certain majors and that taking a course (or at least part of a course) corrects beliefs or resolves uncertainty. There

31. Specifically, students state preferences for branches and locations and are then assigned in order of their Order of Merit List (OML) ranking, a ranking that is 55 percent academic GPA, 30 percent military GPA, and 15 percent physical fitness. Students can increase their chances of assignment to a branch or location by committing to serve additional years, but these additional service slots are also given out in order of OML.

is considerable evidence that individuals have biased beliefs about important aspects of college majors.[32] If students have biased initial beliefs, it is possible that the treatment could lead students to update their beliefs and change their major choices systematically.

However, there is a potential challenge to biased beliefs explaining our results. Since we find positive effects of first-semester assignment on choosing a corresponding major in each of the four randomly assigned courses in sophomore year, a biased-belief explanation would suggest students are systematically biased against American Politics, Economics, Geography, and Philosophy majors and, on average, systematically biased toward other majors. While these patterns are possible, it may be unlikely given these four subjects are topically distinct and attract significantly different types of students to the majors (see Online Appendix Table A.8).

Another possible explanation for our results is that students are uncertain about the value of majors they have not experienced (that is, diffuse priors) and are unlikely to maximize their expected utility by choosing majors they have not yet experienced. Research suggests that students are uncertain about the returns to college and college majors prior to exposure (for example, Zafar 2011; Eide and Waehrer 1998; Stange 2012) and that students are responsive to new information about majors (Zafar 2011; Stinebrickner and Stinebrickner 2013; Arcidiacono et al. 2016). In some situations, resolving uncertainty about a major may increase the probability that students select that major (see Online Appendix D for an example).

Whether students have biased or unbiased beliefs, an implication of updating beliefs is that the direction of the effect of first-semester assignment likely depends on whether the course positively or negatively affects the anticipated value of a corresponding major. Specifically, students would be more likely to choose a particular major if they receive information that increases their anticipated value of that major and would be less likely to choose that major if they receive information that reduces their anticipated value of that major. While we are unable to observe how students update their valuations of majors, we are able to collect data on individual course evaluations and performance. If the effects of first-semester assignment are driven by students updating their beliefs after having a high degree of uncertainty about a major, then we hypothesize that students who take a course in which they give a high overall evaluation score or receive a high grade (relative to their other evaluations and grades) will be more likely to choose a corresponding major, and students who take a course in which they give a low overall evaluation score or receive a low grade will be less likely to choose a corresponding major.

To test formally whether the quality of experience influences the effect of first-semester assignment, we first create quartiles of aggregate instructor course evaluation scores, within-student overall course evaluations, and within-student performance (measured by course grades).[33] We then estimate Equation 1 for each quartile of experience. This estimation strategy compares students that are having a high- (or low-) quality experience in the semester they initially choose a major with students who will eventually have a high- (or low-) quality experience in the following semester.

32. For example, Betts (1996) and Wiswall and Zafar (2014) find that students have biased beliefs about the earnings distribution across majors, and Stinebrickner and Stinebrickner (2013) find that students are systematically overconfident about their abilities in STEM courses.

33. For the within-student quartiles of course evaluations and performance, we include all courses students take in their first three semesters along with the four treatment courses in this calculation. A student's highest quartile grades are 1.2 grade points higher than their lowest quartile grades, on average. This is roughly equivalent to the difference between an A and B– or the difference between a C+ and a D.

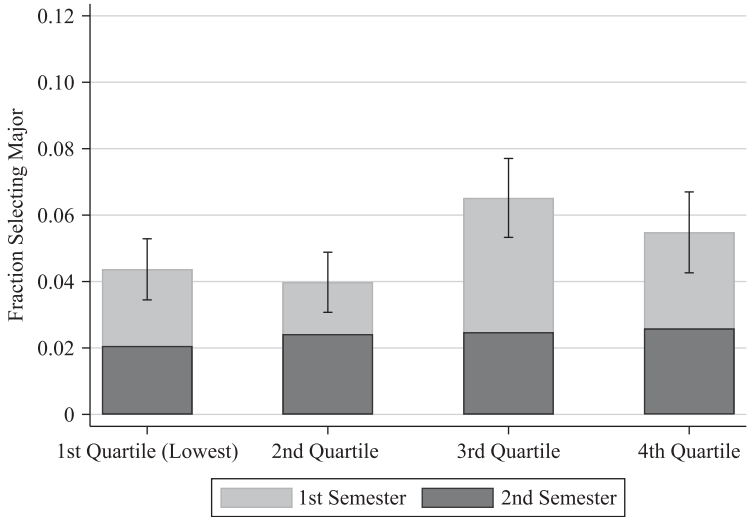

Figure 7

Effects by Instructor Course Evaluation Quartile

Notes: Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to Column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. Course evaluation quartiles are constructed within year and course. The dark bar shows the fraction of students who are assigned a course in the second semester of their sophomore year and select a corresponding major. The light bar adds the estimated effect of first-semester assignment on major choice (that is, baseline mean + first-semester effect). The whiskers represent the 95 percent confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figures 7, 8, and 9 report the results of this approach. In Figure 7, we find that assignment to a first-semester course has a positive effect on choosing a corresponding major, regardless of whether students are assigned to an instructor in the first (lowest), second, third, or fourth (highest) quartile of overall student evaluations. In Figure 8, we find that assignment to a first-semester course also has a positive effect regardless of the whether the student evaluated a course positively or negatively relative to the other courses they had taken. Although students in the top quartile are approximately three times as likely to choose the corresponding major than students in the bottom quartile, in percentage terms, the effect of having a first-semester course is similar across quartiles.

Similar to Figure 8, in Figure 9, we show that assignment to a first-semester course has a positive effect on choosing a corresponding major, regardless of whether a student performs well or poorly in the course.[34] Again, although students in the top quartile are

34. One caveat is that the timing of courses and major choice might affect the composition of the quartiles of within-student performance. In particular, if declaring a major prior to taking a related course decreases the probability that the course is in the bottom quartile of within-student performance, our results would be biased

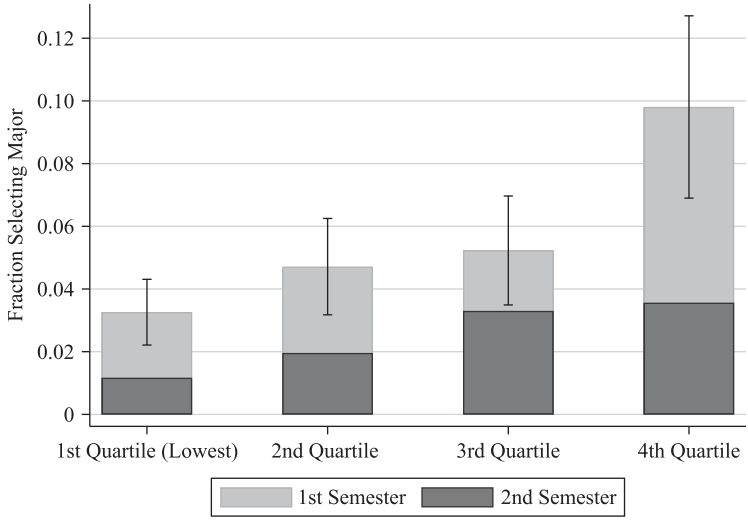

Figure 8

Effects by Within-Student Course Evaluation Quartile

Notes: Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to Column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. Within-student course evaluation quartiles are constructed from all students who complete at least four course evaluations among American Politics, Economics, Geography, Philosophy, required freshman courses, or required first-semester sophomore courses. The dark bar shows the fraction of students who are assigned a course in the second semester of their sophomore year and select a corresponding major. The light bar adds the estimated effect of first-semester assignment on major choice (that is, baseline mean + first-semester effect). The whiskers represent the 95 percent confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

approximately four times as likely to choose the corresponding major compared to students in the bottom quartile, in percentage terms, the effect of having a first-semester course is similar across the quartiles. Even among student–course observations in the bottom quartiles of both own performance and own evaluations, first-semester assignment increases the probability that students select a corresponding major by 0.92 percentage points, or 252 percent (p-value < 0.05).[35]

A prediction of the updating model is that the effect of first-semester assignment would likely be positive for students who have better-than-anticipated experiences

toward finding positive effects in the bottom quartile of within-student performance. Since students declare majors near the beginning of the first semester of sophomore year, this possible type of compositional difference may be negated or even reversed by first-semester students increasing their effort immediately after declaring a major.

35. This estimate comes from a separate regression of major choice on first-semester assignment among students who both receive a bottom-quartile within-student grade and give a bottom-quartile within-student evaluation.

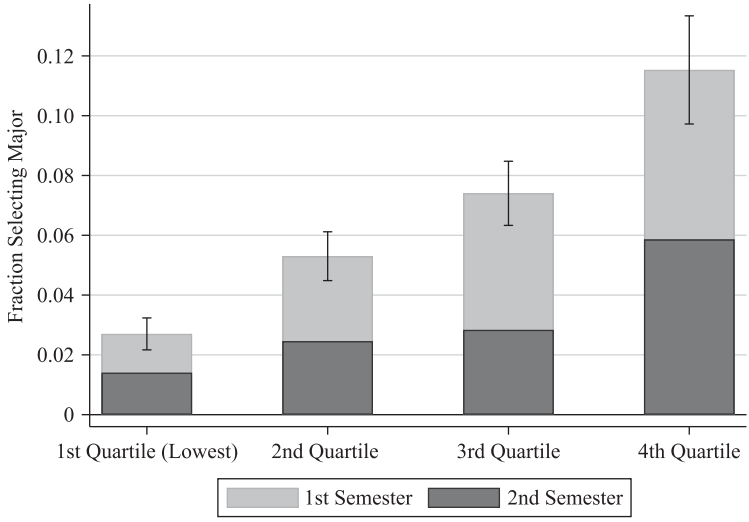

Figure 9

Effects by Within-Student Performance Quartile

Notes: Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to Column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. Within-student course performance quartiles are constructed from grades in American Politics, Economics, Geography, Philosophy, required freshman courses, or required first-semester sophomore courses.The dark bar shows the fraction of students who are assigned a course in the second semester of their sophomore year and select a corresponding major. The light bar adds the estimated effect of first-semester assignment on major choice (that is, baseline mean + first-semester effect). The whiskers represent the 95 percent confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

and negative for students who have worse-than-anticipated experiences. However, our results in Figures 7, 8, and 9 show that the effects of first-semester assignment are positive among all students, regardless of the measured quality of their experiences. A caveat is that courses are likely to provide students with information about the value of a major that is not captured fully by performance and course evaluations. If the value of the unobserved information is negatively correlated with course evaluations and grades, then it is possible that the effects of first-semester assignment could be driven by an updating model. However, within-student performance and evaluations are strong predictors of major choice, and it is unclear what types of information would be negatively correlated with these measures. Altogether, the results shown in Figures 7, 8, and 9 suggest that updating beliefs may play a limit role in explaining these results.[36]

36. In Online Appendix Figures A.4, A.5, and A.6 we examine whether assignment to first-semester courses affects graduating major across quartiles of instructor course evaluations, own course evaluations, and own performance. Our results are broadly consistent with Figures 7, 8, and 9. Although less precise, we generally find positive effects of first-semester assignment on graduating major regardless of whether students have a positive or negative experience. Specifically, across the three sets of quartiles in Online Appendix Figures A.4, A.5, and A.6

2. Ambiguity aversion

While a response to information may be unlikely to lead students who receive poor grades or give a negative course evaluation to become more likely to major in a corresponding subject, other explanations could predict this response. One such explanation is that students may be averse to ambiguity (Fox and Tversky 1995), or prefer majors with clear prospects to those with vague prospects.[37] It is possible that assignment to a course significantly reduces the ambiguity of a major's value. If students are sufficiently ambiguity averse, then assignment to a first-semester course may increase the probability of choosing a corresponding major, even among students who perform poorly or give the course negative ratings. If first-semester effects are driven by ambiguity aversion, then experiences that reduce the ambiguity of the value of a major, such as previously taking a college-level course in a subject, would likely reduce the magnitude of first-semester effects.

For academic years 2007–2015, we observe whether students took a high school AP course in American Politics (US Government & Politics), Economics (Macroeconomics or Microeconomics), or Geography (Human Geography). During this period, approximately 8 percent of students took AP US Government & Politics, 3 percent took AP Macroeconomics or Microeconomics, and 2 percent took AP Human Geography. However, taking and passing an AP test in a subject does not exempt students from a course requirements at West Point. We hypothesize that if the effects of first-semester assignment on major choice operates through ambiguity aversion, then the effects may be attenuated among students who have taken a high school AP course in the same subject. To estimate whether students exposed to AP courses in a subject respond differently to first-semester assignment, we estimate the following equation:

$$(2)\quad Y_{icjt} = \beta_1 T_{ict} + \beta_2 AP_{ic} + \beta_3 T * AP_{ict} + \delta_1 X_i + \delta_2 \frac{\sum_{k \neq i} X_{kcts}}{n_{cts} - 1} + \delta_3 R_{it} + \gamma_c + \phi_j + \lambda_t + \varepsilon_{cjt}$$

where Y_{icjt} is an indicator of whether individual i in course c with professor j in year t chooses to major in a corresponding subject area, T_{ict} is an indicator of whether the course is assigned in the first semester of a student's sophomore year, AP_{ic} is an indicator of whether the individual had taken an AP course in the subject area while in high school, and T^*AP_{ict} is the interaction between first-semester treatment and whether a student has taken a related AP course. All other variables are as described in Equation 1.

We report the results of this estimation in Panel A of Table 5.[38] In contrast to the prediction of ambiguity aversion, it does not appear that previously taking a high school

(12 estimates), we find positive point estimates among 11/12 quartiles examined and statistically significant positive ($p < 0.05$) effects for 9/12 quartiles.

37. Ambiguity research focuses the distinction between measurable uncertainty and unmeasurable uncertainly (Knight 1921). As discussed by Ellsberg (1961), individuals prefer gambles with clearly defined probabilities to gambles with ambiguous probabilities with the same expected value. In Ellsberg's canonical example, an individual is told Urn I has 100 red and black balls of an unknown ratio and Urn II has exactly 50 red and 50 black balls. An individual can choose a color and an urn, and, if that color is drawn, they win a sum of $100. In this setup, many individuals paradoxically prefer to draw for red from Urn II than red from Urn I *and* prefer to draw for black from Urn II than black from Urn I. Fox and Tversky (1995) expand upon this work and find that people are willing to pay more for gambles with clear probabilities than gambles with vague probabilities with the same expected values.

38. In Panel B of Table 5, we estimate whether first-semester assignment affects the likelihood of graduating in a corresponding major deferentially among those with and without prior AP course experience. In Column 1

Table 5
Prior Advanced Placement (AP) Course, Semester Order, and Major

	All Courses	American Politics	Economics	Geography
Panel A: Initial Major Choice				
First term	0.0314***	0.0152***	0.0397***	0.0478***
	(0.0036)	(0.0034)	(0.0067)	(0.0072)
Prior HS course	0.0206**	0.0114	0.0270	–0.0010
	(0.0098)	(0.0098)	(0.0269)	(0.0173)
Prior HS course × First term	–0.0002	–0.0049	0.0634	–0.0217
	(0.0163)	(0.0161)	(0.0487)	(0.0313)
N	17,775	5,784	5,784	5,784
R^2	0.0749	0.0814	0.1079	0.0719
Control group dependent variable mean	0.026	0.012	0.046	0.029
Demographic controls	Y	Y	Y	Y
Peer demographic controls	Y	Y	Y	Y
Teacher FE	Y	Y	Y	Y
Schedule roster FE	Y	Y	Y	Y
Panel B: Graduating Major				
First term	0.0142***	0.0078**	0.0176***	0.0234***
	(0.0037)	(0.0032)	(0.0066)	(0.0080)
Prior HS course	0.0420***	0.0227*	0.0928**	0.0090
	(0.0127)	(0.0121)	(0.0367)	(0.0265)
Prior HS course × First term	–0.0269	–0.0143	–0.0402	–0.0430
	(0.0175)	(0.0173)	(0.0503)	(0.0362)
N	17,775	5,784	5,784	5,784
R^2	0.0645	0.0715	0.0897	0.0654
Control group dependent variable mean	0.035	0.014	0.061	0.049
Demographic controls	Y	Y	Y	Y
Peer demographic controls	Y	Y	Y	Y
Teacher FE	Y	Y	Y	Y
Schedule roster FE	Y	Y	Y	Y

Notes: Significance: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Each specification represents results for a regression where the independent variable is being assigned to a course in the first of two semesters (fall vs. spring semester) in students' sophomore year. The corresponding AP course for American Politics is AP US Government & Politics, the corresponding AP courses for Economics are AP Microeconomics and AP Macroeconomics, and the corresponding AP course for Geography is AP Human Geography. AP test scores are available for sophomore students between 2007 and 2015. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. All specifications include an indicator for being a recruited athlete and for the year, with 2007 being the omitted category. Robust standard errors are clustered at the individual and section-by-year levels.

AP course in the corresponding subject attenuates the effect of first-semester assignment on major choice. Column 1 of Panel A shows that although students who have taken a corresponding AP course are approximately 2.1 percentage points more likely to select a major related to a course, the small and insignificant interaction effect (–0.02 percentage points) does not suggest attenuation in the effect of first-semester assignment on initial major choice for those who have taken an AP course.[39] However, the estimates on the interaction effect are substantially underpowered, and we would not be able to detect differences less than 3.2 percentage points (or approximately the size of the main effect). Columns 2–4 estimate the interaction between first-semester assignment and prior AP experience separately for American Politics, Economics, and Geography. While these subject-specific results are even less precise, they also show that the effects of first-semester assignment do not significantly differ by prior AP experience. To the extent that taking an AP course in a subject reduces ambiguity of a major, the results in Table 5 do not support an ambiguity aversion explanation for our results.[40]

3. Exposure to majors

Another potential explanation for the first-semester effect is that instead of evaluating all feasible options when choosing a major, a student might only consider majors to which they have been exposed. Researchers in marketing and more recently in economics often refer to the set of choices an individual evaluates as the *consideration set* (Eliaz and Spiegler 2011; Nedungadi 1990; Manzini and Mariotti 2014), which might be smaller than the choice set. If students (or some students) begin with consideration sets of majors that exclude American Politics, Economics, Geography, or Philosophy, then even negative experiences that expose students to a subject could expand students' consideration sets and increase the probability that they choose a corresponding major (Dawes and Brown 2002). While we are unable to observe students' consideration sets directly, we can examine whether our results differ by whether students have been previously exposed to a subject by having taken a high school advanced placement (AP) test in the topic or having expressed interest in a major prior to attending West Point. To the degree that students have incomplete consideration sets, taking an AP course related to a major or expressing interest in that major are likely to increase the probability that the major enters a student's consideration set and reduce the effects of semester order on major choice.

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of Panel B, the coefficient on *AP*×*First Semester* estimates that the effect of first-semester assignment on graduating is 2.7 percentage points lower among those with prior AP experience than those with no AP experience. We find similar results for individual courses in Columns 2–4. While the results have large standard errors such that the estimate on the interaction term is statistically insignificant and we are unable to rule out even large difference between students with and without AP experience, these results suggest that those with AP experience who are assigned to a second-semester course eventually choose a corresponding major at similar or even higher rates than those assigned a first-semester course.

39. If estimated separately, the effect of first-semester assignment on those with AP course experience is imprecisely estimated (a 2.8 percentage point increase, p-value = 0.155) but similar in magnitude to the effects among students who have not had AP courses (a 3.1 percentage point increase p-value < 0.01).

40. As noted earlier, taking and passing an AP course does not exempt students from course requirements at West Point, but a potential concern is that the effect among AP students is driven students who had poor AP instructors and were not exposed to the relevant subject matter. However, in Online Appendix Table A.9, we interact semester order with scoring the top two potential scores on an AP exam (4 and 5) with semester order and find no evidence of attenuation of the semester order effect among these high performers.

While imprecisely estimated, we do not find evidence that exposure to a subject through having taken a high school AP courses attenuates the effect of first-semester assignment on major choice in Table 5. While AP test-taking may be a reasonable measure of prior exposure, survey data on student interest in majors may provide even better evidence on what majors are in a student's consideration set. During the summers of 2002–2009, all incoming freshman completed a survey that included questions about their interest in certain majors.[41] Students appear to take the survey seriously since their answers correlate strongly with major choice (see Table 6). If the effects of first-semester assignment are driven by exposure effects, then the effects may be attenuated among students who expressed prior interest in majoring in a subject. We test this hypothesis using a similar approach as outlined in Equation 4, replacing AP_{ic} with a binary variable for prior interest in the major obtained from the freshman survey.

In Column 1 of Table 6, we report the results of this estimation for all majors. We find that the coefficient on the interaction term is marginally significant at 2.54 percentage points. This indicates that for students who expressed interest in a major, the effect of having a first-semester course on choosing a corresponding major is not smaller, but twice as large (p-value < 0.10). This finding is in the opposite direction of what an exposure explanation would predict. However, similar to Table 5, the estimates on the interaction effect are substantially underpowered, and we would not be able to detect differences less than 2.7 percentage points (or approximately the size of the main effect). In Columns 2–5 of Table 6, we report the estimates by subject. We find that a positive interaction effect between prior interest and first-semester assignment in American Politics and Geography and no significant interaction effect between prior interest and first-semester assignment in Economics and Philosophy. Altogether, we do not find evidence to support the exposure mechanism in either the full sample or course-specific estimates, although this evidence is limited by the imprecision of the estimates.

4. Availability bias

In our discussion of updating beliefs and exposure effects, we made the implicit assumption that individuals optimally weigh past and present experiences when evaluating a choice. This, however, might not be the case. Research in economics and psychology suggests that individuals weigh experiences based on when they occur. For example, behavioral economic models, such as projection bias and present-biased preferences,[42] suggest that individuals overly value contemporaneous information and experiences when making decisions. Recency (that is, how recently a memory was considered) and associativeness (that is, how similar a memory is to current events) have also been

41. Two questions relevant to our research question are: (1) Which one of the following Humanities/Military Arts and Sciences/Military Affairs/Public Affairs areas are you most interested in? (a) Art, Literature, and Philosophy, (b) Behavioral Sciences (e.g. Leadership, Psychology, Sociology, etc.), (c) Foreign Languages, (d) Geography, (e) History, (f) No interest in Humanities/Military Arts and Sciences/Military Affairs/Public Affairs, (g) None of the above and (2) Which one of the following Humanities/Military Arts and Sciences/Military Affairs/Public Affairs areas are you most interested in? (a) Law, (b) Management, (c) Military arts & science/Military Affairs, (d) Political Science, (e) Economics, (f) No interest in Humanities/Military Arts and Sciences/Military Affairs/Public Affairs, (g) Answered Question 12 above.

42. See Loewenstein, O'Donoghue, and Rabin (2003) for projection bias and Laibson (1997) and O'Donoghue and Rabin (1999) for present-biased preferences.

Table 6
Prior Interest in Subject, Semester Order, and Major

	All Courses	American Politics	Economics	Geography	Philosophy
Panel A: Initial Major Choice					
First semester	0.0254***	0.0079**	0.0451***	0.0513***	0.0043
	(0.0029)	(0.0038)	(0.0065)	(0.0077)	(0.0038)
Prior interest	0.0652***	0.0189**	0.1208***	0.0594**	0.0632***
	(0.0091)	(0.0077)	(0.0222)	(0.0256)	(0.0212)
Prior interest × First semester	0.0254*	0.0515***	–0.0097	0.0806*	0.0348
	(0.0138)	(0.0153)	(0.0329)	(0.0478)	(0.0328)
N	22,517	5,455	5,458	5,457	5,458
R^2	0.0799	0.0854	0.1464	0.0953	0.0971
Control group dependent variable mean	0.026	0.012	0.046	0.029	0.016
Demographic controls	Y	Y	Y	Y	Y
Peer demographic controls	Y	Y	Y	Y	Y
Teacher FE	Y	Y	Y	Y	Y
Schedule roster FE	Y	Y	Y	Y	Y

(*continued*)

Table 6 (*continued*)

	All Courses	American Politics	Economics	Geography	Philosophy
Panel B: Graduating Major					
First semester	0.0135***	0.0008	0.0293***	0.0294***	0.0006
	(0.0031)	(0.0037)	(0.0069)	(0.0086)	(0.0035)
Prior interest	0.0715***	0.0283***	0.1238***	0.0462*	0.0871***
	(0.0093)	(0.0094)	(0.0228)	(0.0253)	(0.0238)
Prior interest × First semester	0.0202	0.0431***	–0.0098	0.0785	0.0112
	(0.0138)	(0.0162)	(0.0330)	(0.0479)	(0.0345)
N	22,517	5,455	5,458	5,457	5,458
R^2	0.0732	0.0771	0.1301	0.0843	0.0902
Control group dependent variable mean	0.035	0.014	0.061	0.049	0.018
Demographic controls	Y	Y	Y	Y	Y
Peer demographic controls	Y	Y	Y	Y	Y
Teacher FE	Y	Y	Y	Y	Y
Schedule roster FE	Y	Y	Y	Y	Y

Notes: Significance: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Each specification represents results for a regression where the independent variable is being assigned to a course in the first of two semesters (fall vs. spring semester) in students' sophomore year. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. Prior interest in a subject is collected from a survey administered in the summer prior students' freshman year between 2002 and 2009. Interest in subjects is determined from the responses to the following two questions: (1) Which one of the following Humanities/Military Arts and Sciences/Military Affairs/Public Affairs areas are you most interested in? (a) Art, Literature, and Philosophy, (b) Behavioral Sciences (for example, Leadership, Psychology, Sociology, etc.), (c) Foreign Languages, (d) Geography, (e) History, (f) No interest in Humanities/Military Arts and Sciences/Military Affairs/Public Affairs, (g) None of the above and (2) Which one of the following Humanities/Military Arts and Sciences/Military Affairs/Public Affairs areas are you most interested in? (a) Law, (b) Management, (c) Military arts & science/Military Affairs, (d) Political Science, (e) Economics, (f) No interest in Humanities/Military Arts and Sciences/Military Affairs/Public Affairs, (g) Answered Question 12 above. All specifications include an indicator for being a recruited athlete and for the year, with 2003 being the omitted category. Robust standard errors are clustered at the individual and section-by-year levels.

identified as contributors to how easily experiences are recalled.[43] Finally, studies from psychology suggest that individuals exhibit availability bias or conflate availability (that is, how readily a choice comes to mind) and the value of a choice.[44] We more formally outline how we conceptualize availability bias in our context in Online Appendix B.

It is possible that being assigned a course in the semester students select a major increases the availability of a corresponding major. If students experience availability bias, then assignment to a first-semester course is likely to increase the probability that they select a corresponding major. In prior results, we find that assignment to a course in the semester major decisions are made (that is, first semester of sophomore year) increases the probability that students select a corresponding major regardless of whether (i) they have positive or negative course experiences, (ii) have already taken a course in the subject, or (iii) expressed interest in the major prior to taking a corresponding course. Since assignment to a course in the first semester of sophomore year is likely to increase the availability of a major, regardless of whether course experiences are positive or whether students had prior experience with or interest in a major, availability bias can potentially explain each of these results.

Because recency likely increases the availability of a choice (Mullainathan 2002), availability bias would also predict that the more recently a student has experienced a major, the more likely the student is to choose it. In contrast, responses to new information and exposure effects predict recency would likely have little effect on choices as long as recency is unrelated with the information a student receives. To investigate whether recency increases the likelihood that students select a major, we examine the patterns of major choices corresponding to two courses assigned in either the first or second semester of students' freshman year. During freshman year, students are either assigned to take computer science in the first semester and psychology in the second semester, or the same courses in the opposite order. Similar to sophomore courses, the order of these courses is exogenously assigned by the registrar's office. However, unlike sophomore courses, which are randomly assigned, the registrar's office assigns students to psychology in the first semester if they believe they will struggle in computer science. The registrar's office bases this on the student's overall academic readiness score,[45] Math SAT score, and assignment to a remedial math course.[46] In practice, higher-performing students are generally assigned to computer science first, and weaker students are assigned to psychology first. Since the order of courses is assigned based on students' observable characteristics, a balance test of characteristics across freshman course order fails (see Online Appendix Table A.10). Although the balance across observable characteristics fails, we estimate the same specification outlined in Equation 1 with one modification; we interact demographic characteristics with course assignment.[47] Since

43. See Mullainathan (2002); Gennaioli and Shleifer (2010); Agarwal et al. (2011); Bordalo, Gennaioli, and Shleifer (2017).

44. See Menon and Raghubir (2003); Tversky and Kahneman (1973); Tybout et al. (2005); Schwarz et al. (1991).

45. This is a composite of high school performance and standardized test scores.

46. We requested the assignment rules from the registrar's office, but it was unable to recover the assignment rules for our data. We can confirm that Math SAT, readiness score, and assignment to remedial math all correlate strongly with assignment, but we are unable to identify clear assignment rules using these variables.

47. We do this to account for the fact that assignment to courses is based on demographics, which are likely to affect majoring in Computer Science and Psychology differently. For example, a strong verbal SAT score might decrease the probability that students major in Computer Science but increase the probability that they major in Psychology.

Table 7
Freshman Year Semester Order and Major Choice

	(1)	(2)	(3)	(4)	(5)
Panel A: Initial Major Choice					
First semester	–0.0012	–0.0051**	–0.0049**	–0.0047**	–0.0047**
	(0.0022)	(0.0023)	(0.0023)	(0.0023)	(0.0024)
N	25,563	25,563	25,563	25,563	25,562
R^2	0.0132	0.0235	0.0242	0.0331	0.0996
Control group dependent variable mean	0.033	0.033	0.033	0.033	0.033
Demographic controls	N	Y	Y	Y	Y
Peer demographic controls	N	N	Y	Y	Y
Teacher FE	N	N	N	Y	Y
Schedule roster FE	N	N	N	N	Y
Panel B: Graduating Major					
First semester	0.0025	–0.0013	–0.0011	–0.0011	–0.0009
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0024)
N	25,563	25,563	25,563	25,563	25,562
R^2	0.0111	0.0222	0.0228	0.0310	0.0989
Control group dependent variable mean	0.030	0.030	0.030	0.030	0.030
Demographic controls	N	N	Y	Y	Y
Peer demographic controls	N	N	N	Y	Y
Teacher FE	N	Y	Y	Y	N
Schedule roster FE	N	N	N	N	Y

Notes: Significance: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Each specification represents results for a regression where the independent variable is being assigned to a course in the first of two semesters (fall vs. spring semester) in students' freshman year. Estimates include student–course observations for IT/Computer Science and Psychology courses. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. All specifications include an indicator for being a recruited athlete and for the year, with 2003 being the omitted category. Robust standard errors are clustered at the individual and section-by-year levels.

students are unable to influence the order of these courses, and the registrar is making assignment decisions based on the same demographics available to us, then estimating Equation 1 with course-specific demographic controls may be a reasonable approximation of the causal effect of semester order on major choice in freshman year. Since the registrar's office positively selects students into first-semester classes in freshman year, not fully controlling for observable characteristics used by the registrar's office is likely to upwardly bias our first-semester estimates and lead us to underestimate any recency effects.

Results of this estimation appear in Table 7. In Column 1 of Panel A, we find a negative, but insignificant correlation between first-semester assignment on initial major

choice. However, when we control for demographic characteristics in Column 2 of Panel A, we find that assignment to a course in the first semester of freshman year correlates with a 0.5 percentage point, or 16 percent, drop in the probability that students select a corresponding major (p-value < 0.05). This effect remains constant in magnitude and significance as peer demographics, instructor, and freshman year schedule fixed effects are added in Columns 3, 4, and 5 of Panel A, respectively. These results suggest that the semester timing of courses matters in semesters other than the semester in which students are required to select a major. In Panel B of Table 7, we estimate the effects of freshman course order on graduating major, and do not find a significant correlation between the order of freshman course assignment and graduating major. While the results in Table 7 should be interpreted more cautiously than our primary results given the nonrandom assignment to freshman courses, they do suggest that taking a course more recently (that is, second semester of freshman year compared to first semester of freshman year) increases the likelihood of initially choosing the corresponding major, but might not influence graduating major. Given recency is likely another source of availability, these freshman-year results provide additional support for availability bias.

B. Mechanisms for the Effect of Course Order on Graduating Major

In this section we explore why approximately half of the effect of semester assignment on initial major choice persists through graduation. To investigate these potential mechanisms, it is important to understand the process by which students switch majors. Students are able to switch majors by completing a major change form (see Online Appendix Figure E.1). This form requires two signatures and a one or two sentence description regarding why the student is changing majors. One signature is from the academic counselor of the "losing" department and one from the academic counselor of the "gaining" department. Students are permitted to switch as long as they are able to complete all required courses in their new major by the end of their senior year. Since all majors can be completed within two academic years, and students in the sample are unable to take major-oriented courses prior to their junior year, this requirement does not affect the choice to switch majors prior to the beginning of a student's junior year.[48]

If the only cost of switching majors is completing the major change form (that is, no implicit costs), then the administrative costs to switching are likely to be small. When switching costs are potentially negligible, and there are significant benefits to switching to a preferred major, updating beliefs, exposure effects, and models of salience and availability each predict that the imbalance of majors created by first-semester assignment should be negated or even reversed by graduation. Under an updating beliefs framework, by the end of sophomore year, students will have taken all four randomly assigned courses and updated their beliefs about the value of each of the four corresponding majors (compared to just two after the first semester of their sophomore

48. After students begin their junior year, however, switching does become significantly more difficult. This is because students are required to graduate within four years, all majors require at least 11 major-related courses, and the typical academic schedule only allows for 14 total major and elective courses during junior and senior years. Students who switch after the first semester of their junior year need the new department to count completed courses toward their new major, take an overloaded schedule of 18–21 credit hours, or both.

year). As long as the information content for each course is the same across semesters, an updating beliefs framework predicts no differences in graduating major between those assigned to APol/Geo and Econ/Phil in the first semester of sophomore year. Similarly, for exposure effects, students are exposed to all four courses by the end of their sophomore year (instead of just two). Therefore, students' consideration sets should not systematically differ by what set of courses a student was assigned in the first semester. Without differences in consideration sets and negligible switching costs, an exposure framework does not predict any differences in graduating major by first-semester assignment. Finally, models of availability and salience (including monotonic availability bias) often predict that the courses a student has taken most recently are likely to be the most available. If students are more likely to choose majors that correspond to courses that are more available, then they are more likely to choose majors they have experienced more recently. Therefore, models of availability and salience suggest that the effects of first-semester assignment may be reversed, and students may actually be more likely to graduate in majors that correspond to courses they are assigned in the second semester of their sophomore year.

In contrast to the predictions made by updating beliefs, exposure effects, and models of salience and availability, we find large, positive effects of first-semester assignment on graduating major. Students assigned to a first-semester section of a course are 1.38 percentage points, or 39 percent, more likely to graduate in a corresponding major (see Table 3). Despite the large effect on graduation major, this is less than half the size of the effect on initial major choice. The smaller effects on graduation compared to initial major choice are due to students both adding and dropping majors after their initial decision (see Table 4). Since first-semester assignment does affect graduating major, we explore why the effect of first-semester assignment persists through graduation.

One potential mechanism for why the effect persists through graduation is that switching costs are substantially larger than they appear. A potential cost of switching majors at many universities is that students begin taking courses related to their major early in their college experience, and switching majors might require additional time or effort. At USMA students are unlikely to take courses required for their major prior to their junior year, must take a full academic course load (15 or more credits) in each semester, and must graduate within four years. Therefore, switching majors prior to junior year is unlikely to increase the time or effort required to graduate. Furthermore, our results are unchanged when we include a fixed effect for sophomore course rosters, essentially comparing within students who take an identical set of courses in their sophomore year (see Column 5 of Table 3). Another potential cost that could prevent students from switching majors is that students may be reluctant to ask for the signatures required to switch majors. For example, most academic counselors are officers in the U.S. Army, and students may be reluctant to ask for the required signatures to switch majors. While this particular cost is possible, students interact with Army officers daily, and counselors typically have relatively low rank among Army faculty members. In addition, because USMA students attend small classes, have limited opportunities to leave campus, and regularly interact with instructors and students, they may be particularly susceptible to influence from faculty (Carrell, Page, and West 2010) and peers (Carrell, Fullerton, and West 2009). If faculty and peers encourage students to stay in their initially selected major, then this could contribute to the persistent effects of semester assignment on graduating major. Finally, there may be other psychological burdens

Table 8
Effects of Semester Order on Grades

	(1)	(2)	(3)	(4)	(5)
First semester	0.0167	0.0118	0.0083	0.0019	–0.0034
	(0.0126)	(0.0105)	(0.0107)	(0.0085)	(0.0085)
N	35,097	35,097	35,097	35,091	35,090
R^2	0.0001	0.1953	0.1965	0.2450	0.3257
Control group demographic controls	N	Y	Y	Y	Y
Peer demographic controls	N	N	Y	Y	Y
Teacher FE	N	N	N	Y	Y
Schedule roster FE	N	N	N	N	Y

Notes: Significance: $*p<0.10$, $**p<0.05$, $***p<0.01$. Each specification represents results for a regression where the dependent variable is normalized course grade and the independent variable is being assigned to a course in the first of two semesters (fall vs. spring semester) in students' sophomore year. Demographic controls include age, SAT math and verbal scores, USMA academic potential (CEER) score, and indicators for sex, race/ethnicity, prior military service, prior college experience, preparatory school attendance, and Division I athlete. All specifications include an indicator for being a recruited athlete and for the year, with 2003 being the omitted category. Robust standard errors are clustered at the individual and section-by-year levels.

that may arise from stitching majors due to unpleasant conversations with faculty, friends, and family or feeling like a failure for switching.

Another potential cost to switching majors is that students may perform better in first-semester courses. We explore whether there are differences in performance across semesters in Table 8 and find no evidence that grades differ between first and second semesters of sophomore year. In our preferred specification (Column 5), we can rule out effects of first-semester assignment on performance larger than 0.014 standard deviations. An effect of this size is unlikely to have a meaningful impact on major choice.

There are also at least two plausible behavioral explanations for the persistence of first-semester effects on college majors. First, students might be exhibiting a high degree of procrastination or present bias (Laibson 1997). After choosing a major based on first-semester courses, a student might discover that they prefer a different major. However, if they exhibit strong present-biased preferences, they might perceive the small temporary, but present, costs of switching as prohibitive to switching majors.

Another plausible behavioral explanation could be that students exhibit status quo bias. Once students select a major, they might experience psychological costs to switching majors. There may be several potential sources for this bias. For example, students might feel ownership of their initial choice and exhibit loss aversion (Kahneman, Knetsch, and Thaler 1991). Students may also avoid making decisions they might regret later.

Although we are unable to test for present bias or status quo bias, a broad literature has found evidence that individuals do not change their decisions even when they are likely to benefit significantly by doing so. For example, even when presented with significant financial gains, individuals often do not change their retirement savings (Madrian and Shea 2001), health insurance plans (Handle 2013), or mortgages (Keys, Pope, and Pope 2016).

V. Conclusion

We find that the timing of experiences can significantly affect decision-making. Timing might matter even when changes to timing are minor or seemingly unimportant. Specifically, we find that USMA students who are randomly assigned a course in the same semester they select a college major are more than 100 percent more likely to initially choose a major corresponding to that course than students assigned the same course in the following semester. While several explanations, including a response to new information, ambiguity bias, and exposure effects, can partially explain our results, the effect of timing on initial major choice aligns most closely with an availability bias framework.

Approximately half of the effect of semester timing persists through graduation, despite what appear to be low switching costs. For context, Haggag et al. (2018) examine several predictors of majors choice at USMA, and our effects on graduating majors are similar to a one standard deviation increase in course grades and a two standard deviation improvement in instructor evaluations. Furthermore, Haggag et al. (2018) replicate Carrell, Page, and West (2010) and estimate the effects of assignment to female instructors among female students in STEM courses selecting a corresponding STEM major at USMA. Our effects on graduating major are approximately double the magnitude of these effects. Our large effects relative to these other relationships suggest that semester timing is an important contributor to major choices.

To the extent that our results generalize to other colleges, our results imply that colleges' course schedule policies impact the distribution of college majors. Whether passively (by not changing course schedule policies) or actively (by changing course schedule policies), administrators cannot escape making decisions that likely influence the distribution of college majors at their school. Although it is difficult to know the optimal distribution of college majors at a given college, administrators could potentially change the distribution of college majors by requiring introductory courses in preferred fields (for example, STEM) to be taken in the semester students are most likely to select a major. While the individual welfare effects for students nudged into particular majors is unclear, these types of policies could be targeted towards underrepresented groups within various fields.

This work also has implications for choice settings outside of the college major decision. In many important choice environments, individuals draw on their experiences to inform their decisions. Our results suggest that the timing of these experiences matter and that individuals are likely to be biased toward choices they are experiencing at the time of the decision. For many choices, the timing of when something is experienced may be just as important as the experience itself.

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