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 the 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 over 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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1 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 influenced individuals' choices. In this paper, we examine how the timing of experiences influence 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.

[1] For example see: Altonji et al. (2012, 2014); Chevalier (2011); Hastings et al. (2013); Kirkeboen et al. (2016); Webber (2014); Patnaik et al. (2020)

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 major. Second, if students are ambiguity averse – preferring clear prospects to a 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 she is 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 paper relates to research in economics and psychology that documents how the timing of experiences influence how those experiences are weighed in the decision making process. Broadly, this paper 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 mind and the qualities of that good (e.g. Menon and Raghubir, 2003; Tversky and Kahneman, 1973; Tybout et al., 2005; Schwarz et al., 1991). This paper provides supportive evidence for models that incorporate availability by demonstrating that seemingly small changes in the

[2] For example, models of present-biased preferences (e.g. 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 (e.g. Loewenstein et al., 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.

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 et al., 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 (e.g Castleman et al., 2018), financial incentives (e.g Denning and Turley, 2017; Stange, 2015), and the gender and racial composition of instructors (e.g. Bettinger and Long, 2005; Carrell et al., 2010; Fairlie et al., 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

[3]Related studies include 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 et al. (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. (2017); Bordon and Fu (2015); Malamud (2010); Zafar (2011).

Section V we conclude.

2 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 4-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 5-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 et al., 2017). USMA admits approximately 10% 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% white, 9% Hispanic, 7% black, and 6% 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 selective liberal arts colleges, some characteristics are unique. Only 14% of USMA students are female, 18% have prior military service, 17% have prior college experience, 15% previously attended a military preparatory academy, 34.1% are Division I athletes,

[5]Our sample was constructed based on graduating year groups and includes 7 students who are sophomores in 2000, and 28 students in 2002. Our results are not sensitive to the exclusion of these students.

[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 9/14/2017.

[8]Source: https://www.usma.edu/admissions/SitePages/FAQ_Academics.aspx. Accessed 11/12/2018.

[9]Percentiles based on 2011 SAT score distributions. Source: http://media.collegeboard.com/digitalServices/pdf/SAT-Percentile_Ranks_2011.pdf. Accessed 12/11/2018.

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 independent of student characteristics. Within the years of the sample, students are required to declare a major in a 4-5 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

[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 4-5 weeks; opening between August 27 and September 11 and closing between September 29 and October 11.

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

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 defaulted students, the registrar fills sections to create roughly equal portions of students taking (1) APol/Geo in their first semester then Econ/Phil in their second and (2) Econ/Phil in their first semester then APol/Geo in their second. Of all students enrolled at USMA, 57% take one of these default combinations of courses. The remaining 43% 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 have a scheduling conflict that requires a different configuration.[16] Table A.10 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% 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 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

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

[15]e.g. 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.

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

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% level. We formally test whether semester assignment affects major choice as outlined below in the methods section.

[17]One concern is that expressed interest is uncorrelated with major choice. However, we find that student 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

3 Methods and Results

3.1 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:

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

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

[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 (a) having high academic qualifications or (b) 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 non-honors sections are treated as different courses.

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.[22]

3.2 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.[23]

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 (i.e., 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

[22] Including demographic and peer demographic controls tests whether variation in student characteristics across semesters and classrooms could explain our results. Including teacher fixed effects tests whether differences in the composition of teachers who teach first and second semester could explain our results. Finally, including a schedule roster fixed effect tests whether variation in student schedules during sophomore year (e.g. path dependency) is a possible mechanism for our findings.

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

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[24] 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 students (Appendix Table A.3) and conditional logit specifications (Appendix Table A.4).[25]

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 to 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. In Column 1 of Panel A of Table 4, 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 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).

One question is whether the main effects in Table 3 are driven by a particular course. In

[24]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.

[25]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 OLS estimates.

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.[26] 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 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,[27] with no discernible pattern in the effects. In Figure 4, more than half of the effect of first-semester assignment persists 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 significantly vary by sex, race, or academic ability. In 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 Appendix Table A.8, we find that the demographic characteristics of graduating majors in American Politics, Economics, Geogra-

[26] Appendix Table A.5 reports the results of Figures 3 and 4 numerically.

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

phy, 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, we explore whether assignment to either APol/Geo or Econ/Phil broadly affects the type of majors students select in Figure 6.[28] 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. 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.[29] First-semester assignment to APol/Geo might decrease the probability that students major in a language course by approximately 1 percentage point. These patterns on the broader selection of majors 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: (1) APol/Geo draws solely from Econ/Phil, and vice versa, (2) APol/Geo and Econ/Phil draw similarly from other majors because they are similar course bundles, or (3) first semester-courses draw broadly from various majors regardless of which courses are taken during the first semester.

[28]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.

[29]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.

3.3 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 et al., 2009; Sacerdote, 2001), student and instructor matches (Carrell et al., 2010; Hoffmann and Oreopoulos, 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 Appendix Figure A.3 shows that 64% of these USMA students keep the major they declare in their third semester, 29% of students switch majors in their fourth semester, and only 7% of students switch majors at any point after. In a sample of 401,314 first-time full-time students from 2000-2008 at 41 four year institutions, Venit (2016) finds that 65% of students make their last major declaration within in their first four semesters (i.e. do not switch after their fourth semester), 24% make their last major declaration during their fifth semester, and only 11% made their last major declaration after their fifth semester.

Perhaps more importantly for generalizability, are major decisions at USMA driven by similar considerations to those made at other institutions? While some of the factors influencing major choice at USMA may differ than those at other institutions (e.g. a 5 year

Army service commitment), we argue that USMA students face many of the same trade-offs as other students.[30] 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.[31] Second, a number of studies identify student-subject match as an important factor in major choice (e.g. Arcidiacono, 2004; Stinebrickner and Stinebrickner, 2013; Wiswall and Zafar, 2014). For USMA graduates, the assignment to both career type (branch) and first long-term assignment location is determined by a matching process that prioritizes those with high GPAs.[32] 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. Table A.9 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, Table A.9 shows most USMA graduates in the majors we consider (63%) leave the Army within 10 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%) – a path that is likely to be influenced by undergraduate choices. Finally, due to USMA's unique teaching model, 7% of USMA graduates from these majors, or 19% of those who stay in the Army at least 10 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

[30] See Patnaik et al. (2020) for a review.

[31] Similarly, Malgwi et al. (2005) find that interest in subject is the most important determinant of major choice.

[32] 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% academic GPA, 30% military GPA, and 15% 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.

are likely to be guided by the same concerns over tastes, ability, and long-run career goals as are other student choices.

4 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 difficult to reconcile with a response to new information or models of exposure. We then develop a simple framework of availability that fits 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 face small explicit cost to switching majors and that status quo bias might explain the persistence of the effects of semester assignment.

4.1 Mechanisms for the Effect of Course Order on Initial Major Choice

4.1.1 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 (i.e., 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 is considerable evidence that individuals have biased beliefs about important aspects of college majors. 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) finds that students are systematically overconfident about their abilities in STEM courses. 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 major 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 requires students to be 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 Appendix Table A.2).

Another possible explanation for our results is that students are uncertain about the value of majors they have not experienced (i.e., 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 (e.g. 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 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 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 formally test 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.

The results of this approach are reported in Figures 7, 8, and 9. 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 she had taken. Although students in the top quartile are approximately three 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 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 approximately

[33]For the within-student quartiles of course evaluations and performance, we include all courses students take in their first 3 semesters along with the 4 treatment courses in this calculation. A student's highest quartile grades are 1.2 grade-points higher than her 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.

[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 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.

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 should be positive for students who have better-than-anticipated experiences 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 are difficult to reconcile with updating beliefs.[36]

4.1.2 Ambiguity Aversion

While a response to information is 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

[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.

[36] In 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 Appendix Figures A.4, A.5, and A.6 (12 estimates), we find positive point-estimates among 11/12 quartiles examined and statistically significant positive ($p<0.05$) effects for 9/12 quartiles.

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% of students took AP US Government & Politics, 3% took AP Macroeconomics or Microeconomics, and 2% took AP Human Geography. Furthermore, 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 are likely to 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:

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

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

[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.

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] Despite the predictions of ambiguity aversion, we find no evidence that previously taking a high school AP courses 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] 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 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]

[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 of Panel B, the coefficient on $AP * FirstSemester$ suggests 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 these results are statistically insignificant, they 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 Appendix Table A.6 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.

4.1.3 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 she has 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.

Despite the predictions of the exposure model, we do not find evidence that 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 to 2009, all incoming freshman completed a survey that included questions about their interest in certain majors.[41] Students

[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*

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 should 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 the opposite of what an exposure explanation predicts. 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.

4.1.4 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 (e.g. Loewenstein et al., 2003) and present-biased preferences (e.g. Laibson, 1997; O'Donoghue and Rabin, 1999), suggest that individuals overly value contemporaneous information and experiences when making decisions. Recency (i.e., how recently a memory was considered) and associativeness (i.e., how similar a memory is to current events) have also been identified as contributors to how easily experiences are recalled (e.g. Mullainathan, 2002; Gennaioli and Shleifer, 2010; Agarwal et al., 2011; Bordalo et al., 2017). Finally, studies from psychology suggest that individuals exhibit availability bias or conflate availability (i.e., how readily a choice comes to mind) and the value of a choice (e.g. Menon and Raghubir, 2003; Tversky and Kahneman, 1973; Tybout et al., 2005; Schwarz et al., 1991). We more formally outline how we conceptualize availability bias in our context in Appendix B.

It is likely 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 (i.e., first semester of sophomore year) increases the probability that students select a corresponding major regardless of whether (1) they have positive or negative course experiences, (2) have already taken a course in the subject, or (3) 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 increases the availability of a choice (Mullainathan, 2002), availability bias also predicts 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 should have little effect on choices as long as recency is unrelated with the information a student receives. To determine if 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. 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,[42] Math SAT score, and assignment to a remedial math course.[43] 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 Table A.7). 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.[44] Since 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. 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

[42]This is a composite of high school performance and standardized test scores.

[43]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.

[44]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.

order of freshman course assignment and graduating major. Overall, our results in Table 7 suggest that taking a course more recently (i.e., 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. Since recency is another source of availability, these freshman-year results provide additional support for availability bias.

4.2 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 Appendix Figure D.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.[45]

If the only cost of switching majors is completing a simple form (i.e., no implicit costs), then the switching costs are likely to be small. When switching costs are negligible and there are non-negligible 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 fully or even reversed by graduation.

[45] 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.

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 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. As discussed in Section 3.2 and shown in Table 3, 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. Despite the large effect on graduation major, this is less than half the size of the effect on initial major choice. The smaller effects of first-semester assignment on graduation compared to initial major choice might be due to students either adding or dropping majors after their initial decision. Table 4 shows how semester assignment affects major add/drop patterns. In Panel A of Table 4, we report the effects of first-semester assignment on the probability of adding a major after the first semester of sophomore year is completed. In Column 1 of Panel A, we find that those assigned to a course in the first semester of sophomore year are 0.71 percentage points, or 39 percent, less likely than students assigned to a course in the second semester of sophomore year to add a corresponding major after the first semester of sophomore year is completed. In Columns 2-5 of Panel A, we estimate the effects of first-semester assignment on subsequently adding a major separately by subject. We find that first-semester assignment to Economics and Geography courses significantly decreases the probability that students add corresponding majors after the first semester of their sophomore year but has no significant effect on American Politics and Philosophy.

In Panel B of Table 4, we explore whether first-semester assignment affects whether students ever drop a corresponding major. In Column 1, we find that first-semester assignment increases the probability that students drop a major by 0.55 percentage points, or 137%. Columns 2-4 show that first-semester assignment increases the probability of dropping American Politics, Economics, and Geography, whereas Column 5 indicates that we do not observe any students dropping a Philosophy major in the sample. Overall, Table 4 suggests that the effects of first-semester assignment on major choice attenuate between the initial choice and graduation due to both adding and dropping patterns. However, the effects on major choice are not negated fully as predicted by updating beliefs, exposure effects, or models of salience and availability.

Since first-semester assignment does affect graduating major, we explore why the effect of first-semester assignment persists through graduation. One potential mechanism is that switching costs are actually prohibitive despite appearing to be low. 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. However, 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 sophomore course-roster fixed effect, essentially comparing 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.

Another potential cost to switching majors is that students may perform better in first-semester courses. However, 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 any 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 she prefers a different major. However, if she exhibits strong present-biased preferences, she 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 et al., 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 (Handel, 2013), or mortgages (Keys et al., 2016).

5 Conclusion

In this paper 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 over 100 percent more likely to initially choose a major corresponding to that course than students assigned the same course in the following semester. Approximately half of this effect persists through graduation, despite what appear to be very low switching costs. For context, Haggag et al. (2018) examines several predictors of majors choice at USMA and our effects on graduating majors are similar to a 1 standard deviation increase in course grades and a 2 standard deviation increase in instructor evaluations. Furthermore, Haggag et al. (2018) replicate Carrell et al. (2010) estimated effects of assignment to female instructors among female students in STEM courses selecting a corresponding STEM major at USMA and 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.

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. Additionally, the persistence of this effect to graduation is explained most easily by status quo bias.

To the extent that our results generalize to other colleges, our results imply that colleges' course schedule policies are not neutral and impact the distribution of college majors. As such, whether passively (by not changing course schedule policies) or actively (by change course schedule policies), administrators are making choices that influence the distribution of college majors at their school. College administrators should be aware that this policy lever exists and administrators are forced to make a choice over potential college major distributions either by defaulting into current course schedule policies or by making changes. Although it is difficult to know the optimal distribution of college majors at a give college, administrators can use this low-cost lever to move the distribution of college majors. Administrators could potentially change the distribution of college majors by requiring introductory courses in preferred fields to be taken in the semester students are most likely to select a major. If a university believes their optimal distribution would include more STEM majors, then it could increase STEM course requirements early in a students academic career, particularly when a student is choosing a major. However, the individual welfare effects for students nudged into particular majors is unclear. These types of policies could also be targeted towards underrepresented groups, such as women and minorities – again with unclear welfare implications for the nudged students.

This paper 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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Tables and Figures

Table 1: Summary Statistics

	Mean	Std. Dev.
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

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.

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	–	–

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.

Table 3: Effects of Semester Order on Major Choice

Panel A: Initial Major Choice	(1)	(2)	(3)	(4)	(5)
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	(1)	(2)	(3)	(4)	(5)
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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 6 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

Panel A: Add Major After 3rd Semester	All Courses	American Politics	Economics	Geography	Philosophy
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 3rd Semester	All Courses	American Politics	Economics	Geography	Philosophy
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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.

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

Panel A: Initial Major Choice	All Courses	American Politics	Economics	Geography
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	All Courses	American Politics	Economics	Geography
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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 2007-2015. 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.

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

Panel A: Initial Major Choice	All Courses	American Politics	Economics	Geography	Philosophy
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

Panel B: Graduating Major	All Courses	American Politics	Economics	Geography	Philosophy
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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 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 (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.* 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.

Table 7: Freshman Year Semester Order and Major Choice

Panel A: Initial Major Choice					
	(1)	(2)	(3)	(4)	(5)
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					
	(1)	(2)	(3)	(4)	(5)
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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.

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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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.

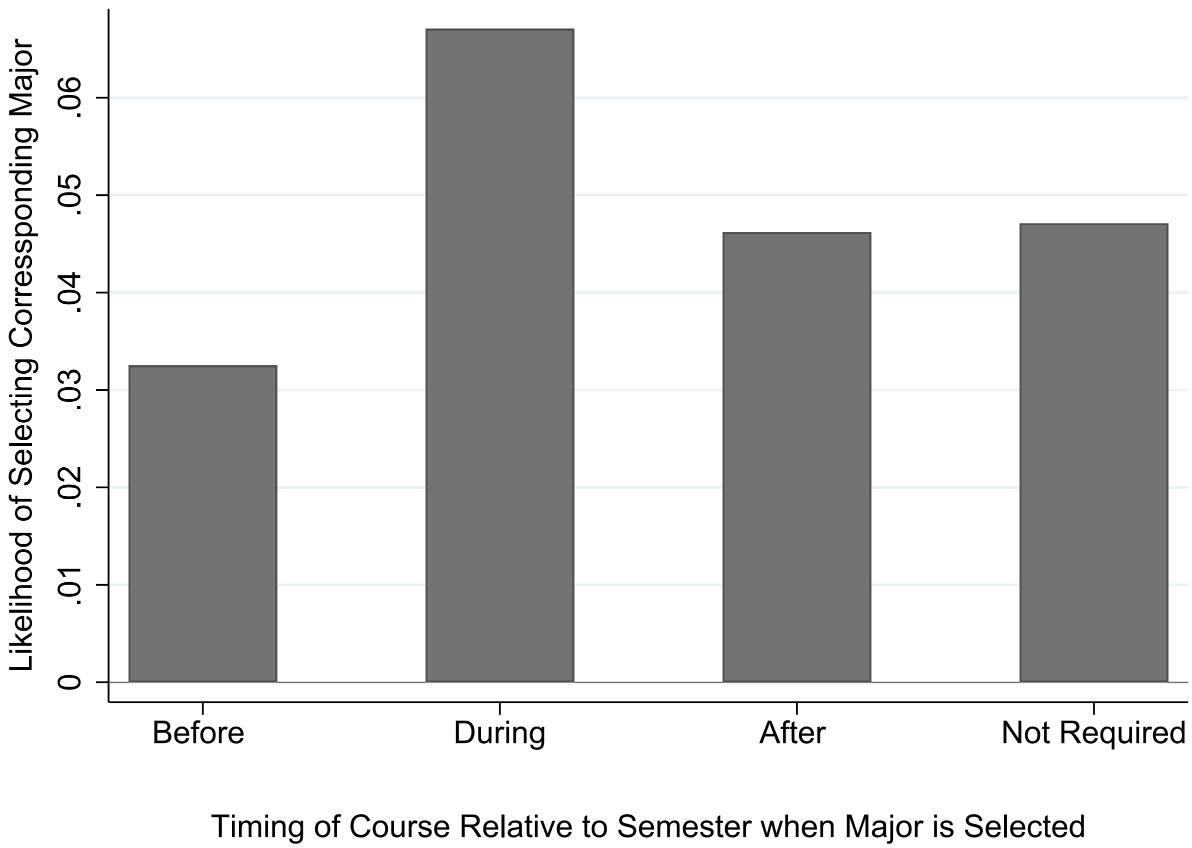
Figure 1: Typical USMA Schedule in First Two Years

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

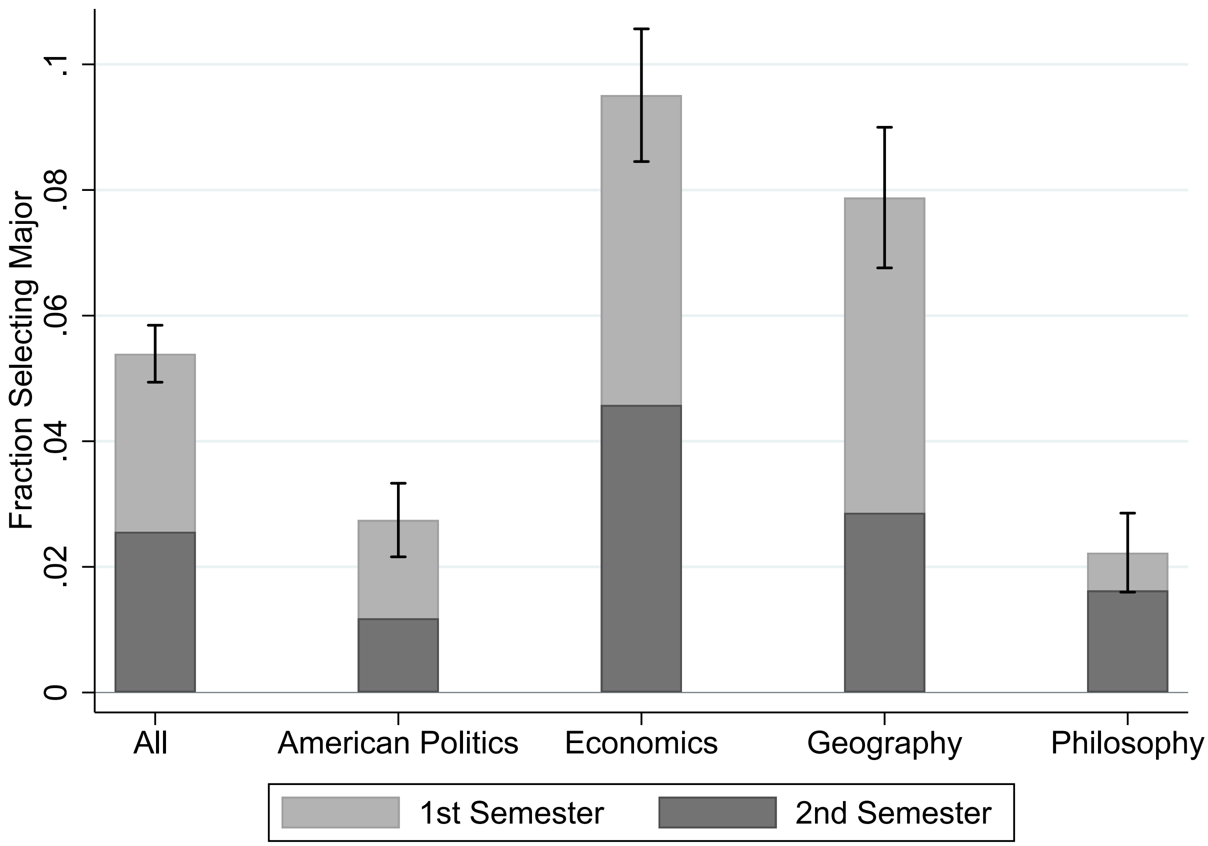
Courses highlighted in yellow may be assigned to students in either first or second semester of the respective year. Students must complete or test out of all courses listed.

Figure 2: Likelihood of Selecting a Corresponding Major



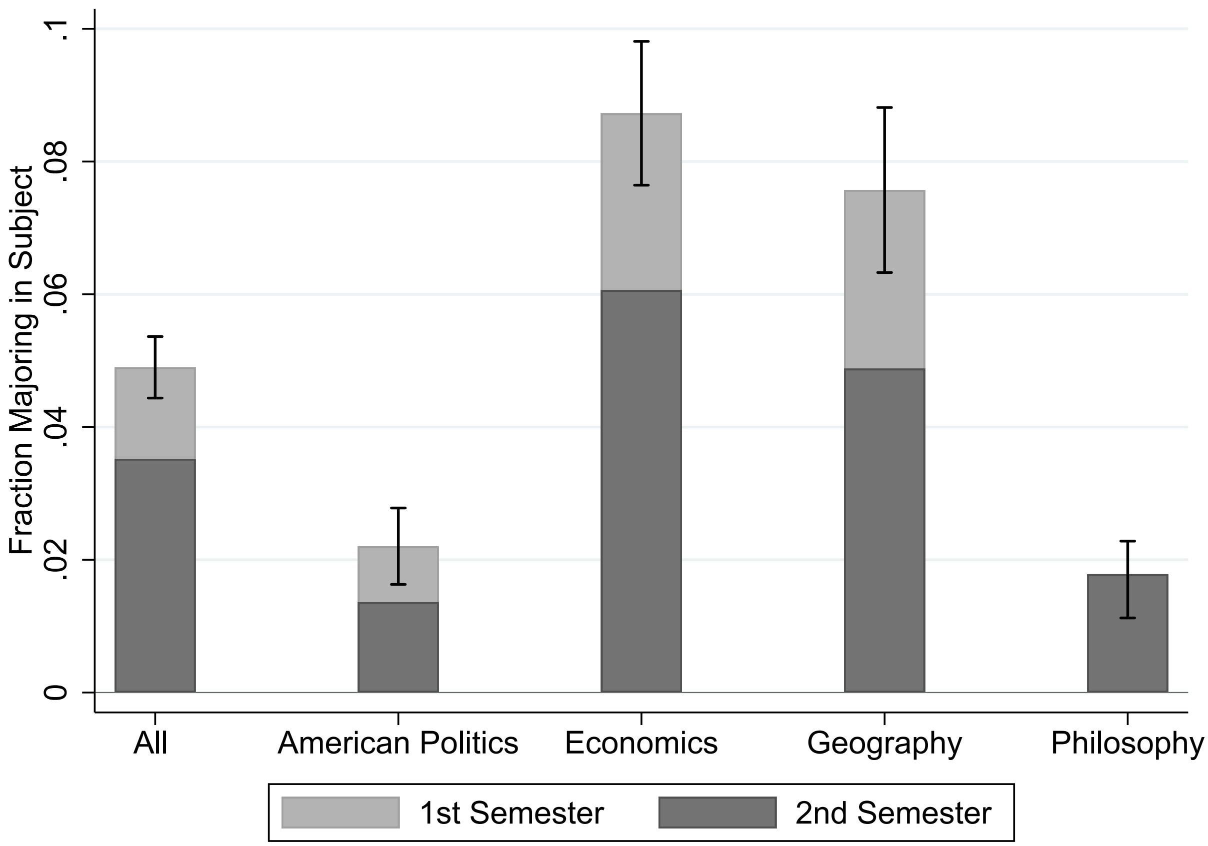
Per-course averages reported. Subjects assigned prior to the semester when majors selected include Chemistry, English, History, Information Technology, and Math. Courses assigned during the semester when majors are selected include Foreign Language courses and Physics courses. Courses assigned after 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. Appendix Figure A.1 includes these courses and generates a similar pattern.

Figure 3: Subject Specific Effects of Semester Order on Initial Major Choice



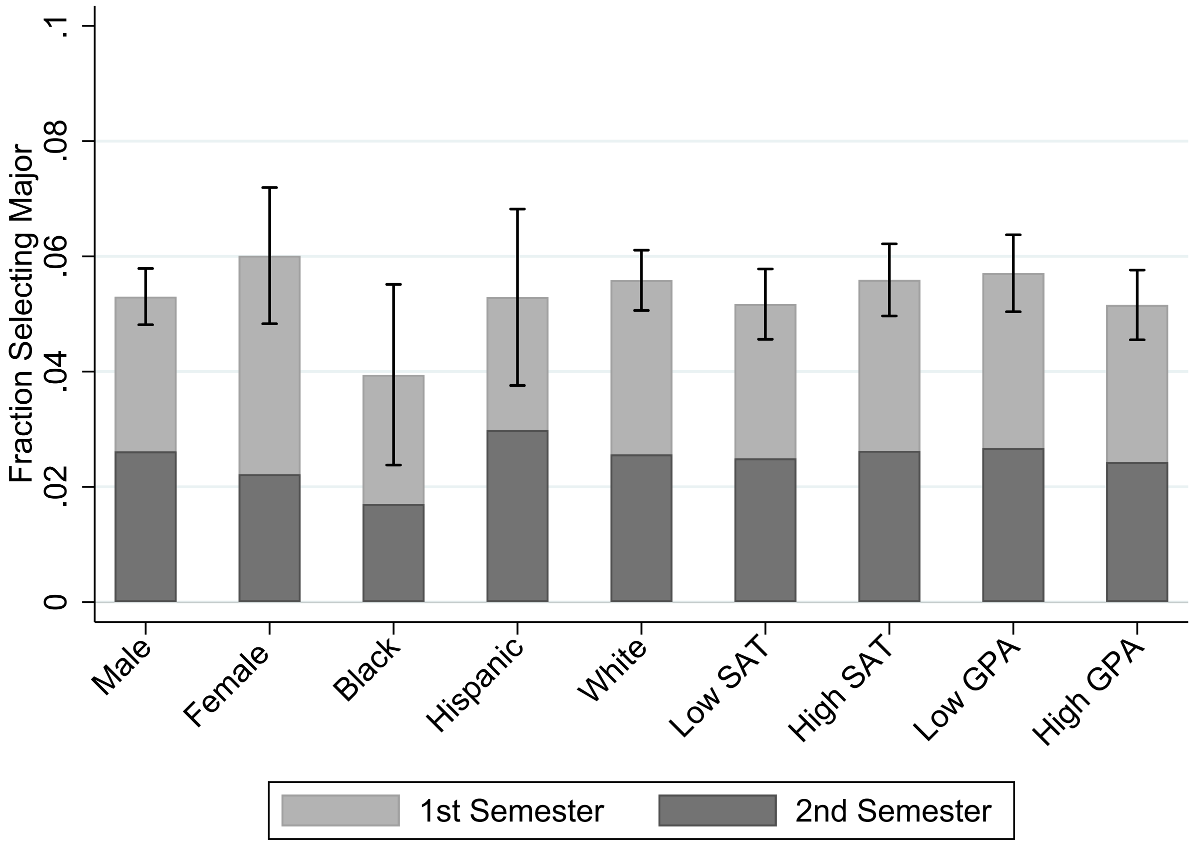
Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure 4: Subject Specific Effects of Semester Order on Graduating Major



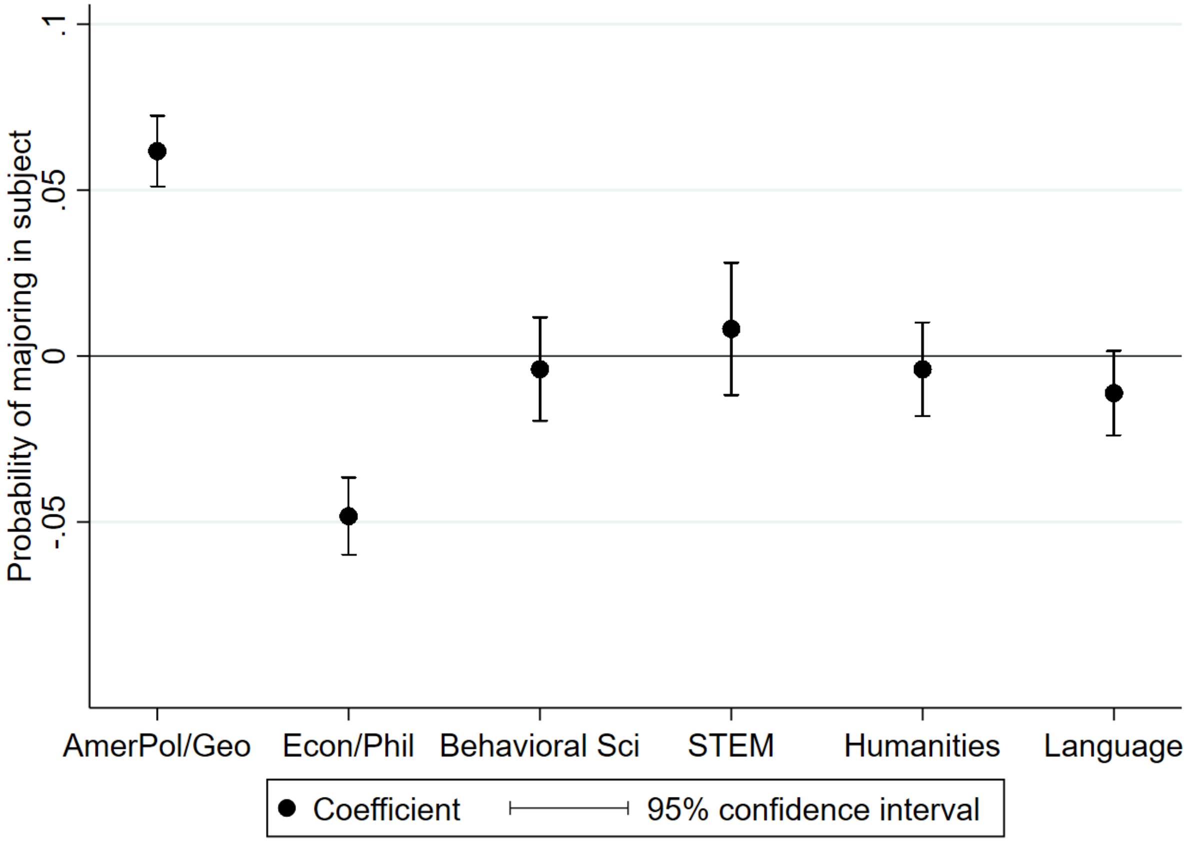
Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure 5: Effects of Semester Order on Initial Major Choice by Demographic Subgroup



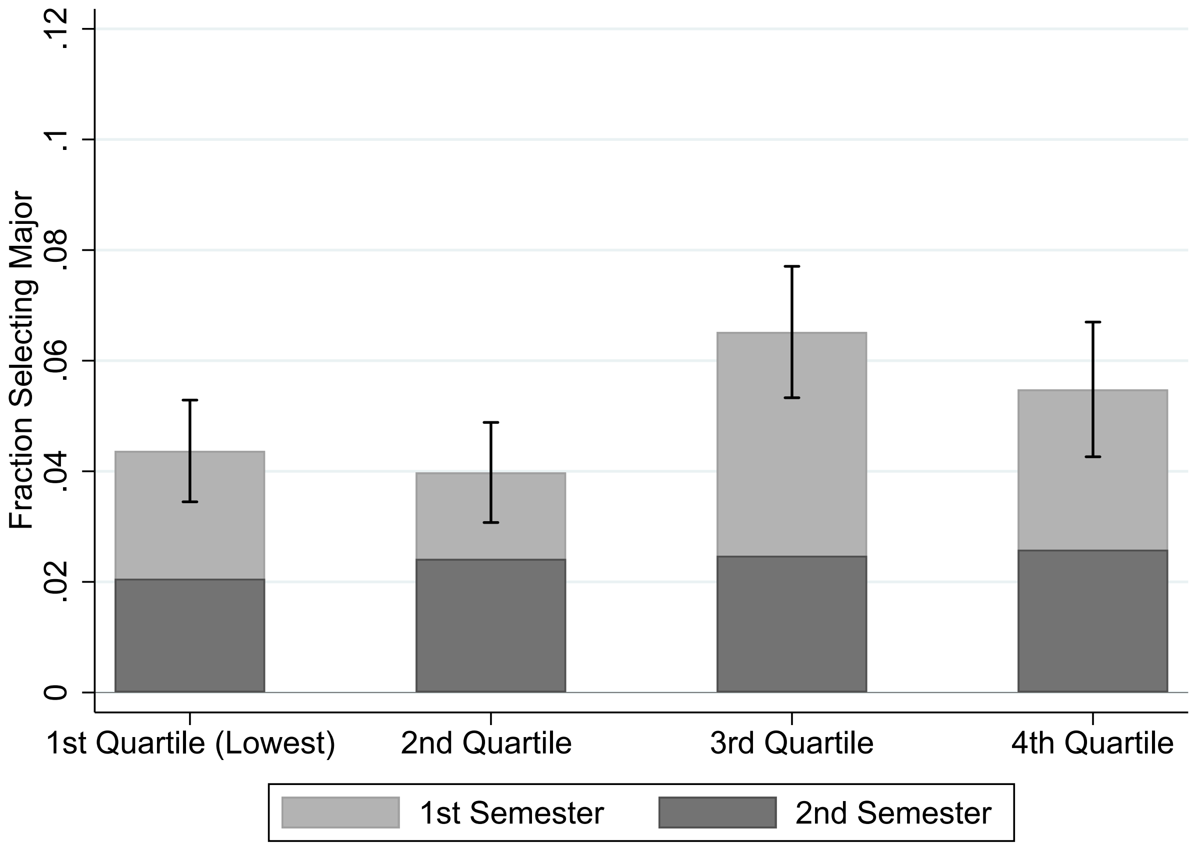
Differences are estimated from regressions that include a subset of demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects separately for each subgroup and are analogous to column 5 of Table 3. The dark bar shows the fraction of students who are assigned a 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 (i.e. baseline mean+first-semester effect). Robust standard errors are clustered at the individual and section-by-year levels.

Figure 6: Effects of First-Semester Assignment to American Politics and Geography on Initial Major Choice



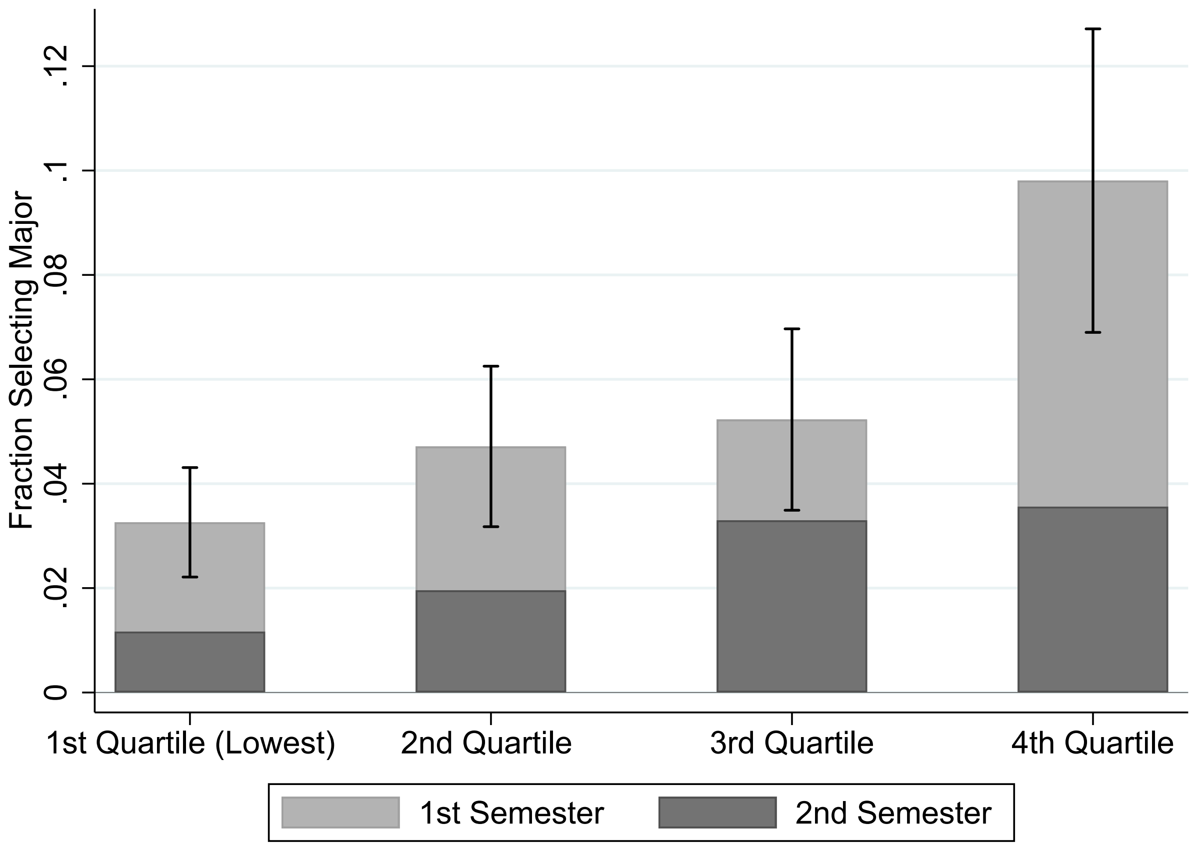
95% confidence intervals shown. Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to column 5 of Table 3. Demographic controls include age, SAT math and 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.

Figure 7: Effects by Instructor Course Evaluation Quartile



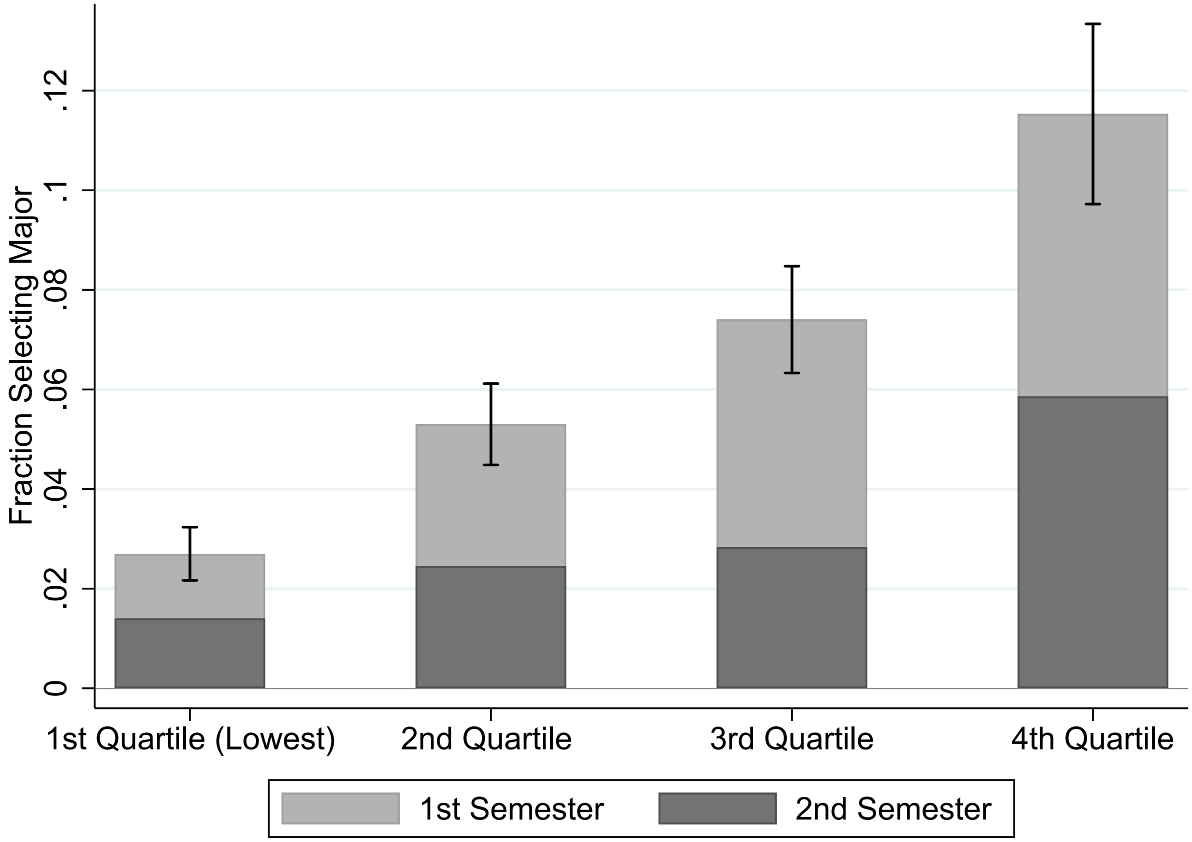
Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure 8: Effects by Within-Student Course Evaluation Quartile



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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure 9: Effects by Within-Student Performance Quartile



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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

A Appendix A: Tables and Figures

Table A.1: Mapping Between Required Courses and Majors

Course	Year	Majors
Chemistry I	1	Chemistry; Chemical Engineering
Chemistry II	1	Chemistry; Chemical Engineering
English Composition	1	English
English Literature	1	English
US History	1	US History; International History; Military History; European History
World History	1	US History; International History; Military History; European History
Western Civilization	1	US History; International History; Military History; European History
Math Modeling	1	Mathematical Sciences
Calculus I	1	Mathematical Sciences
General Psychology	1	Psychology; Engineering Psychology
Computing and Information Technology	1	Computer Science; Information Technology
Calculus II	2	Mathematical Sciences
Probability and Statistics	2	Mathematical Sciences
Physics I	2	Physics; Physics Engineering; Interdisciplinary Physics
Physics II	2	Physics; Physics Engineering; Interdisciplinary Physics
Economics	2	Economics
American Politics	2	Political Science
Philosophy and Ethics	2	Art, Philosophy, and Literature
Physical Geography	2	Geography
Foreign Language	2	Foreign Language; Foreign Studies

Table includes major mappings for required courses for first two years at USMA. Students are required to take or test out of each of these courses in order to meet graduation qualifications.

Table A.2: Major Characteristics

	All	Economics	American Politics	Geography	Philosophy
Female	0.136	0.060	0.131	0.176	0.417
Age	19.759	19.703	19.737	19.817	19.679
Asian	0.062	0.097	0.040	0.043	0.060
Black	0.067	0.051	0.040	0.050	0.107
Hispanic	0.090	0.087	0.091	0.092	0.125
White	0.748	0.745	0.789	0.783	0.649
SAT Verbal	628	633	642	617	628
SAT Math	649	663	636	630	630
Entering Class Rank	602	608	601	587	601
Prior Military Service	0.176	0.120	0.154	0.233	0.185
Prior College Attendance	0.167	0.173	0.160	0.178	0.137
USMA Preparatory Academy	0.154	0.104	0.126	0.217	0.190
Division I Athlete	0.340	0.342	0.257	0.384	0.321
N	8,777	549	175	437	168

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.

Table A.3: Effects of Semester Order on Major Choice for All Students

Panel A: Initial Major Choice	(1)	(2)	(3)	(4)	(5)
First Semester	0.0274***	0.0273***	0.0269***	0.0258***	0.0285***
	(0.0020)	(0.0018)	(0.0019)	(0.0018)	(0.0019)
N	58,022	58,022	58,022	58,022	58,022
R^2	0.0046	0.0228	0.0231	0.0335	0.0963
Control Group					
Dependent Variable Mean	0.028	0.028	0.028	0.028	0.028
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	(1)	(2)	(3)	(4)	(5)
First Semester	0.0161***	0.0159***	0.0153***	0.0143***	0.0155***
	(0.0020)	(0.0018)	(0.0019)	(0.0018)	(0.0019)
N	58,022	58,022	58,022	58,022	58,022
R^2	0.0015	0.0219	0.0223	0.0308	0.0903
Control Group					
Dependent Variable Mean	0.036	0.036	0.036	0.036	0.036
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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. Robust standard errors are clustered at the individual and section-by-year levels.

Table A.4: Effects of Semester Order on Major Choice, Conditional Logit Specification

Panel A: Initial Major Choice	(1)	(2)	(3)	(4)	(5)
First Semester	0.7818***	0.8250***	0.8226***	0.8351***	0.8832***
	(0.0583)	(0.0590)	(0.0594)	(0.0634)	(0.0654)
N	35,097	35,081	35,081	32,695	29,600
R^2					
Control Group					
Dependent Variable Mean	-0.058	-0.058	-0.058	-0.058	-0.058
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	(1)	(2)	(3)	(4)	(5)
First Semester	0.3586***	0.3907***	0.3941***	0.3807***	0.4093***
	(0.0537)	(0.0544)	(0.0549)	(0.0586)	(0.0601)
N	35,097	35,081	35,081	32,655	30,529
R^2					
Control Group					
Dependent Variable Mean	-0.058	-0.058	-0.058	-0.058	-0.058
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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. Robust standard errors are clustered at the individual and section-by-year levels.

Table A.5: Subject Specific Effects of Semester Order on Major Choice

Panel A: Initial Major Choice	All Courses	American Politics	Economics	Geography	Philosophy
First Semester	0.0284***	0.0156***	0.0493***	0.0502***	0.0060*
	(0.0023)	(0.0030)	(0.0054)	(0.0057)	(0.0032)
N	35,090	8,556	8,556	8,555	8,553
R^2	0.0656	0.0791	0.1186	0.0746	0.0822
Control Group Dependent Variable Mean	0.026	0.012	0.046	0.029	0.016
Panel B: Graduating Major	All Courses	American Politics	Economics	Geography	Philosophy
First Semester	0.0138***	0.0084***	0.0266***	0.0269***	-0.0008
	(0.0024)	(0.0029)	(0.0055)	(0.0063)	(0.0030)
N	35,090	8,556	8,556	8,555	8,553
R^2	0.0579	0.0704	0.0988	0.0634	0.0646
Control Group Dependent Variable Mean	0.035	0.014	0.061	0.049	0.018

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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. Robust standard errors are clustered at the individual and section-by-year levels.

Table A.6: High Performance in Advanced Placement (AP) Course, Semester Order, and Major

Panel A: Initial Major Choice	All Courses	American Politics	Economics	Geography
First Semester	0.0311***	0.0152***	0.0393***	0.0480***
	(0.0036)	(0.0034)	(0.0066)	(0.0071)
High-Performance AP Course	0.0331**	0.0306**	0.0320	0.0171
	(0.0137)	(0.0151)	(0.0440)	(0.0151)
High-Performance AP Course* First Semester	0.0044	-0.0050	0.0722	-0.0340
	(0.0129)	(0.0112)	(0.0477)	(0.0215)
N	17,775	5,784	5,784	5,784
R^2	0.0751	0.0825	0.1079	0.0720
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	All Courses	American Politics	Economics	Geography
First Semester	0.0134***	0.0074**	0.0161**	0.0233***
	(0.0037)	(0.0033)	(0.0065)	(0.0079)
High-Performance AP Course	0.0513***	0.0439***	0.1037**	0.0086
	(0.0153)	(0.0158)	(0.0517)	(0.0176)
High-Performance AP Course* First Semester	-0.0099	-0.0082	-0.0065	-0.0397*
	(0.0116)	(0.0088)	(0.0457)	(0.0217)
N	17,775	5,784	5,784	5,784
R^2	0.0646	0.0732	0.0894	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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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. High performance is defined as scoring a 4 or 5 (out of 5) on an AP Test. 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 2007-2015. 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.

Table A.7: Heterogeneous Effects of Semester Order

	(1)	(2)	(3)	(4)
First Semester	0.0269***	0.0293***	0.0257***	0.0286***
	(0.0024)	(0.0024)	(0.0031)	(0.0024)
Female	-0.0077**			
	(0.0033)			
Female*First Semester	0.0100			
	(0.0062)			
Black/Hispanic		0.0008		
		(0.0032)		
Black/Hispanic*First Semester		-0.0067		
		(0.0057)		
High SAT			0.0059**	
			(0.0024)	
High SAT*First Semester			0.0053	
			(0.0042)	
Prior College				0.0013
				(0.0032)
Prior College*First Semester				-0.0019
				(0.0058)
N	35,090	35,090	35,090	35,090
R^2	0.0648	0.0647	0.0651	0.0647
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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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. Robust standard errors are clustered at the individual and section-by-year levels.

Table A.8: Characteristics among Majors Across Terms

	First Semester	Second Semester	Difference	P-value
Female	0.117	0.135	-0.018	0.28
Age	19.748	19.746	0.002	0.98
Asian	0.066	0.060	0.006	0.60
Black	0.040	0.052	-0.012	0.31
Hispanic	0.099	0.086	0.013	0.41
White	0.762	0.774	-0.012	0.60
SAT Verbal	633	634	-1.306	0.69
SAT Math	645	645	-0.753	0.81
Entering Class Rank	599	602	-3.206	0.28
Prior Military Service	0.175	0.152	0.023	0.23
Prior College Attendance	0.168	0.153	0.015	0.42
USMA Preparatory Academy	0.144	0.135	0.009	0.64
Division I Athlete	0.354	0.332	0.022	0.37
Prior interest in subject	0.241	0.224	0.017	0.53
N	871	618	–	–

Interest-in-subject variables come from a smaller subset of 1,483 students who responded to a survey prior to beginning their coursework at USMA. The joint F-test(13; 1,469) value for all variables is 1.03 with a P-value of 0.43. The joint F-test (12; 2,547) for the full sample of students (excluding prior interest) is 1.47 with a P-value of 0.13.

Table A.9: Outcomes Across Majors

	American Politics	Economics	Geography	Philosophy	F-stat P-value
Occupations					
Combat Arms	0.65	0.69	0.66	0.52	0.000
Engineering	0.05	0.06	0.09	0.05	0.047
Military Intelligence	0.14	0.10	0.06	0.12	0.000
Outcomes at 10+ years					
In Army 10+ Years	0.39	0.31	0.42	0.40	0.008
Post-Graduate Degree	0.54	0.46	0.45	0.52	0.112
USMA Instructor	0.12	0.06	0.06	0.07	0.098

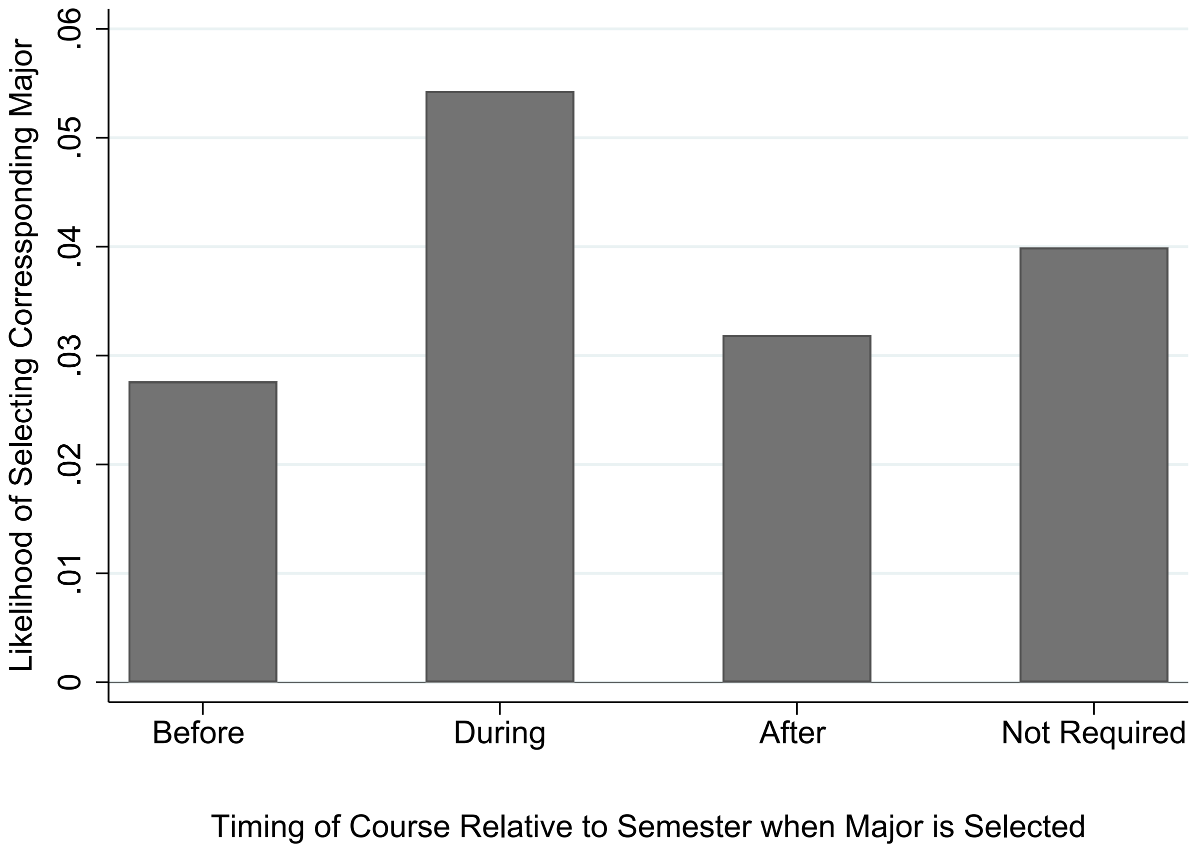
* Combat Arms occupations or branches include Air Defense Artillery, Armor, Aviation, Engineering, Field Artillery, and Infantry. Sample includes all 2,734 from American Politics (362), Economics (1,014), Geography (1,032), and Philosophy (326) from the 2004-2017 graduating classes (sophomores between 2001-2015).

Table A.10: Summary Statistics

	Analysis Sample		Excluded Sample		P-value
	Mean	Std. Dev.	Mean	Std. Dev.	
Female	0.14	0.34	0.18	0.38	0.00
Asian	0.06	0.24	0.08	0.27	0.00
Black	0.07	0.25	0.08	0.27	0.00
Hispanic	0.09	0.29	0.08	0.27	0.03
White	0.75	0.43	0.73	0.44	0.01
Prior Military Service	0.18	0.38	0.16	0.36	0.00
Prior College Attendance	0.17	0.37	0.25	0.43	0.00
USMA Preparatory Academy	0.15	0.36	0.14	0.35	0.02
Division I Athlete	0.34	0.47	0.32	0.46	0.00
Age	19.8	0.96	19.9	1.05	0.00
Number of Courses	5.48	0.56	5.31	0.62	0.00
SAT Verbal	628	64.4	647	80.4	0.00
SAT Math	649	60.9	654	75.2	0.00

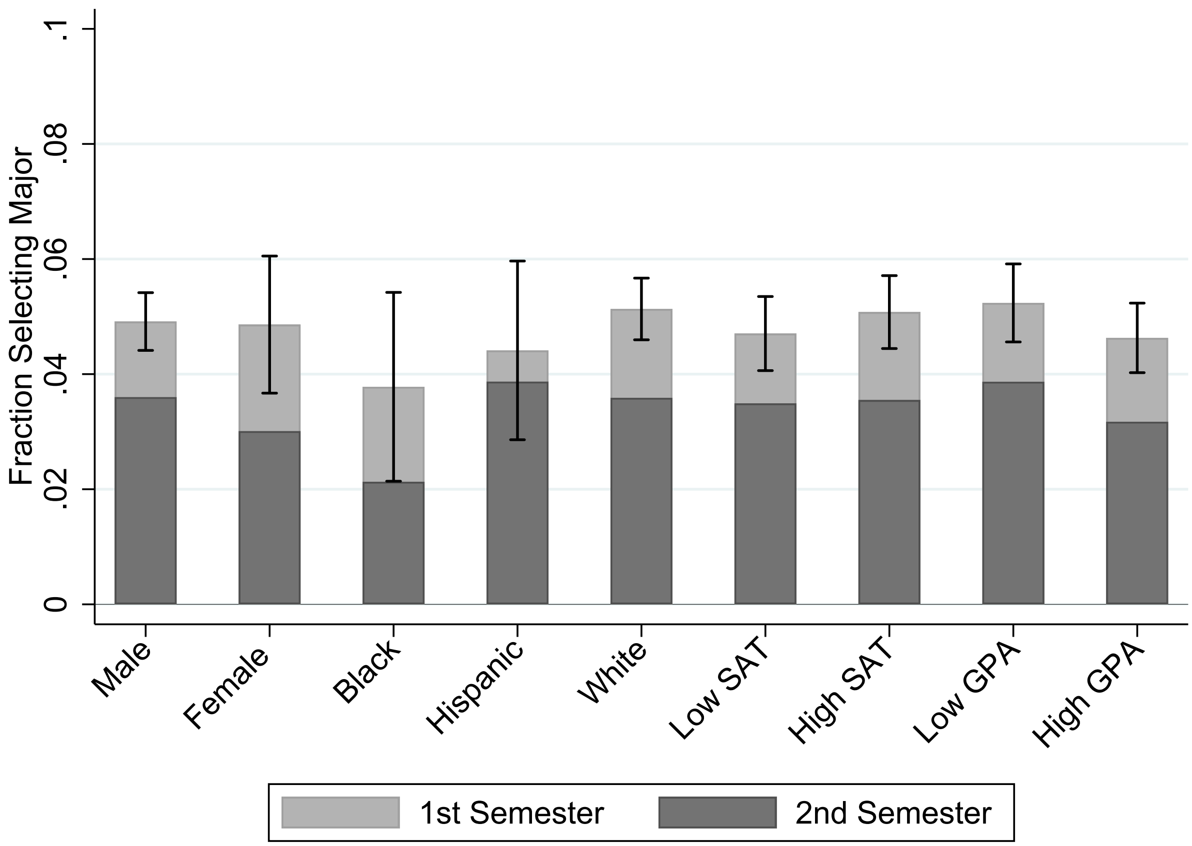
Includes characteristics from the 8,777 students in our primary sample and from the 6,376 students excluded from our sample. This sample includes sophomores that attended the United States Military Academy between the years of 2001 and 2015.

Figure A.1: Likelihood of Selecting a Corresponding Major, All Courses



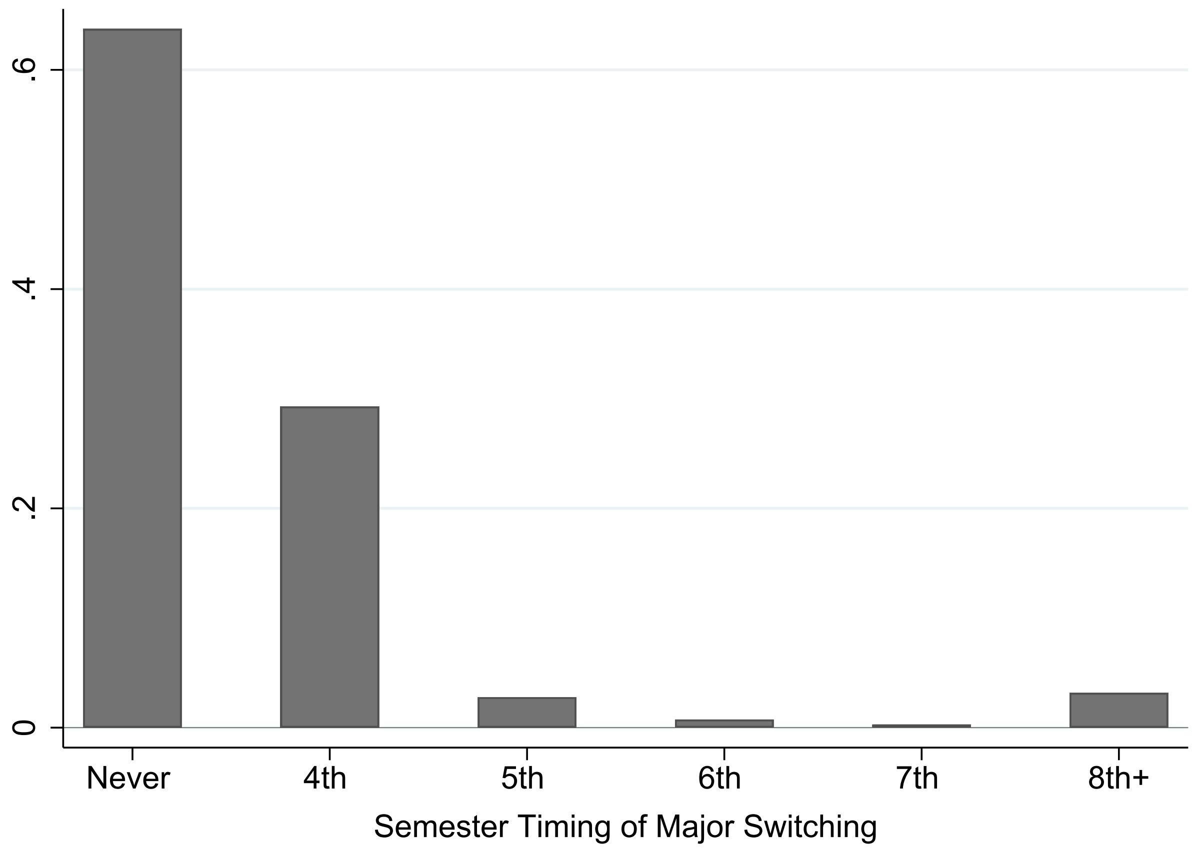
Per course averages reported. Subjects assigned prior to the semester when majors selected include courses in Chemistry, English, History, Information Technology, and Math. Courses assigned during the semester when majors are selected include Foreign Language courses and Physics courses for all students and American Politics, Economics, Geography, and Philosophy for those assigned the a first-semester section of these courses. Courses assigned after the semester when majors are selected include Legal Studies and International Relations for all students and American Politics, Economics, Geography, and Philosophy for those assigned to a second-semester section of these courses.

Figure A.2: Effects of Semester Order on Graduating Major by Subgroup



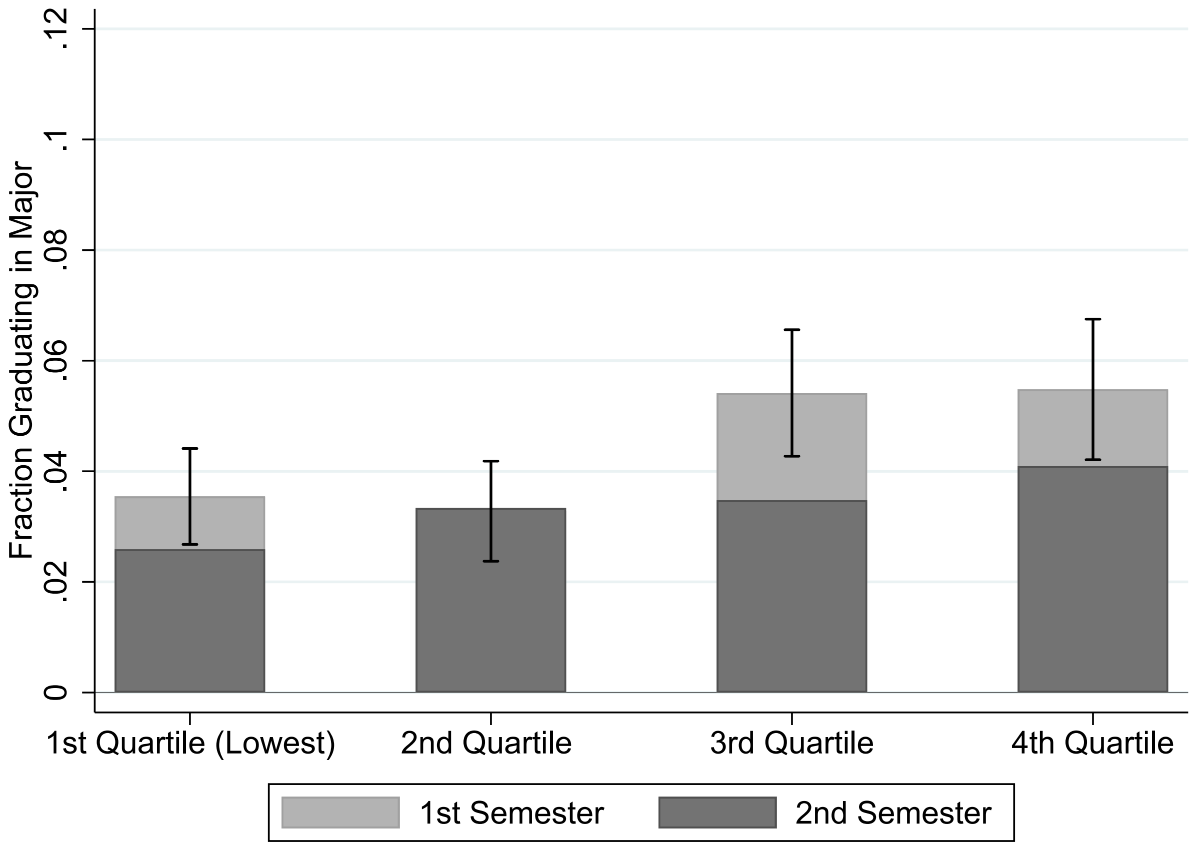
Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects separately for each subgroup and are analogous to column 5 of Table 3. Demographic controls include age, SAT math and verbal 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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure A.3: Semester of Major Switching



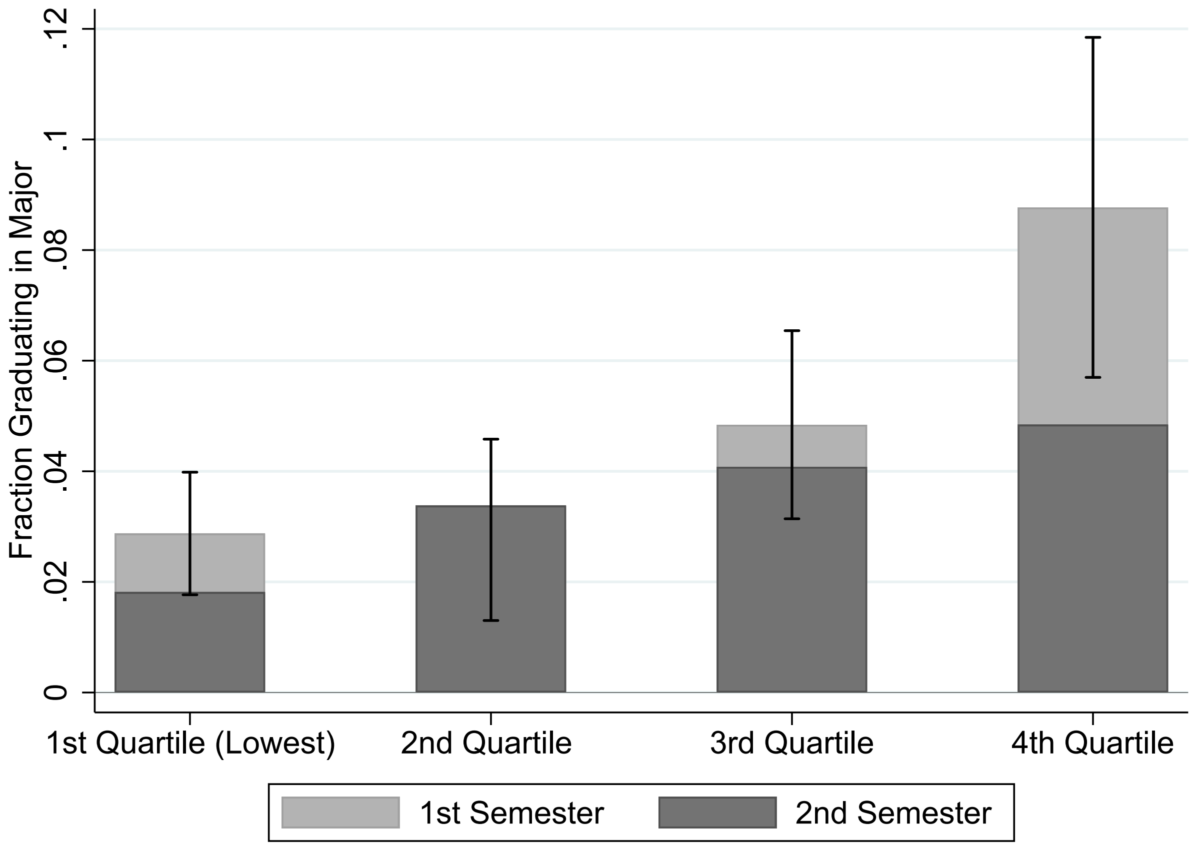
This figure shows the semester timing of last major declaration among students who selected an initial or final major in American Politics, Economics, Geography, or Philosophy.

Figure A.4: Effects on Graduating Major by Instructor Course Evaluation Quartile



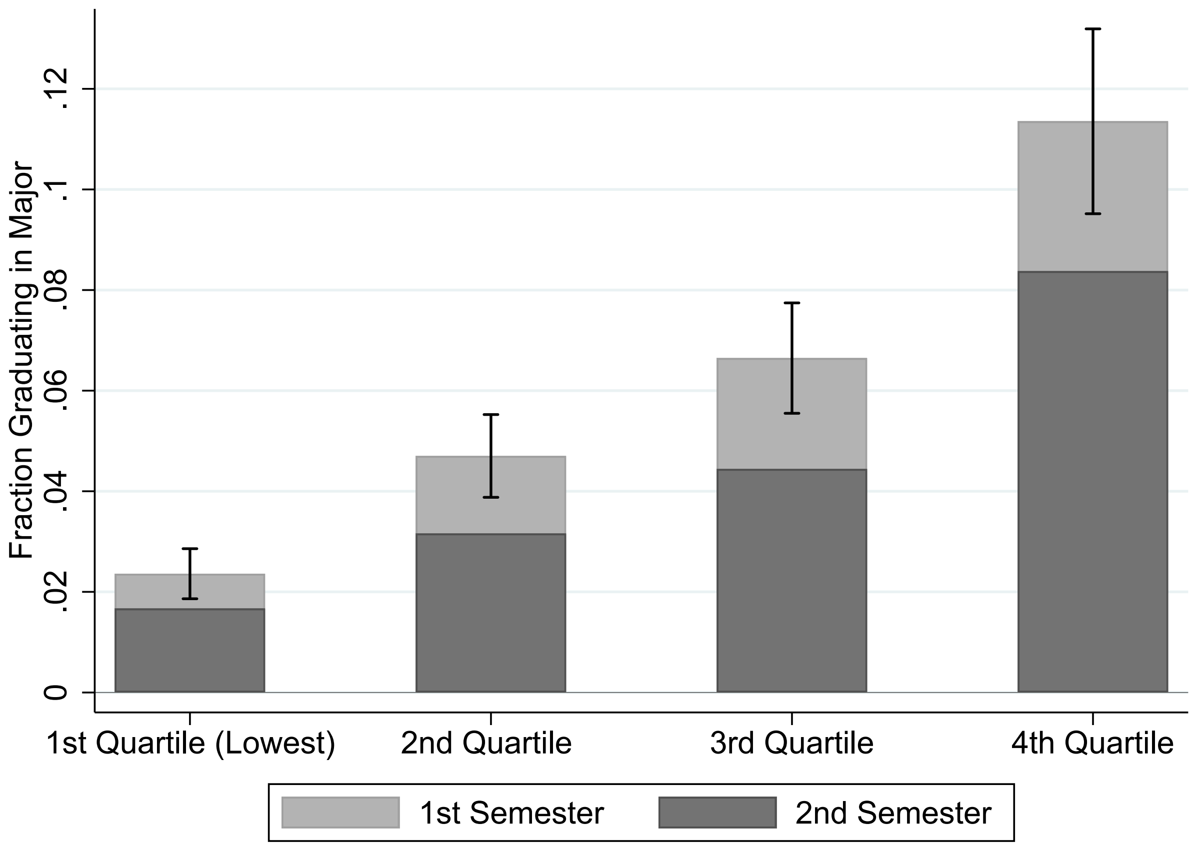
Differences are estimated from regressions that include demographic controls, peer demographic controls, faculty fixed effects, schedule roster fixed effects, and year fixed effects and are analogous to column 5 of Table 3. Demographic controls include age, SAT math and verbal scores, USMA academic potential (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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure A.5: Effects on Graduating Major by Within-Student Course Evaluation Quartile



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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

Figure A.6: Effects on Graduating Major by Within-Student Performance Quartile



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 (i.e. baseline mean+first-semester effect). The whiskers represent the 95% confidence intervals for the first-semester effect. Robust standard errors are clustered at the individual and section-by-year levels.

B Appendix B: Availability Bias Framework

In our availability bias framework, individuals conflate the availability of a choice – how easily it comes to mind – with the value of that choice. In addition, more recent and salient experiences are more available. Thus the more recent and salient an experience, the more likely an individual is to select a choice corresponding to that experience.

To clarify how timing may influence student major choice, we outline a conceptual framework that incorporates elements of present bias, availability, and salience. We refer to this framework as *Monotonic Availability Bias*. This framework is motivated by two ideas: (1) experiences that are more recent or salient are more available to a decision-maker and (2) decision-makers conflate the availability and value of a choice. In this framework, an individual's accurate projection of her future utility of consuming x is $u(x) = \sum_{\tau=1}^{t} \theta_\tau u(x_\tau)$, where θ_τ is the optimal weight placed on an experience from time period τ. This is simply a weighted sum of past utilities of consuming x. With Monotonic Availability Bias, an individual perceives her future utility as: $\hat{u}(x) = [\sum_{\tau=1}^{t} \theta_\tau u(x_\tau)] + \alpha[\gamma(x_t) + \beta \sum_{\tau=1}^{t-1} \delta^{t-\tau}\gamma(x_\tau)]$, where $\alpha \in [0, \infty)$ is a measure of availability bias, $\gamma(x_\tau) \in [0, 1]$ is a measure of how salient the choice of x is in period τ (i.e. the degree to which the choice stands out), $\beta \in [0, 1]$ is a present-bias discount factor, and $\delta \in [0, 1]$ is an exponential discount factor.

In this framework, an individual's time t projected utility of consuming x has three main components: (1) an accurate (or unbiased) projection of utility, captured by $u(x) = \sum_{\tau=1}^{t} \theta_\tau u(x_\tau)$, (2) a susceptibility to availability bias, captured by α, and (3) an overall availability of choice x at time t captured by $\gamma(x_t) + \beta \sum_{\tau=1}^{t-1} \delta^{t-\tau}\gamma(x_\tau)$.[46] In our representation of availability, we assume that experiences with a choice make a choice salient or stand out,[47] all experiences weakly increase the overall availability of a choice, and overall availability increases if experiences are more recent. If an experience occurs in period t, the period when a decision is made, the salience of that experience is not discounted and will have the largest possible contribution to the overall availability of a choice. However, the salience of an experience that occurs in any prior period $\tau \in \{1, ..., t-1\}$ is discounted by a present-biased discount factor β and an exponential discount rate $\delta^{t-\tau}$.[48] Altogether, the term $\alpha[\gamma(x_t) + \beta \sum_{\tau=1}^{t-1} \delta^{t-\tau}\gamma(x_\tau)]$ captures the extent to which an individual is biased by the timing and salience of experiences. We refer to our framework as Monotonic Availability Bias because the availability bias term, $\alpha[\gamma(x_t) + \beta \sum_{\tau=1}^{t-1} \delta^{t-\tau}\gamma(x_\tau)]$, is always (weakly) positive and thus the more available a choice, the more likely an individual is to choose it.

Our Monotonic Availability Bias framework has several straightforward and intuitive predictions. First, if an individual has two equally positive (or negative) experiences with two majors (that would lead her to be indifferent except for Monotonic Availability Bias), she will strictly prefer the major she experienced most recently. This is because the choice experienced more recently is more available to the decision-maker. Second, an additional experience (at any time) that is more positive than the average prior experiences will increase an individual's perceived future utility of x. However, an additional experience (at any time) that is more negative than an individual's average prior experiences might increase or decrease an individual's expected utility

[46] In our framework, salience captures the degree to which a choice stands out at the time it is experienced, and availability captures how all current and prior experiences contribute to how readily a choice comes to mind. When an individual's only experience with a choice is in the period that she makes a choice, salience and availability are identical.

[47] Our definition of an experience with a choice is intended to be broad. An experience could be making the choice, researching the choice, discussing the choice with someone else, or even watching someone else make the choice. If an individual does not experience choice x in period t, then $\gamma(x_t) = 0$.

[48] Our construction of overall availability adopts a nearly identical approach to Laibson (1997) in modeling present-bias. The two distinctions between our representation of present-biased salience and Laibson's model of quasi-hyperbolic present-biased preferences are (1) our framework is retrospective instead of prospective and (2) our framework applies to salience instead of utility. An advantage of this approach is that many of the properties of the well-established quasi-hyperbolic present-biased model apply directly to our framework. More importantly, this approach incorporates several intuitive properties that match models of memory (e.g. **?**) and present bias (e.g. O'Donoghue and Rabin, 1999). Several of these properties are discussed below. Other approaches, however, have many of the same general properties. For example, availability could be calculated as $MAX\{\beta\delta^{t-1}\gamma(x_1), \beta\delta^{t-2}\gamma(x_2), ..., \beta\delta\gamma(x_{t-1}), \gamma(x_t)\}$, or the highest discounted salience of current and prior experiences. This approach would eliminate the positive effect of repetition and generally make individuals more biased toward their most recent experiences. Another approach would be to take the average discounted salience of all experiences that have positive experiences. This would also eliminate the positive effect of repetition but make individuals less biased toward their most recent experiences.

of x. This is because a negative experience reduces the unbiased portion of an individual's projected utility, $\sum_{\tau=1}^{t}\theta_\tau u(x_\tau)$, but increases the biased portion of her projected utility, $\alpha[\gamma(x_t)+\beta\sum_{\tau=1}^{t-1}\delta^{t-\tau}\gamma(x_\tau)]$. The greater α, β, δ, and $\gamma(x)$, the more likely a negative experience will increase an individual's projected utility of x. Thus, Monotonic Availability Bias has a "raise all boats" characteristic; as $\alpha[\gamma(x_t)+\beta\sum_{\tau=1}^{t-1}\delta^{t-\tau}\gamma(x_\tau)]$ becomes sufficiently large, both good and bad experiences increase projected utility.

C Appendix C: Course Descriptions

C.1 American Politics

This course explores the American political system - how it works, its strengths, its weaknesses, its conflicts, its controversies. The course emphasizes how our democracy makes decisions about politics & policy to balance the many competing values and demands of a free society. The course begins with the study of the constitutional foundations of American government and then examines political behavior, institutions of government, and the policy making process. The course integrates the study of civil-military relations and the broader study of political science as a discipline throughout the semester.

C.2 Economics

This standard course presents the basic principles of economic analysis and their application to contemporary economic problems and supports the further study of economics and related disciplines in the social sciences. The course is organized into three general sections: microeconomics, outlining basic theory of allocation by supply and demand in a market economy and relating this theory to contemporary issues; macroeconomics, surveying the theory of aggregate economics and illustrating the application of macroeconomic theory to public policy in the American economy; and international economics, introducing trade theory and international monetary theory and policy and application of economics to selected public policy issues (taxation and resource allocations, provision of public goods, etc). Cadets examine the implications of economics on national security and defense, and the use of economic analysis to improve decisions they will make as Army officers.

C.3 Philosophy

This course helps third class cadets develop their capacities to think clearly and critically. It acquaints cadets with various viewpoints on major philosophic issues, assists them in acquiring a facility with the language, arguments, and methods of moral discourse, and gives special attention to the subject of war and morality.

C.4 Physical Geography

This core course provides cadets with a fundamental understanding of scientific principles and processes of earth science, meteorology, climatology, geomorphology and environmental systems, as well as an introduction to cultural Geography. Further, the course furnishes cadets with the technical skills - digital terrain analysis, image interpretation and spectral analysis, remote sensing, global positioning system, geographic information systems cartography - to delineate the geographic distribution of landforms, weather, climate, and culture systems; and evaluate their potential impact on military operations. Lessons are reinforced by extensive use of in- and out-of-class practical exercises, terrain walks and computer exercises to demonstrate the interrelationship between physical and human systems, and their impact on the environment. Historical vignettes are employed to demonstrate how the factors of weather, climate, terrain, soils, vegetation and culture are important, cogent and frequently decisive in military operations.

D Appendix D: Example of Semester Order and Updating Beliefs

Below we provide an example for how assignment to a course in the semester a student selects a major may increase the probability she chooses a corresponding major when updating beliefs. Take a student who is assigned courses in Geography, Economics, and Philosophy. We make the following assumptions: (1) she is only considering majors in these three subjects, (2) she initially values each major equally and is unbiased in these evaluations, (3) she is uncertain about the value of each major and the distribution of potential values for each major is identical and non-skewed, and (4) she will update her anticipated value after taking each introductory course and taking a course only informs the student's value of the related major. Now let us say that this student is assigned a course in Geography prior to making a decision about her major but is assigned to take Economics and Philosophy in the semester after she makes a decision. Given these assumptions, there is a 50% chance she will choose Geography, but only a 25% chance she will choose Economics and a 25% chance she will choose Philosophy. This result is simply because after taking Geography there is a 50% chance the student positively updates her anticipated value of Geography and therefore prefers Geography over the other two majors. However, there is a 50% chance that she negatively updates her anticipated value of Geography and divides this 50% equally between the other two majors.

Now let us say that the order of courses is reversed and she is assigned courses in Economics and Philosophy prior to choosing a major but is assigned to take Geography in the semester after she makes a choice. Given these assumptions, there is a 37.5% chance she will choose Economics, a 37.5% chance she will choose Philosophy, but only a 25% chance she will choose Geography. The reason she has a 37.5% chance of choosing Economics is that there is a 50% chance that she positively updates her anticipated value of Economics and, conditional on positively updating her anticipated value of Economics there is a 75% chance that she will prefer Economics to Philosophy. Therefore, there is a $50\% \cdot 75\% = 37.5\%$ chance she will choose Economics. By symmetry, there is also a 37.5% chance she will choose Philosophy. However, there is only a 25% chance she will choose Geography. This is because, after seeing both Philosophy and Economics, there is a 50% chance she negatively updates her anticipated value of Economics and a 50% chance she negatively updates her anticipated value of Philosophy, and therefore only a $50\% \cdot 50\% = 25\%$ chance that her anticipated value of Geography is more than Economics *and* Philosophy. In both of these examples, a student is systematically more likely to choose a major corresponding to a course she has seen relative to a course she hasn't seen, when her evaluations were unbiased and she valued all majors equally, ex-ante.

In general, in cases where an individual is choosing among majors that (1) start with the same anticipated value, and (2) share the same non-skewed distribution of potential values, then when there are N majors to choose from and X majors that are not seen prior to the major choice, then the probability of choosing a particular unseen major is:

$$(\frac{1}{2})^{N-X}(\frac{1}{X}) \tag{1}$$

And the probability of choosing a particular major that is seen is:

$$(1-(\frac{1}{2})^{N-X})(\frac{1}{N-X}) \tag{2}$$

A key insight of this exercise is that the probability of choosing a seen major is greater than choosing an unseen major as long as $N > 2$.

E Appendix E: Major Change Request Form

MAJOR CHANGE REQUEST FORM

MADN-ORD

DATE:________________

SUBJECT: REQUEST TO CHANGE MAJOR

OLD CODE:_______ NEW CODE:_______

CADET:______________________ USMA ID: _______________ CO: ____ GY:_____

Reason for Request:

APPROVE/DISAPPROVE
FORMER DAC:____ DEPT:_________
Print Name Sign and date

APPROVE/DISAPPROVE
GAINING DAC:____ DEPT:_________
Print Name Sign and date

CADET SIGNATURE:___________________________________

NOTE to cadet: It is your responsibility and duty to work with your new DAC to ensure the correct courses are in your 8TAP.

Figure D.1. USMA Major Change Form

Table 11: Effects of Semester Order on STEM Majors

	Final GPA	Graduate	Op. Br.	Support Br.	Sust. Br.	5+ Years	Early Prom.
Amer. Pol./Geo. First	-0.0075	-0.0062	0.0107	-0.0063	-0.0003	-0.0059	0.0046
	(0.0080)	(0.0047)	(0.0099)	(0.0067)	(0.0064)	(0.0150)	(0.0099)
N	8,327	8,617	8,617	8,617	8,617	4,050	2,029
R^2	0.3409	0.0078	0.0721	0.0188	0.1107	0.0113	0.0064

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Each specification represents results for a regression where the independent variable is being assigned to a combination of American Politics and 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.