The Time Costs of Academic Credit Hours*

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Abstract

The time costs of academic credits are poorly measured due to limited data and endogenous course enrollment. We estimate the effect of additional credits on leisure using campus departure logs linked to academic records of U.S. Air Force Academy students and two natural experiments. Leveraging pre-assigned course schedules, each credit reduces leisure by 7 hours per semester, while unexpected changes to graduation requirements reduced leisure by 17 hours per credit. Foregone leisure accounts for 17–50% of time costs imposed by a modal 3-credit course. Academic, athletic, and military performance decline, indicating students struggle to absorb heavier course loads.

Keywords: Higher Education, Leisure Choice, Credit Hours

JEL Classification Numbers: I2, J22, D12

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1 Introduction

Facilitating on-time college graduation is incredibly important: students that fail to finish on time must pay additional tuition and forego wages for another academic term or more. With nearly 8 million new undergraduate students enrolling each year,[1] current estimates suggest that only half graduate in four years and only 60 percent within six.[2] Universities have encouraged students to enroll in more credit hours per term with "15 to Finish" campaigns purporting 15-hour course loads increase grades, retention rates, and on-time graduation rates (Chan, 2022; University of Wisconsin, 2025) through increased academic momentum (Adelman, 1999, 2006; Attewell et al., 2012; Brownback and Sadoff, 2024). Administrators can affect enrollments by adjusting the financial aid eligibility threshold for full-time students but it is difficult to anticipate the effects of such policies as students reallocate their study and leisure time in response. Study time has been falling (Babcock and Marks, 2011) and leisure time increasing[3] implying that students may have more ability than previously assumed to absorb credit hour shocks by reducing leisure. Administrators may therefore intend for more credits to be met with more study hours and less leisure, but students could adjust their time allocation to preserve leisure at the cost of lower grades, possibly negating the benefits of higher loads. We fill this gap by estimating the effect of larger undergraduate course loads on student leisure time and performance.

The effect of an additional credit hour on student time allocation is theoretically ambiguous. Additional courses increase total possible grade points earned in a semester, inducing both income and substitution effects. Students may respond to additional classes by studying less while maintaining the same GPA, especially if the courses added have high average grades and low work requirements. Alternatively, students may respond to credit hour increases by studying more because the added work increases the return to study. If additional courses increase study hours as intended, students can accommodate the higher workload in several ways. First, they may adjust their current and future semester course loads and difficulty to dampen the effect of enrollment shocks in any given semester. Second, students may decrease their leisure time to study more for each additional class. If students are forced to reduce their leisure time, they may adjust time spent on different types of activities with different levels of marginal utility, dispensing first with low-value activities

1. U.S. Department of Education, National Center for Education Statistics. Digest of Education Statistics 2023: Table 303.70.
2. Integrated Postsecondary Education Data System (IPEDS), Graduation Rates component final data (2002-2022) and provisional data (2023)
3. National Survey of Student Engagement (2024). NSSE Summary Tables - Core Survey. NSSE Interactive Reports. Retrieved from nsse.indiana.edu.

such as scrolling social media before cutting back on high-value weekend trips, for example. Estimating the total effect of these competing incentives is further complicated by students endogenously choosing when to graduate with no limit on their tenure.

To our knowledge, we are the first to demonstrate the causal effect of additional credit hours on leisure time. To do this, we link administrative records of campus departure and arrival times of all U.S. Air Force Academy (USAFA) students to their academic records in four consecutive semesters. Unlike other undergraduate students, USAFA students cannot set their own schedules; course enrollment is managed by their faculty advisor and many students do not request any changes. USAFA also limits tenure to exactly eight semesters with rare exceptions such as medical emergencies. Thus, there is limited opportunity for endogenous course load selection or smoothing. Conditional on student fixed effects, an additional credit hour reduces high-value leisure time spent off-campus by 6.9 hours, on average. These estimates could be biased by semester-varying, student-specific factors; for example, a student overcoming the administrative barriers to schedule fewer courses during a semester they have higher leisure preferences. To combat this potential bias, we additionally exploit a natural experiment in which USAFA unexpectedly reduced the number of credit hours required to graduate by class year relative to an unaffected cohort. Departments facing unanticipated staffing shortages eliminated requirements for some cohorts but the changes were not widely announced. Using graduation year as an instrument for semester course enrollments, we find the local cost of higher course loads induced by unexpected schedule changes exceeds 17.4 hours per credit hour. We rationalize our findings using a simple labor-leisure model and show students exhibit a labor supply elasticity of 0.3, similar to those found in other studies of the broader labor market.[4]

Although students can somewhat accommodate an increase in credit hours by decreasing their leisure, we also find that higher course loads impose substantial burden to students in other domains. An additional 3 credit hour course reduces term GPA by 0.15-0.24 standard deviations (SD), military performance by almost 1 SD, and physical fitness by 0.09-0.24 SD. Thus, students seem to choose a new utility-maximizing bundle at a lower level of production. Higher course loads slightly increase the likelihood of academic probation but the effect is not large enough to attribute the leisure reductions entirely to accompanying sanctions that restrict students to campus. These secondary findings instead suggest the reduction in high-value leisure is indeed students reallocating time to academics and not to exercise or military duties.

We contribute to course scheduling literature in two important ways. First, we are the first paper to our

4. See Keane (2022) for a review of the labor supply literature.

knowledge to study the effect of additional credit hours on an objective measure of leisure time for an entire student body. Much work has been done to understand the impacts on student performance such as GPA, completion rates and timing, and academic probation (Aina et al., 2024; Attewell and Monaghan, 2016; Bostwick et al., 2022; Huntington-Klein and Gill, 2021) but the welfare effects cannot be determined without understanding how students adjust their leisure in response. The few studies that can examine student leisure rely on small samples of self-reported time diaries administered infrequently (Barrow and Rouse, 2018; Stinebrickner and Stinebrickner, 2008) which are prone to recall bias (Juster and Stafford, 1991; Te Braak et al., 2023) and measurement error from non-response that is likely correlated with related time-use activities like work hours (Barrett and Hamermesh, 2019; Hamermesh et al., 2005). Our study improves upon existing efforts to measure student leisure time by using objective computer logs of all campus departures during the semester.

Second, we contribute by credibly estimating the causal effect of increasing academic credit hours. While some studies potentially avoid endogenous student behavior by leveraging natural experiments (Aina et al., 2024; Bostwick et al., 2022), most rely on student fixed effects alone with conflicting results (Belanger et al., 2019; Darolia, 2014; Huntington-Klein and Gill, 2021; Kramer et al., 2018). We address these limitations with fixed effects that are more credible due to students' limited control over their schedule and required eight semester tenure. We complement this methodology with a instrumental variable strategy leveraging changes to graduation requirements by cohort which exchanges individual variation in credit hours with class year variation, avoiding potential time-varying idiosyncratic bias in student fixed effects estimates. Phipps and Amaya (2023) similarly provide strong evidence that randomly assigning West Point students additional military training courses (for example, hand-to-hand combat or survival swimming) reduces GPA and increases course failure rates. Our work substantially differs in that we examine the impact of additional *academic*—rather than military—credit hours, which are more representative of a typical post-secondary experience.

2 Background

Student life at USAFA is, in many ways, similar to what is experienced at other competitive liberal arts colleges. Admitted students have standardized test scores on par with other selective college admissions criteria (see Table 3) and USAFA is regionally accredited by the Higher Learning Commission (HLC). USAFA

offers 27 academic majors in common subjects such as History, Mathematics, Biology, and Economics. To meet degree requirements, students spend the bulk of their time dedicated to academic courses similar to those offered by other colleges. USAFA is, however, different in some important ways. After the successful completion of eight semesters of studies,[5] students are awarded a Bachelor of Science in their chosen field, as well as a commission into the United States Air or Space Force. In preparation for their military careers, students must also meet requirements for athletic and military training and obey a strict behavioral code of military discipline.

USAFA is also unique in that students have less control over their academic time than a typical student. Class attendance is mandatory and the USAFA degree program is quite demanding with around 93 credit hours of required core curriculum. To facilitate timely completion, students are not able to make changes to their schedule without approval from their faculty academic advisor. Moreover, academic requirements have often changed without student input or notice. First year course schedules are set prior to freshmen students arriving and any changes are typically made to correct clerical errors. Major curriculum is similarly applied as a template with any electives usually added when the student declares. Furthermore, students can only view the current term enrollment and weekly class schedules are published days before semester start. Late changes require paper documentation signed by student, advisor, affected department heads, and, occasionally, the Vice Dean before being delivered physically to the Registrar. Within-semester course rescheduling (e.g. moving a class later in the day to allow for more sleep) is not permitted given the complex optimization algorithm needed to accommodate all schedules and space constraints. The Registrar may even administratively drop a course from a student's schedule due to infeasibility. With little ability or gain from scheduling changes, USAFA students largely accept their schedules as given.

Students must maintain accountability for their whereabouts at all times during the academic year. The academic duty day follows a set schedule Monday to Friday beginning around 5 AM and concluding mid-afternoon. Compliance with this schedule (e.g. attending class or noon meal) is considered a student's military duty and therefore not optional; any non-emergency absence from academic time must be approved beforehand by a committee of commissioned Air Force officers and is generally granted only for official duties like military events or intercollegiate athletic competitions.

After their duty day has ended, students are free to spend their time how they choose but may not leave base without permission. Permission to leave base is granted during certain days and times depending on

5. Additional semesters are rarely granted and only in extenuating circumstances.

class rank. For example, freshmen are only permitted to leave on occasional weekends, sophomores may leave any time Friday through Sunday, while juniors and seniors have standing permission to depart any time after the duty day ends provided they return by late evening.

In addition, students are given an off-base "pass" budget each semester to spend on trips taken outside the aforementioned windows (e.g. overnight trips) which grow with class rank and time. Freshman are allowed 0-1 passes per week while seniors are allowed 1-3 per week.[6] The within-rank pass budget increases as students complete phases of military training throughout the academic year. The entire student body progresses through training phases simultaneously regardless of rank so pass budgets for students are almost entirely a function of rank and time-in-rank. In summary, upperclassmen are allowed a greater number of passes with greater flexibility in their use and thus we expect them to be more responsive to changes in time costs as detailed below.

Students record their time off campus via a computer log system. When a student signs out, the system records their departure time and asks if the pass to be used is official or recreational.[7] Upon return, they sign back in and the system calculates the elapsed time spent off-base and deducts the appropriate number of passes from the student's budget. A student departing base without signing out is considered "over the fence" (OTF) which results in considerable discipline ranging from loss of privileges (including permission to leave base) to disenrollment (USAFA, 2023). A student with repeated infractions could even face general court-martial (U.S. Congress, 2023) which could result in loss of monthly stipend, confinement to quarters, or dishonorable discharge from the military. Students punished for OTF are highly visible in their squadron (roughly 100-person peer group) and the entire student body: restricted students typically would not be allowed to travel for intercollegiate competitions, might be required to march around common areas in their highly-conspicuous service dress uniform, and often must lead other probationary students through the same disciplinary process they experienced.

The chances of being caught OTF are high for two reasons. First, students must appear at mandatory events throughout the day like morning inspection, meals, and evening checks in their residential quarters. This creates moments each day an OTF student would be noticed. Second, the nearest off-base amenities are at least a 30-minute round trip by car through three badged security checkpoints. A student could, for

6. No student is allowed more than 72 hours absence nor allowed to travel outside a 150 mile radius around USAFA without special approval.

7. The logs also include a destination field, but is defined by the student and not required. Hence, it is often incomplete or non-specific, e.g. "Colorado Springs."

instance, leave base to quickly purchase food and return without notice. A longer illicit trip, however, likely overlaps with one of the many check-times and would result in an OTF. Because of the severity of punishment and likelihood of detection, students use the sign out system to track most significant trips off-base.[8]

3 Conceptual Framework

To illustrate explicitly the trade-off between academic effort and leisure time, we adapt a simple model of leisure choice from Keane (2011). Convex student preferences are given by $U(G_s, L_s, \ell_s, \mathbf{X})$ where G_s is total grade points earned in semester s,[9] L_s is hours of high-value leisure spent off-base, ℓ_s is hours of low-value leisure in activities on-base such as scrolling social media or watching TV, and $\mathbf{X}$ is a vector of taste shifters. Since students earn grades instead of money through their labor, utility is a function of grade points rather than consumption. Higher GPA at graduation increases the chances a student is matched to their preferred USAF career assignment (e.g. pilot) so replacing consumption with grades is both intuitive and realistic for USAFA students. Additionally, all students receive fixed room, board, and stipend and are legally forbidden from formal employment. Although they enjoy goods consumption, students cannot labor more to increase their consumption as traditional models allow. Thus, their choice variables are limited to L_s, ℓ_s, and G_s.

Students allocate their semester time endowment net of class attendance, military activities, and sleep, T_s, to academic work hours, h_s, low-value leisure, ℓ_s, and high-value leisure, L_s with travel costs, $\tau > 0$. Students are constrained by the daily schedule which dictates not only class meeting times but also mandatory activities such as morning inspection, meal attendance, and lights out. Any remaining flexible time remaining is therefore primarily for studying or leisure. Section 5 discusses how USAFA students spend time in detailed activities that can be broadly categorized into academics, leisure on- and off-base, with the remainder going to military duties and personal care.

Students earn grade points according to $G_s = wh_s$ where $w > 0$ is the real return to study—i.e. the real wage rate—and 0 grade points are earned if a student does not study. Substituting into the time budget and rearranging, the constraint is then $G_s + w(1+\tau)L_s + w\ell_s = wT_s$. The price of low-value leisure on base is therefore $p_\ell = w$ while the price of high-value time away from campus is $p_L = w(1+\tau)$. Students allocate

8. Although OTFs are not formally reported and tracked at the institution-wide level, squadron leadership has commented that the logs are mostly accurate for longer trips and most squadrons have no OTF violations in the average semester. The violations that are found are usually due to changes in plans that were not properly reported rather than willful evasion of accountability systems.
9. Defined as credit hours times grade received out of 4.0.

time to high- and low-value leisure such that

$$\frac{MU_L}{w(1+\tau)} = \frac{MU_\ell}{w} \tag{1}$$

and therefore $MU_L > MU_\ell$ in equilibrium. Consider how optimal time allocation changes in response to an increase in the real wage rate to $w' > w$: assuming diminishing marginal utility, our model quite intuitively predicts students reduce time spent in both types of leisure but dispense with more low- than high-value leisure as wages rise. Formally, Equation 1 implies

$$\frac{\partial L^*}{\partial w} < \frac{\partial \ell^*}{\partial w} \tag{2}$$

which allows us to bound effects on low-value leisure allocation with estimated changes in high-value leisure.

An exogenous increase in credit hours reduces the total available free time T_s as students must attend more class meetings. At any interior solution, the marginal rate of substitution between high-value leisure and grade points is $-w(1+\tau)$ which implies less free time only reduces the utility-maximizing number of grade points and not leisure time. However, more credit hours likely also changes the real wage rate, albeit ambiguously. Additional credit hours increase the number of out-of-class commitments such as homework and studying. As students get busier, the number of grade points earned per study hour may fall. Conversely, increasing credits also increases the total grade points available which may cause the grade points earned per hour studying to rise. The total effect of more credit hours on a student's optimal bundle therefore depends on whether the income or substitution effect dominates. We empirically test the effect of credit hours on leisure in the proceeding sections with individual fixed effects and instrumental variables that leverage exogenous academic credit hour adjustments due to curricular changes observed from 2017-2021.

4 Curricular Changes

Beginning in April 2016, USAFA underwent a period of substantial changes to the required core curriculum that resulted in different required course loads by graduating class year (CY). Effective Fall 2018 for CYs 2021 and beyond, the total credit hours needed to graduate fell as new basket options allowed students to

use some core classes to satisfy major requirements (USAFA, 2017c).[10] Under the previous regime, some majors like Mechanical Engineering and Astronautical Engineering required 149 credit hours to complete so students needed to enroll in six courses every semester. The overhaul reduced the number of required courses from 32 to 29 which reduced the total credit burden for students in all majors (USAFA, 2016).[11] After these curricular changes, even students selecting majors with the highest course load would only need at most four semesters taking six academic courses.

In April 2017, one of the planned basket options was accelerated to include CYs 2018-2020, effective Fall 2017, resulting in an unanticipated and under-publicized three credit hour reduction in graduation requirements. The basket option combined two, three hour senior-level sociocultural courses into a single three hour course chosen from seven options (USAFA, 2017c). This change was made suddenly to relieve staffing shortages in the English and Geosciences departments rather than any fundamental curricular reason that could have been anticipated outside these departments (USAFA, 2017a) . The adjustment was announced via a 95 page package of institution-wide and (mostly) clerical changes to curricula with little publicity elsewhere, e.g. over email. Because this change was sudden and not well communicated, most students dropped one or both of the old required courses well past the pre-registration deadline and many advisors made these changes without involving the affected student.

The April 2017 curricular revisions also resulted in a decrease in Military and Strategic Studies (MSS) requirements totaling 1.5 credits for CY 2019 and 2020. In the original core, MSS requirements included two, 3 credit hour courses: one for sophomores and one for seniors. These would be combined in the new core into a single 4.5 credit hour course for sophomores. Anticipating this change, the MSS department stopped offering the senior-level 3 credit class before CY 2019 and 2020 could take it, but these students had already taken the old 3 (rather than 4.5) credit hour sophomore course. To remedy this shortage, the MSS department offered a 1.5 hour stop-gap course to CYs 2019 and 2020 to match what CYs 2021 and beyond would experience, resulting in an unanticipated net decrease of 1.5 credits hours for CYs 2019 and 2020 compared to earlier cohorts (USAFA, 2017b).

In summary, the whole of changes between April 2016 and April 2017 created three distinct cohorts: (1) CY 2017 which experienced the original requirements of 96 credit hours in 32 courses, (2) CY 2018 which

10. All curriculum handbooks and change proposals are available upon request from the U.S. Air Force Academy Office of Student Academic Affairs and Academy Registrar.

11. The core curriculum change was also part of broader re-alignment of academics with USAFA institutional learning and mission outcomes on the recommendation of an external curriculum review.

only needed 93 hours in 31 courses after implementing the sociocultural option early, and (3) CYs 2019 and 2020 which had 31 courses and only 91.5 credit hours after both the sociocultural and MSS reductions. Because the changes were imposed by graduation year for students who were already enrolled, the iterative process of core revision generated exogenous variation in course loads that deviated significantly from historical semester course enrollments.

5 Data

Our dataset includes academic and demographic records for the entire population of students attending USAFA from Fall 2000 until Spring 2021, covering CYs 2004-2021. These data include information on outcomes such as courses completed and grades earned as well as background factors such as pre-college standardized test scores and demographic attributes. We match via SSN academic records to administrative sign out logs which overlap for four semesters: Fall 2016, Spring 2017, Fall 2017 and Spring 2018 which covers CYs 2017-2020. The sign out logs contain 4,233 individual students during these four semesters for a total of 15,168 semester-by-student observations.[12] 13,876 of these student-semesters of sign out data can be linked to academic records resulting in joint data for 4,018 unique students. The majority of student-semesters that cannot be linked can be attributed to students with irregular schedules due to early disenrollment, studying abroad, etc. Our final analytical sample contains 3,758 students with complete records of all variables necessary for analysis.

Our analytic dataset features 264,406 unique student trips during the Fall 2016-Spring 2018 period. Almost 90% of sign outs (235,028) are reported as strictly recreational and 428 passes are for explicitly non-recreational reasons such as medical emergencies or bereavement. We exclude these non-recreational sign outs from all estimates because they are explicitly not leisurely in nature. The remaining 29,350 sign outs were for official travel with prior approval, often related to travel for collegiate sports but also including travel for class field trips, club activities, or other academic or military duties. Whether this official travel should be considered labor or leisure is ambiguous. While we may wish to exclude from our sample intercollegiate athletes traveling with official approval to weekend competitions, we may also wish to include non-athletes traveling to spectate those competitions which also requires the same official approval. Required sport or class activities may not seem particularly recreational, but even these required travel events likely include

12. Some clearly erroneous records were removed e.g. sign outs with negative duration or lasting for several week.

recreation as students socialize in and around their scheduled travel. Moreover, students may decrease or increase their participation in sports and activities in response to variation in their academic obligations, and excluding official travel would preclude estimating the magnitude of these adjustments. To accurately portray the effects of varying credit hours on different types of student time, we show separate estimates for all non-emergency sign outs (including officially-approved travel) and for purely recreational sign outs (excluding official travel). We further investigate the potential heterogeneity of travel type by showing results for recruited athletes and non-athletes separately.[13]

We supplement these data with a detailed time-use survey administered to a random 25% sample of USAFA students across all class years in January 2014. Students recorded their time spent on predefined categories of activities including sleeping, eating, and studying during a two-week period. Participation was mandatory and times were set aside each day for responding to the survey. We match these time-use responses to academic records by SSN to measure the returns to study for different course schedules, allowing us to construct "market wages" and thus estimate the elasticity of labor supply. We describe this process in detail in Section 7.

In addition to constructing wages, the time-use data helps characterize student life at USAFA. Although USAFA imposes stricter rules governing daily life than a typical university, students appear to spend their time in similar ways as the average undergraduate. Figure 1 compares the average weekday and weekend for USAFA students to students in the American Time-Use Survey (ATUS).[14] USAFA students spend less time sleeping, attending to meals and grooming, and leisuring, but more time in class, studying, and exercising. These differences are not surprising: USAFA students uniformly take classes at a college more competitive than the national average, have a uniformly high course load of 5-6 classes per semester, and are required to pass periodic physical fitness assessments. Students also spend a fair amount of their day on military duties (the "work" category) which are roughly analogous both in time and scope to a part-time job or extracurricular affinity groups. But, unlike work at other schools, these duties are not optional and students cannot decrease these hours if the utility maximizing time allocation would suggest spending this time on studying or leisure instead.

Figure 1 also shows USAFA students spend relatively more leisure time away from campus. While the

13. To prevent endogenous selection in and out of athlete status we define athletes as students recruited by an intercollegiate sports team prior to enrolling at USAFA.

14. We use the 2012-2019 ATUS sample of full-time students aged 17-23 with no dependents during the academic months of September to April.

USAFA campus offers some amenities such as a coffee shop and small food court, the options are limited and operate shorter hours than a typical university campus. Although there are a wide variety of amenities off-base, the campus lies outside the Colorado Springs municipality in a somewhat isolated area hemmed in by an impassable mountain range on one side and a security perimeter on the other. Leaving base requires non-trivial travel by car and students are not always authorized to do so. Because off-base recreation is costly and students still so routinely seek it, we define their time away as high-value leisure – higher value than low-value leisure activities on-base such as reading or watching TV. The sign out logs give us an objective and systematic way to measure this high-value leisure time.

Figure 2 shows the relationship between the number of credit hour units and sign out activity. The top left panel underlays a histogram of credit hours for our sample. The vast majority of student-semesters feature between 15 and 22 credit hours, with very few ever taking fewer than 15 credits or more than 22. Semester credit hour load is negatively correlated with the total time spent off-base, the total recreational time spent off-base, the total number of trips off-base, and the total number of strictly recreational trips off-base trips. This suggests that coursework indeed serves as an obstacle to high-value recreation. Furthermore, the rate of substitution between sign outs and course load appears to be increasing in credit hours for number of trips: the duration is somewhat flat until approximately 18 units. Interestingly, the relationship between credit hours and total number of sign outs is quite steep at low credit hours but levels off around 20 units: students increasing from 4 to 5 courses show large changes in their sign out activity, but adding a sixth or seventh class appears to be correlated with very little change to the total number of sign out events.

The top panel of Figure 3 shows the average credit hours taken by each cohort in each semester with the four cohorts in our analytic sample shown in blue. CY 2017 completed similar levels of credit hours each semester as all previous CYs. CY 2018 diverged from previous cohorts in semesters 7 and 8 (their graduating year) by roughly three credit hours which coincides with one fewer sociocultural requirement effective Fall 2017. Compared to CY 2018, CY 2019 completed about half a credit hour less in semesters 5-6 and 2020 completed about half a credit hour less in semesters 3-4—both of which coincide with the MSS reduction for these cohorts. The new core was implemented in Summer 2017 as CY 2021 was entering USAFA. This cohort returned to the typical average semester load of CYs 2004-2017 which suggests indeed that CYs 2018-2020 experienced a cohort-specific shock to their course loads.[15]

15. Although the Spring 2020 semester does not appear in our sign out data and is not used to identify the effects of sign outs below, one may also notice the CY 2020 graduates took about 2 credits fewer than would be predicted by the preceding cohorts. This was not due to planned curricular changes but was a response to the Covid-19 pandemic. Seniors were granted granted early completion

The lower panel of Figure 3 shows in bold the specific cohort-semesters used in our analysis. There is significant variation in semester course loads across CYs induced by curricular changes between March 2016 and April 2017. Younger cohorts may have been able to smooth their course loads in future semesters—e.g. CY 2020 seems to converge with CY 2018 in semesters 6-8—but we do observe same-semester differences across cohorts that coincide with the effective dates of graduation requirement revisions. We use this exogenous variation in credit hours by cohort-semester to construct a novel cohort instrument to identify the effect of credit hours in leisure in the sections below.

6 Causal Identification

Despite the strong and intuitive negative correlations between sign outs and credit hours in Figure 2, the choice of labor-leisure allocation is clearly endogenous to a host of unobserved student characteristics and preferences. To combat potential selection bias in our estimates, we use two complementary identification strategies to corroborate our findings: student fixed effects and instrumental variable estimates using cohort-specific curricular changes. This dual approach has two advantages: first, each addresses different sources of potential bias. Fixed effect estimates consider only within-student variation which eliminates bias from student-specific preferences for leisure correlated with course load enrollments. This strategy is still susceptible to bias from time-varying individual preferences for leisure that affect credit hour choices. Our instrument addresses this threat by considering only credit hour differences associated with each cohort which averages over any idiosyncratic unobservables that change across semester. This IV strategy is possibly threatened by differences in the composition of cohorts correlated with leisure preferences unlike fixed effects that capture such differences. We show our results are robust to the choice of model which supports our claim of causality.

Second, each model estimates a different but compelling treatment effect. Fixed effect estimates identify the treatment effect of additional credit hours averaged across all semester course schedules and students. This average treatment effect is identified by credit hour variation from term to term as any student might regularly experience. In contrast, our cohort IV identifies the local average treatment effect induced by unexpectedly removing whole courses from student schedules through USAFA's curricular update for students subject to these changes. Because the courses moved by curricular revision are in common academic subjects, both parameters are quite policy relevant, particularly in cases where an institution suddenly changes schedules,

at reduced credits for many of their core required courses during the Spring 2020 semester to allow for their early graduation and thus early departure from USAFA.

for example, course shut-outs (Mumford et al., 2025; Robles et al., 2021). For these reasons, both the average treatment effect identified by fixed effects as well as the local average treatment effect found using an IV specification are interesting and therefore we show the results of estimating each.

6.1 Student Fixed Effects

The negative correlation between course load and leisure found above could be driven by student-specific factors. For instance, some students place higher priority on their studies, causing them to both take more classes and spend less time off base. Alternately, some students may have less opportunity for recreation off-base and therefore choose to take more classes. Hence, we estimate a student fixed-effects model to address concerns of bias from unobserved, time-invariant student-specific factors:

$$Y_{ist} = \alpha + \beta^{\text{FE}}\text{Credit Hours}_{ist} + \mu_i + \mu_s + \mu_t + \varepsilon_{ist} \tag{3}$$

Y_{ist} are sign out outcomes for student i with s semesters of tenure. The estimated effect of credit hours per semester on sign outs, β^{FE}, is additionally conditioned on student fixed effects μ_i to account for any time-invariant, student-specific preferences for sign out leisure time. We also include tenure fixed effects, μ_s, to control for sign out allowances increasing with seniority and calendar year fixed effects, μ_t, to account for any changes to sign out policies that are common to all students. Note we exclude any fixed student-level covariates to satisfy conditional independence. We observe many demographic and academic attributes of students which vary by semester and could in theory be added, such as grades earned and academic major, but these are all likely endogenous and therefore omitted to prevent bias.

Our estimates of β^{FE} give the casual effect of credit hours on sign outs if there are no time-varying, student-specific shocks correlated with both course load and sign out behavior. Although this assumption may be unrealistic at other institutions, it is likely to hold at USAFA. First, USAFA has a large core curriculum: students must complete 91-96 credit hours of required courses which does not leave much room for variation in any individual semester. Second, scheduling these core classes is subject to strict timing and sequence. For example, two semesters of core calculus must be taken in sequence during first year, while a semester each of Econ and Law must be completed during the second year. Third, schedule changes are difficult because many courses are only offered either fall or spring. Fourth, core courses are often over-enrolled preventing any changes in registration. Fifth, academic majors are also quite large, requiring around 45 credit hours on

average mirroring both the size and sequencing limitations found in the core curriculum. Within each major, most students are only allowed 3-4 elective courses, which themselves may have prerequisites limiting the semesters a student would be eligible to enroll. Students are usually enrolled in 5-6 courses per semester at a minimum to meet requirements—even in their senior year—leaving little room for additional course enrollments or rearranging required courses. Lastly, in addition to the core and major requirements, students must satisfy semester course registration minimums. Even students with many credit transfers and validations must still take at least 4-5 classes every semester to meet minimum registration. This means students stand little to gain by strategically scheduling courses; for example, front-loading their schedule by overloading classes in early semesters would only result in having to take additional classes later on to meet minimums. In sum, because of the large number of core, major, and semester registration requirements students typically stand to gain very little from any changes to the default prescribed four-year academic schedule.

There are also significant procedural obstacles to students modifying their course enrollment in a given semester. First, during the period of our study student records including scheduling and enrollment were maintained on a proprietary system that granted little control or visibility to the students. Students could see only their schedule of classes for the current term and needed to ask a faculty member for any additional information such as their pre-registration plan for future semesters. Also, unlike most colleges, students at USAFA cannot register for classes or change their academic enrollment independently. Initial courses are set for first-year students during matriculation and changes for undeclared students can only be made in coordination with their faculty advisor along with approval from the lead advisors for undeclared students. For upperclassmen, academic courses are set at major declaration by the department lead advisor and future changes can only be made in coordination with their assigned major advisor and then approved by the major's lead advisor. Although advisors can and do make changes at an advisee's request, it is still a more regimented process than is found at other institutions. Pre-registration is set electronically in April and October for the Fall and Spring semesters, respectively—3-5 months ahead of class start. After this deadline, schedule changes require paper documentation hand-delivered to the Registrar with physical signatures by the student, advisor, lead major advisor, and the lead advisor of any courses being added or dropped. Any changes requested after the first week of classes also require signatures from the affected academic department(head or Vice Dean (depending on the date). This presents a major obstacle to schedule changes by the student. Because of the curricular inflexibility mentioned above and tedious process to request changes, students largely accept their schedule as dictated by the first-year and major templates. One notable exception is that

athletes may attempt to lighten course loads in-season when they declare their major. Fortunately, we can explicitly test for this strategic scheduling by subsetting our results by athlete status.

6.2 Fixed Effects Results

Table 1 shows the effect of credit hours on student sign outs with individual fixed effects estimating as in Equation 3. Each additional credit hour leads to 6.9 fewer hours spent off-base (4 percent) and 0.24 fewer trips of any length (1.5 percent), both statistically significant at the 1% level. To put this in context, a typical 3 credit hour class leads to 20.7 fewer hours off base per semester and Equation 2 implies the impacts on time in low-value activities on base is likely even larger. Since the average student accumulates about 500 hours signed out per semester this suggests roughly a 5% decrease in time off base per course. Columns 3 and 4 show smaller impacts of 2.35 fewer purely recreational hours (statistically insignificant) and 0.163 recreational trips per credit ($p < 0.05$), implying the overall effect is driven by official travel. However, this estimate averages over important heterogeneity as we show below.

Consider how an almost 21 hour decrease in time spent off campus relates to the total time cost per course. Since the modal course at USAFA consists of 40 one-hour lessons, an additional course requires at least 40 hours per semester. This means the roughly 21 hour reduction in time off base reflects about half of the time cost imposed by a 3-hour course. If we assume the recommended class to study time ratio of 1:2 (U.S. Department of Education, 2010), each class costs 120 hours and, thus, 17.25% of the time necessary to complete an additional course comes from reducing high-value leisure while the remaining 100 hours must come from decreasing time spent studying for other classes or low-value leisure time.

Columns 1 and 3 of Appendix Table A1 show results are similar for students crossing an 18 credit hour threshold as a student would experience moving from five to six academic courses. This suggests the estimates above are driven primarily by changes among average students not, for instance, highly motivated students moving from 22 to 25 credits. Odd-numbered columns in Appendix Table A2 compares similar fixed effect estimates across quartiles of academic composite. We cannot reject the null hypothesis that estimates are equal across academic composite, suggesting that college preparation does not drastically influence students' ability to adjust to credit hours changes.

We show heterogeneous effects by class rank and athlete status in Table 2. Notice first the means of the outcome for each subgroup: upperclassmen with more freedom accumulate around 170-210 more hours signed out and take around 6.5 more trips than underclassmen who are restricted to base more often. Athletes

in Panel A spend around 90 hours more off-base in the same number of trips compared to similarly-ranked non-athlete students. Comparing this to average recreational time in Panels C and D, we note the hours difference is entirely driven by official travel and athletes do take less recreational trips, implying they take more official trips than non-athletes. Together, the means match our expectations given athletic competition is an official function and underclassmen have much less ability to leave campus recreationally. These patterns of travel further suggest different margins of substitution for athletes and non-athletes which we investigate next.

Columns 1 and 2 of Panel A show the effect of an additional credit hour for upperclass non-athletes and athletes is approximately 10.1 ($p < 0.01$) and 12.9 ($p < 0.05$) fewer hours spent off-base, respectively. The large results for non-athletes suggests that athletes' competition travel alone does not explain the effects found in Table 1. We find no impact on underclass non-athletes (column 3) but a large negative effect of 13.2 per credit hour for underclass athletes (column 4), significant at the 1% level. Since underclassmen have less freedom to sign out recreationally, the latter effect is likely driven by athletes strategically reducing credit hours in-season to allow for more intercollegiate sports travel. Importantly, we find no significant effects for underclass non-athletes which legitimizes our sign out measure since these students show no response of credits to sign outs when they cannot use recreational passes and are not traveling for athletic competition.

Panel B of Table 2 shows upperclassmen allocate their time slightly differently by athlete status. Both groups reduce their leisure hours but non-athlete upperclassmen take 0.43 fewer trips in response to an additional credit hour (significant at the 1% level) while their athlete counterparts reduce the number of trips taken by half as much (-0.25), and the effect is noisily estimated. Taking columns 1 and 2 of Panels A and B together, it seems both groups spend less time off-base, but athletes tend to take the same number of now-shorter trips. Panel B again shows underclass non-athletes sign outs are unaffected by additional credit hours (column 3) while underclass athletes take a statistically significant 0.24 fewer trips per credit hour ($p < 0.05$).

Panels C and D of Table 2 show the effects are driven by recreation for non-athletes and official travel for time-constrained athletes. We estimate non-athlete upperclassmen spend 8.5 fewer hours and take 0.39 fewer trips per credit hour, or 24 fewer hours and one fewer trip per academic course, both significant at the 1% level. This means the sizable effect for non-athletes is mostly explained by recreational travel. On the other hand, upperclass athletes' recreational travel is largely unaffected by additional credit hours (column 2 of Panels C and D). Given that these athletes spend so much time on official travel for competition, it is

unsurprising that athletes have little time left for off-base leisure. We find no or noisily estimated effects on recreational hours and trips for either type of underclassmen who have little opportunity to leave base. Because athletes and underclassmen have lower ability to sign out on recreational passes, the null results in columns 2-4 serve as placebo tests of the intended mechanism. The relationship between sign outs and credits is restricted to non-athlete upperclassmen—the very students who are most able to take advantage of their additional free time during low credit semesters. Unsurprisingly we find little change in recreational travel for underclassmen (athlete or not) as their ability to sign out for unofficial travel is limited regardless of their schedule.

6.3 Cohort Instrumental Variables

Our fixed effect estimates likely reflect the causal effect of credit hours on high-value leisure time spent off base for non-athletes because of the enormous barriers to rescheduling courses discussed in Section 6.1. Nonetheless, it is still possible for students to convince their advisor to adjust their schedule to allow more leisure time, potentially biasing our results if their idiosyncratic efforts vary by semester. For example, some students could move courses to the Fall semester to make their Spring enrollment lighter and allow for more ski weekends. To alleviate concerns that time-varying, student-specific factors threaten our identification, we estimate an instrumental variables model exploiting changes to the core curriculum that occur across graduating year cohorts which are outside the students' and advisors control (see Section 4). Figure 3 shows CYs 2018-2020 completed fewer credit hours than previous years in semesters after Fall 2018 when unanticipated reductions to requirements went into effect. CY 2021 experienced the updated core curriculum as intended and their course enrollments returned to the historical averages of CY 2017 and prior, with fewer courses taken in their junior and senior years as planned. In short, CYs 2018-2019 were required to complete fewer total credit hours to graduate than CY 2017, and CY 2020 had an even lighter requirement than all three.

To estimate explicitly the effect of these curricular changes on classes taken and then sign out activity we estimate via two-stage least squares:

$$\text{Credit Hours}_{ist} = a + b_1 \,\text{CY 2018}_i + b_2 \,\text{CY 2019}_i + b_3 \,\text{CY 2020}_i + \mathbf{X}_i c + \mu_s + \mu_t + u_{ist} \tag{4}$$

$$Y_{ist} = \alpha + \beta^{\text{IV}} \widehat{\text{Credit Hours}}_{ist} + \mathbf{X}_i \gamma + \mu_s + \mu_t + \varepsilon_{ist} \tag{5}$$

In the first stage, we instrument $\text{Credit Hours}_{ist}$ with a set of indicators for graduating in 2018, 2019, or 2020, relative to the cohort graduating 2017. We further condition on a vector of student-specific factors, $\mathbf{X}_i$, namely, academic composite (a measure of pre-USAFA academic ability including standardized high school test scores) and the interaction of semesters of tenure, non-white, female, and recruited athlete. Last, we include fixed effects for semesters of tenure, μ_s and calendar year, μ_t. Our instruments leverage the reduction in required courses by graduation year relative to the status quo of CY 2017 (see Section 4). The second stage uses the predicted number of credit hours as an exogenous determinant of sign out behavior, Y_{ist}, conditional on student characteristics and tenure and calendar year fixed effects.

The causal effect of credit hours on sign outs β^{IV} is identified by two-stage least squares if our graduation year cohort instruments satisfy the relevance and exclusion restriction assumptions. Table 4 shows the first stage F-statistic of 275 is quite large so the relevance assumption is likely satisfied. We anticipate cohort to be strongly correlated with credit hour loads because each CY has a default template for both core and majors courses. Although students may choose to deviate from the typical course load each semester, this will not bias our estimates so long as cohort is still correlated with credit hours in each semester.

Table 3 shows means of pre-USAFA characteristics by CY are balanced which supports the exogeneity assumption. Students admitted to USAFA in every year have similar SAT and ACT test scores. While there are some small discrepancies between cohorts, the absolute value of the mean difference normalized by the standard deviation of the difference is smaller than the 0.25 threshold for significance suggested by Imbens and Wooldridge (2009).[16] USAFA aggregates standardized test scores and other prior academic records like high school course grades into a student's academic composite score, used for admissions and other academic decisions. Academic composite scores do not differ significantly across cohort. Importantly, differences in credit hour loads by graduation year could be the mechanical result of students entering with more validation credits. Table 3 shows there were only small, insignificant differences of at most 0.6 hours validated by CY.

16. The normalized difference in means is independent of sample size which avoids Type I Error that arises from rejecting the null when the difference is economically trivial but sample sizes are large.

Panel B shows demographics of each cohort are also similar. Later class years do have slightly more women and Asian students, but the normalized differences are not significant. Finally, cohort-specific drop out rates could explain average differences in leisure time. Fortunately, attrition was low (10-13%) and similar across graduation years with the largest difference being an insignificant 3 percentage points.[17]

We also argue that graduating class year only affects sign out behavior through semester credit hour loads. The first threat to this assumption is students' strategic selection of USAFA cohort based on knowledge of coming curricular changes and their propensity to sign out. Although it is theoretically possible for some students to strategically time their entry to USAFA, accelerating or delaying college by one year in order to avoid a 3 credit course seems exceedingly unlikely. The fact that these changes were implemented suddenly and without communication outside the USAFA community casts even more doubt. Most students begin college immediately after high school, so our cohort instrument is primarily influenced by birth year. We have no evidence that birth year alone significantly influences propensity to sign out and are not aware of any reason for students born in different years, especially in cohorts so close together, to have significantly different propensities to sign out. Importantly, we show that the differences in sign out behavior are specific to semesters where cohorts differ in average credits, so an alternate explanation driven by cohorts' differential propensity to sign out seems extremely unlikely. Some USAFA students do not come straight from high school and enter USAFA either as previously enlisted or as a transfer from some other university. Moreover, we show results persist after removing students with prior military service, experience at the USAFA prep school,[18] or a large number of transfer credits from other universities (see Table A3). The similarity of the results excluding these students with unusual schedules suggests their behavior does not explain our primary findings. Lastly, there could be some unobserved variable correlated with cohort that is also correlated with sign outs in a given semester. However, all results are conditioned on academic year as well as semesters of tenure. This means that any year-to-year or tenure-specific variation in pass budgets will not bias our results. It is still theoretically possible that, for instance, cohorts with lower course requirements were also systematically granted a larger sign out allowance. This runs contrary to how pass budgets are usually allocated, and we find no evidence of cohort-specific variation in pass allowances based on student military standards documents published during our study period.

17. Cohort differences in preferences for study versus leisure could bias our estimates. However, interest in STEM majors—which require more credit hours and likely demand more attention in academics—reported at matriculation was balanced across CYs 2017-2019 but unfortunately was not recorded for CY 2020 (results available upon request).

18. Typically reserved for people who do not meet academic admission standards but are admitted contingent on passing a remedial year of instruction.

6.4 IV Results

Table 4 displays the results from estimating Equation 5 using two-stage least squares. Column 1 shows the first-stage estimates of predicting credit hour loads by CY conditional on student characteristics and fixed effects for tenure and calendar year. CYs 2018-2020 completed between 2.1 and 2.5 fewer credit hours per semester on average than CY 2017 which coincides with the average course loads by cohort shown in Figure 3. The first stage IV estimates do not exactly match differences in stated credit hour requirements for graduation because curricular changes were binding in different semesters for different cohorts due to required sequencing. In addition, younger students had more notice of these changes and likely smoothed their course loads across semester more than earlier-graduating cohorts. There is some evidence of monotonicity in graduation year, although we cannot reject the null hypothesis that the effect is the same across cohort at the 10% level. Columns 2-5 show the second stage IV estimates of the effect of credit hours on sign out behavior. We find that an additional credit hour reduces students' time spent off-base by 17.4 hours on average, significant at the 1% level. This estimate is much larger than what was found using fixed effects. Intuitively, students may try to balance their semester course loads to leave space for recreation, but the exogenous and unexpected curricular changes meant that many students could not smooth as effectively. Column 3 shows that each additional credit hour of enrollment causes students to take .52 fewer trips off base, although this effect is noisily estimated. Columns 4 and 5 show similarly negative impacts on strictly recreational sign outs. Unlike our fixed effects results, reductions in sign outs induced by curricular changes are almost entirely driven by recreational leisure: students reduce time off-base by 12.5 hours and 0.34 trips per semester for every additional credit hour taken. This suggests that students may be more willing and able to adjust their recreational sign out behavior than their officially-sanctioned time off-base. Columns 2 and 4 in Appendix Figure A1 show that IV results are similar using crossing an 18 credit threshold as our treatment rather than just adding one additional credit. Even-numbered columns in Appendix Table A2 compares similar IV estimates across quartiles of academic composite. As with our fixed effect estimates, We find mostly similar IV estimates across the distribution of previous academic experience.

Table 5 shows second stage estimates for upperclass students by athlete status. We cannot estimate Equation 5 using 2SLS for underclass students separately because we do not observe enough semesters of sign outs for older cohorts during their first four semesters to estimate all of the first stage cohort effects along with semester and year fixed effects. Panel A shows the instrumented effect of an additional credit hour

on any time spent off-base. Non-athletes and athletes reduce sign out duration by 14.4 ($p < 0.05$) and 28.6 hours ($p < 0.01$), respectively. The IV estimates exhibit a similar pattern as fixed effect estimates but the magnitude is larger. Unsurprisingly, upperclass athletes seem especially time-constrained such that they cut almost 90 hours off-base per semester for every additional three credit hour course. Column 1 of Panel B shows non-athletes reduce sign outs by a statistically insignificant 0.4 trips per credit hour while column 2 shows athletes take 1.32 fewer trips, significant at the 1% level. Unlike previous estimates, Panels C and D show our IV estimates for upperclass students are driven by recreational trips: non-athletes spend 12.87 fewer recreational hours off-base (column 1, panel C, $p < 0.05$) and take 0.29 fewer recreational trips off base (column 1, panel D). The effect on recreational hours for athletes is insignificant and about half as large for any hours signed out (-14.77) but much larger than was found estimating the same relationship using fixed effects. Finally, column 2 of panel D shows the effect of more credit hours on trips for athletes is almost entirely cutting back on recreational departures; 0.95 fewer recreational trips per credit hour, significant at 5% level. These instrumental variable estimates provide further evidence that higher course loads causally reduce high-value leisure for college students. And, as with our fixed-effect results, our most precise estimates for recreational travel are those for upper-class non-athletes—the exact group that should be best able to take advantage of their additional free time during semesters with exogenously reduced credit burden.

7 Elasticity of Leisure Substitution

To further contextualize our findings, we estimate the elasticity of high-value leisure substitution students exhibit in response to higher returns to study. Assuming CRRA preferences that are increasing in leisure,[19] the empirical log-leisure equation is,

$$\ln L_{is} = a + \eta \ln w_{is} + \mathbf{X}_i\theta + \mu_s + \mu_t + \varepsilon_{is} \tag{6}$$

where η is the partial Frisch elasticity of substitution from a temporary wage shock, $d\ln w$. To estimate this equation, we measure L_{is} using total hours signed out[20] by student i during semester s, $\mathbf{X}_i$ is the vector of student-specific covariates used in Equation 5, and μ_s and μ_t are semester and year fixed-effects, respectively.

Given our model in Section 3, the student-by-semester wage rate is $w_{is} = G_{is}/h_{is}$—grade points earned

19. Replacing labor hours—which we do not directly observe—with leisure hours merely changes the sign of the elasticity.
20. We use the predicted total hours signed out from our 2SLS model to avoid reverse causality, though results are similar using observed sign out time.

per academic work hour. Unfortunately, we do not observe study hours in our analytical sample. Instead, we use the January 2014 detailed time-use survey to construct individual wage rates during the Spring 2014 semester. We then model wages as

$$w_{is} = \kappa_0 + \kappa_1 MAG_{is} + \mathbf{X}_i\delta + \nu_{is}$$

where $\mathbf{X}_i$ is a vector containing demographics, academic composite score, class rank, and major division.[21] MAG_{is} is the moving average grade points earned in the previous three semesters by students with the same course schedule which measures the difficulty of a course load and captures differences in the return to study across student. We then predict out-of-sample using OLS the wage rate for our analytical sample of students enrolled during the Fall 2016-Spring 2018 semesters. Importantly, this predicted wage rate is based on a separate sample who took courses of similar difficulty and thus is entirely unaffected by student effort in our analytical sample. We consider this the exogenously-determined "market" wage for all students with a particular set of observable attributes taking the same set of courses in a given semester. While students could strategically design a schedule to increase their wage rate, we do not believe this is the case for the same reasons described in Section 6.1. Furthermore, if students did manipulate their schedule it would likely be to smooth effort over time which would bias our estimate of η towards zero.

Panel A of Table 6 shows students exhibit an elasticity of leisure substitution equal to -0.17, significant at the 1% level, conditional on taste-shifters and any semester- or year-specific trends. Intuitively, estimates suggest that every 1% increase in grade points earned per study hour is associated with a 0.17% decrease in leisure time. We find a similar elasticity of -0.149 using instead strictly recreational sign out hours as our measure of leisure, also significant at the 1% level. To further combat the potential for idiosyncratic demand-shocks to wages, we include individual fixed effects in Panel B and find even larger elasticities of -0.377 (any sign outs) and -0.322 (strictly recreational), both significant at the 1% level. This suggests that the substitution effect dominates for the average student: students spend less time leisuring off-base and presumably more time studying during semesters in which they are most productive, rather than achieving some GPA threshold with less effort and allocating the balance of their time to leisure. Although our "consumption" good of grade points is somewhat unusual and our population younger than the labor market's average, the Frisch elasticities themselves are generally in line with previous research (Chetty et al., 2011;

21. Basic Sciences, Engineering, Humanities, or Social Sciences.

Elminejad et al., 2023; Keane and Wasi, 2016; Orr, 2023).

8 Effects on Performance

We have shown students adjust to additional time constraints by reducing their high-value leisure time inelastically, implying they may also reduce their effort assigned to required tasks to preserve some leisure time. To investigate the magnitude of this adjustment, we estimate below how student performance changes in response to additional credit hours. In addition to typical grade point average (GPA), USAFA records a student's military performance average (MPA) and physical education average (PEA) each semester, all measured on an analogous 0-4.0 point scale. MPA is a weighted average of instructors' and squadron commander's[22] subjective ratings of professionalism and leadership abilities based on classroom interactions and duties performed in squadron.[23] While these scores are subjective, they are intended to measure student executive functioning skills, such as organization or time management, and likely to increase from additional time dedicated to required tasks for students' academic classes and military squadrons.[24] Finally, PEA is a weighted average of physical education (PE) course grade and Air Force physical fitness test score.[25] Unfortunately, we do not observe physical fitness test scores directly so we instead use the residuals from the regression of PEA on PE grade points to isolate the variation in PEA due to physical fitness tests alone. PE grades reflect competence in specific athletic skills such as the ability to accurately serve in tennis, and athletes are automatically awarded an A for varsity practice hours during one semester per year during their sports' primary season. Although PEA gives some measure of dedication to fitness, we believe residual PEA better reflects the student's actual physical fitness throughout the semester.

Table 7 shows the effect of an additional credit hour on the three measures of performance using both our fixed effects and IV models. Columns 1 (fixed effects) and 2 (IV) show each additional credit hour course reduces a student's semester GPA by 0.054 to 0.084 standard deviations, both significant at the 1% level. This translates to an additional three credit hour course reducing GPA by between one-third and one-half of a letter grade; the distance between a B (3.0) and B+ (3.3), for example. Lower GPA could lead to academic probation and estimates in Appendix Table A4 shows more credit hours do slightly increase the probability

22. Typically an active duty Air Force Major or Lieutenant Colonel whose full time assignment is leading a squadron of approximately 100 students.
23. The closest analogue to these duties in a typical university setting would be extracurricular club officers, such as a treasurer.
24. The unconditional correlation between term GPA and MPA is 0.29.
25. Points are earned by performing push-ups, sit-ups, time in a 1.5-mile run, and an abdominal measurement.

of probation.[26] Column 3 shows no effect of credit hours on MPA in our fixed effects model but isolating the variation from our cohort-based instrument reveals an effect of -0.35 ($p < 0.01$) standard deviations. While subjective, it is no surprise that busier students might appear less engaged in class or forget to accomplish all required military duties, leading to a lower MPA rating. Lastly, columns 5 and 6 show negative impacts on standardized physical fitness test scores of 0.027 (FE) and 0.08 (IV) per credit hour, both significant at the 1% level. Although students can somewhat accommodate additional credit hours by reducing their leisure time, we also find that students make significant compromises in their academic, military, and physical performance when faced with the additional time requirements of added academic coursework.

Table 7 shows higher course loads not only worsen academic performance but also hinder physical fitness and personal development of soft skills like time management. These results further imply two important points: first, students do not seem to reallocate the lost off-base leisure time to military duties or exercise given the lower MPA and physical fitness scores observed. Instead, they may spend those saved hours studying, though we do not observe time in academic preparation. Part of the time is attending additional class meetings; but, one might expect attenuated impacts on GPA if students devoted the remainder to studying. They may indeed study more as course loads rise to avoid even deeper GPA losses and, potentially, academic probation, but most students evidently prioritize academic success over squadron accolades or physical fitness.

9 Conclusion

By estimating the causal effects of credit hours on time spent off campus for college students, this paper presents new evidence on the time costs of higher education. We combine USAFA students' academic history with records from a mandatory sign out log of campus departures to find each additional credit hour taken reduces off-campus time by 6.9 fewer hours on average. During our sign out history USAFA underwent several revisions to its core curriculum which induced several exogenous changes to student course loads. Exploiting this exogenous variation we estimate a cohort-based IV and find a local average treatment effect of each credit hour on high value leisure to be 17.4 hours off base per semester. Attaching to our dataset exogenous wage rates (i.e. grade points per study hour) estimated from untreated cohorts we find the effects

26. students on academic probation are restricted from leaving campus which, in theory, could be one explanation for why we observe sign outs decreasing in academic credit hours. Importantly the effect size that we find (0.005 percentage points per credit hour, $p < 0.01$), is very small - certainly not large enough to explain the impact a credit hour has on sign outs.

of wages on the leisure hours suggests a labor supply elasticity 0.377 which is similar to what has been found elsewhere in the labor literature.

Our study is particularly unique in that it examines how student leisure choice interacts with academic and extracurricular performance. A detailed panel of students allows us to observe a broad set of outcomes over time, characterizing credit hour effects not only on leisure and academics but also on soft skills development through leadership training and on physical fitness. Despite significant cutbacks to leisure time, students with additional credit hours have worse GPA, worse military performance ratings, and lower physical fitness scores. Unlike previous studies that focus on a narrow set of outcomes, we show how an added course affects a student's college experience holistically.

This paper provides the first credible estimates of the time costs of credit hours in higher education. College students at most schools exert great control over their course loads so choosing the right level of enrollment is important for both their happiness and success. The constraints imposed by USAFA are decidedly atypical and likely attract more responsible students. Yet, we find even the most able students struggle to balance demands on their time without relinquishing performance, implying effects for the median undergraduate student are likely larger, *ceteris paribus*. Recognizing students supply academic labor inelastically, university initiatives to increase term course loads such as the "15 to Finish" campaign or raising the full-time student aid threshold[27] may have the unintended consequence of harming student performance as they struggle to adapt, possibly extending their time-to-graduation as course performance declines. Understanding the time costs of course scheduling can better inform decisions made by both students and university administrators.

27. Scott Huddleston, "Pell Grant Aid a Big Concern for Alamo Colleges, Educators in Federal Megabill," San Antonio Express-News, 1 July 2025, Accessed 2025 Nov 6, https://www.expressnews.com/news/education/article/pell-grant-megebill-concern-20402902.php.

References

Adelman, Clifford. 1999. *Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment*. US Department of Education, Office of Educational Research and Improvement.

Adelman, Clifford. 2006. "The toolbox revisited: Paths to degree completion from high school through college." *US Department of Education*.

Aina, Carmen, Koray Aktaş, and Giorgia Casalone. 2024. "Effects of workload allocation per course on students' academic outcomes: Evidence from STEM degrees." *Labour Economics* 90 102559.

Attewell, Paul, Scott Heil, and Liza Reisel. 2012. "What is academic momentum? And does it matter?" *Educational Evaluation and Policy Analysis* 34 (1): 27–44.

Attewell, Paul, and David Monaghan. 2016. "How many credits should an undergraduate take?" *Research in Higher Education* 57 (6): 682–713.

Babcock, Philip, and Mindy Marks. 2011. "The falling time cost of college: Evidence from half a century of time use data." *Review of Economics and Statistics* 93 (2): 468–478.

Barrett, Garry F, and Daniel S Hamermesh. 2019. "Labor supply elasticities: Overcoming nonclassical measurement error using more accurate hours data." *Journal of Human Resources* 54 (1): 255–265.

Barrow, Lisa, and Cecilia Elena Rouse. 2018. "Financial incentives and educational investment: The impact of performance-based scholarships on student time use." *Education Finance and Policy* 13 (4): 419–448.

Belanger, Kevin P, Angela K Dills, Rey Hernández-Julián, and Kurt W Rotthoff. 2019. "Class size, course spacing, and academic outcomes." *Eastern Economic Journal* 45 (2): 301–320.

Bostwick, Valerie, Stefanie Fischer, and Matthew Lang. 2022. "Semesters or quarters? The effect of the academic calendar on postsecondary student outcomes." *American Economic Journal: Economic Policy* 14 (1): 40–80.

Brownback, Andy, and Sally Sadoff. 2024. "College Summer School." *Journal of Human Resources*. 10.3368/jhr.0122-12151R1.

Chan, Roy Y. 2022. "Do credit momentum policies through the 15 to finish improve academic progression and completion of low-income, first-generation students? Evidence from a college promise program." *Research in Higher Education* 63 (8): 1394–1426.

Chetty, Raj, Adam Guren, Day Manoli, and Andrea Weber. 2011. "Are micro and macro labor supply elasticities consistent? A review of evidence on the intensive and extensive margins." *American Economic Review* 101 (3): 471–475.

Darolia, Rajeev. 2014. "Working (and studying) day and night: Heterogeneous effects of working on the academic performance of full-time and part-time students." *Economics of Education Review* 38 38–50.

Elminejad, Ali, Tomas Havranek, Roman Horvath, and Zuzana Irsova. 2023. "Intertemporal substitution in labor supply: A meta-analysis." *Review of Economic Dynamics* 51 1095–1113.

Hamermesh, Daniel S, Harley Frazis, and Jay Stewart. 2005. "Data Watch: The American Time Use Survey." *Journal of Economic Perspectives* 19 (1): 221–232.

Huntington-Klein, Nick, and Andrew Gill. 2021. "Semester course load and student performance." *Research in Higher Education* 62 (5): 623–650.

Imbens, Guido W, and Jeffrey M Wooldridge. 2009. "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature* 47 (1): 5–86.

Juster, F Thomas, and Frank P Stafford. 1991. "The allocation of time: Empirical findings, behavioral models, and problems of measurement." *Journal of Economic Literature* 29 (2): 471–522.

Keane, Michael P. 2011. "Labor supply and taxes: A survey." *Journal of Economic Literature* 49 (4): 961–1075.

Keane, Michael P. 2022. "Recent research on labor supply: Implications for tax and transfer policy." *Labour Economics* 77 102026.

Keane, Michael P, and Nada Wasi. 2016. "Labour supply: the roles of human capital and the extensive

margin." *The Economic Journal* 126 (592): 578–617.

Kramer, Dennis A, Michael R Holcomb, and Robert Kelchen. 2018. "The costs and consequences of excess credit hours policies." *Educational Evaluation and Policy Analysis* 40 (1): 3–28.

Mumford, Kevin J, Richard Patterson, and Anthony LokTing Yim. 2025. "College Course Shutouts." *NBER Working Paper* (w33800): .

Orr, Cody. 2023. "Clocking into Work and Out of Class: College Student Enrollment, Labor Supply, and Borrowing." *mimeo*.

Phipps, Aaron, and Alexander Amaya. 2023. "Are students time constrained? Course load, GPA, and failing." *Journal of Public Economics* 225 104981.

Robles, Silvia, Max Gross, and Robert W Fairlie. 2021. "The effect of course shutouts on community college students: Evidence from waitlist cutoffs." *Journal of Public Economics* 199 104409.

Stinebrickner, Ralph, and Todd R Stinebrickner. 2008. "The causal effect of studying on academic performance." *The BE Journal of Economic Analysis & Policy* 8 (1): .

Te Braak, Petrus, Theun Pieter van Tienoven, Joeri Minnen, and Ignace Glorieux. 2023. "Data quality and recall bias in time-diary research: The effects of prolonged recall periods in self-administered online time-use surveys." *Sociological Methodology* 53 (1): 115–138.

University of Wisconsin. 2025. "15 to Finish." https://go.wisconsin.edu/get-ready-for-your-uw/15-to-finish/, Accessed September 3, 2025.

U.S. Congress. 2023. "10 U.S. Code § 886 - Art. 86. Absence Without Leave." U.S. Government Publishing Office, https://www.govinfo.gov/app/details/USCODE-2023-title10/USCODE-2023-title10-subtitleA-partII-chap47-subchapX-sec886, Accessed: 2024-12-16.

U.S. Department of Education. 2010. "Definition of a Credit Hour." https://www.ecfr.gov/current/title-34/section-600.2, Accessed: 2025-02-03.

USAFA. 2016. "Core Curriculum Revision, Chapter 7 Curriculum Handbook." *USAFA Curriculum Change Proposal* April (16-16): .

USAFA. 2017a. "Accelerated Advanced Sociocultural Option." *USAFA Curriculum Change Proposal* March (49-17): .

USAFA. 2017b. "Add MSS 451, Precommissioning Professional Military Education." *USAFA Curriculum Change Proposal* March (41-17): .

USAFA. 2017c. "U.S. Air Force Academy Curriculum Handbook 2017-2018."

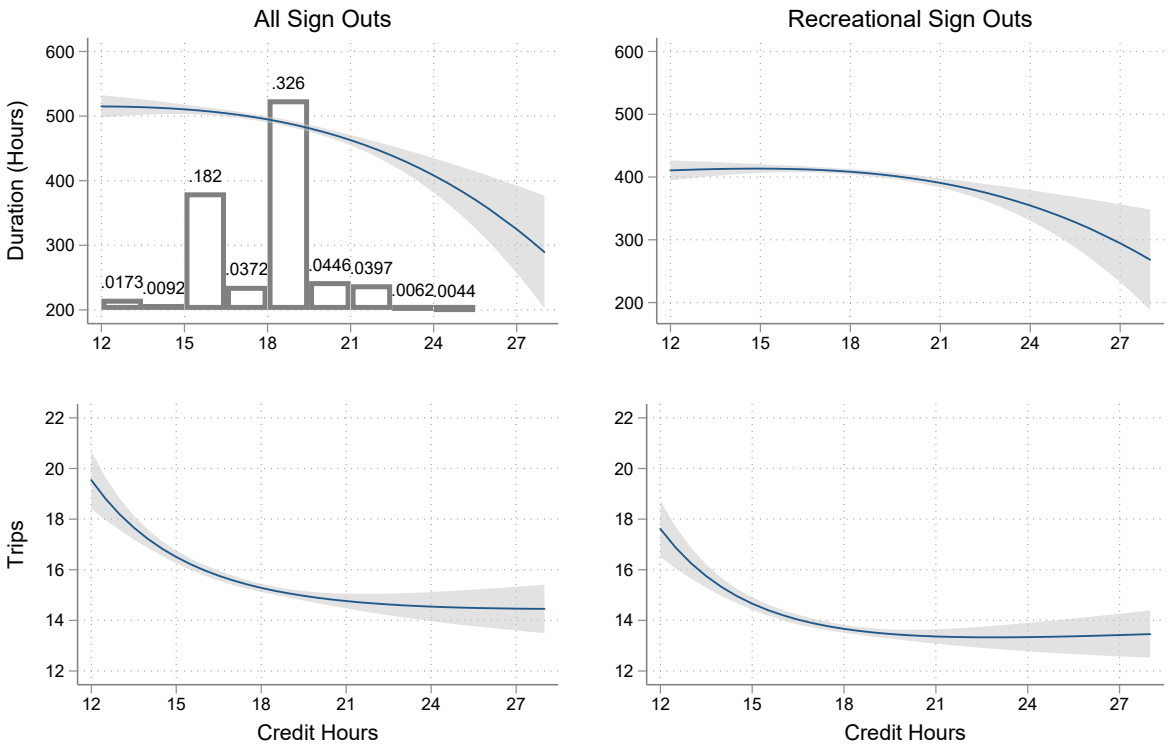
USAFA. 2023. "AFCWI 36-3501: Cadet Standards and Duties." Jan, https://www.usafa.edu/app/uploads/AFCWI-36-3501-Cadet-Standards-and-Duties-27-JAN-2023.pdf, Accessed: 2024-12-16.

Figures and Tables

FIGURE 1 — DETAILED TIME USE BY USAFA STUDENTS VS OTHER POST-SECONDARY STUDENTS

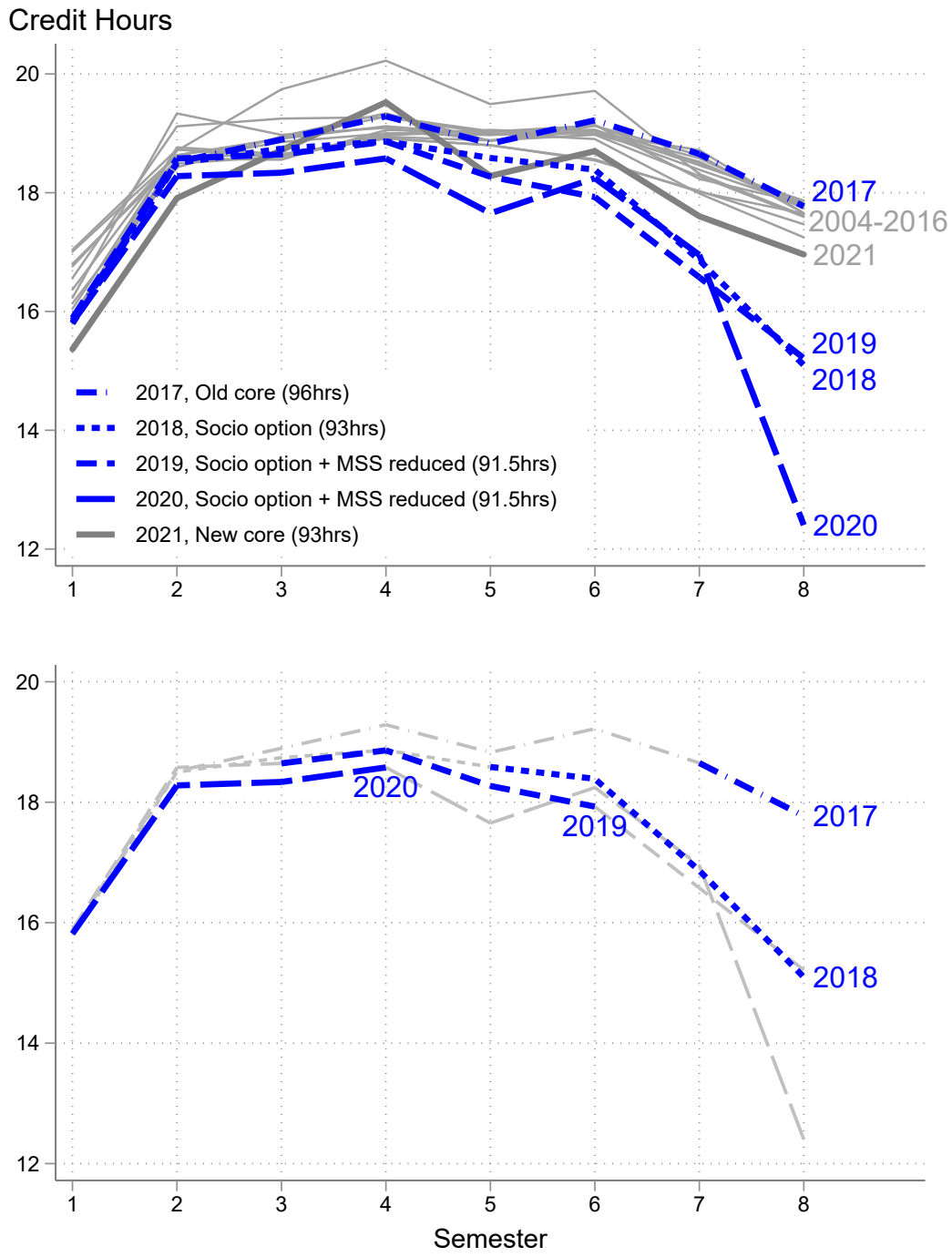
Notes: This figure compares the average time spent on various activities during weekdays versus weekends by USAFA students (Panel A) compared to any post-secondary full-time student aged 17-23 with no dependents during September-April as measured in the 2012-2019 American Time-Use Survey (ATUS). Personal care is defined as time spent on hygiene, grooming, and meals. Work is defined as military duties for USAFA and any work for pay in the ATUS. Low-value leisure is defined as time spent on activities at home such as playing video games or watching movies while high-value leisure includes time in activities outside the home. Totals do not add up to 24 hours given activities irrelevant to this study are omitted.

FIGURE 2 — CREDIT HOURS AND SEMESTER SIGN OUT ACTIVITY



Notes: This figure shows the relationship between credit hours completed in a given semester and sign out duration in hours (upper row) and number of trips of any length taken (lower row) is decreasing regardless of the reason for signing out (any, left column, and strictly recreational, right column). The density of credit hours is shown in the top left panel with bar labels indicating the proportion of students in each 1.5 credit hour bin. 95% confidence interval in gray.

FIGURE 3 — SEMESTER COURSE LOADS BY COHORT



Notes: This figure shows the average credit hours completed in each semester was consistent across cohorts except 2018-2020 when the curricular redesign was phased in, returning to the average historical trend in 2021. The upper panel of this figure shows the average number of credit hours a student attempted in each semester by cohort net of validation and transfer credit. Cohort labels include applicable curricular changes and total credit hours required to graduate. The lower panel shows the same information for our analytic sample of cohorts. The bolded lines denote cohort-semesters with available sign out data while the softened lines show cohort-semesters without sign out data.

TABLE 1 — STUDENT FIXED EFFECTS: CREDIT HOURS AND SEMESTER SIGN OUT ACTIVITY

	All Sign Outs		Recreational Sign Outs	
	Duration (Hours)	Trips	Duration (Hours)	Trips
	(1)	(2)	(3)	(4)
Credit Hours	-6.910	-0.238	-2.355	-0.163
	(1.757)**	(0.058)**	(1.993)	(0.059)*
Mean of Dep. Var.	497.48	15.72	409.94	14.06
Number of Students	3608	3608	3608	3608
Obs	12654	12654	12654	12654

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows a negative relationship between a student's time spent off-base per semester and credit hours completed from estimating Equation 3 that includes individual, semesters of tenure and calendar year fixed-effects. Standard errors are clustered at the squadron group by cohort level.

TABLE 2 — STUDENT FIXED EFFECTS: ESTIMATES BY CLASS RANK & ATHLETE STATUS

	Upperclass		Underclass	
	Non-Athlete	Athlete	Non-Athlete	Athlete
	(1)	(2)	(3)	(4)
Panel A: All Sign Outs, Duration (Hours)				
Credit Hours	-10.057	-12.882	-0.773	-13.231
	(1.859)**	(5.117)*	(1.693)	(3.610)**
Mean of Dep. Var.	560.08	649.71	375.52	460.85
Panel B: All Sign Outs, Trips				
Credit Hours	-0.428	-0.248	0.032	-0.238
	(0.061)**	(0.176)	(0.057)	(0.110)+
Mean of Dep. Var.	18.64	18.27	12.20	12.18
Panel C: Recreational Sign Outs, Duration (Hours)				
Credit Hours	-8.552	3.861	1.444	6.376
	(1.759)**	(5.454)	(1.070)	(3.524)
Mean of Dep. Var.	486.64	483.72	316.01	314.59
Panel D: Recreational Sign Outs, Trips				
Credit Hours	-0.399	0.051	0.057	0.095
	(0.062)**	(0.184)	(0.045)	(0.117)
Mean of Dep. Var.	17.30	15.27	10.98	9.32
Number of Students	2041	609	1434	425
Obs	5426	1597	4326	1258

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows the relationship between a student's time spent off-base per semester and credit hours completed from estimating Equation 3 that includes individual, semesters of tenure and calendar year fixed-effects separately by class rank and athlete status. Standard errors are clustered at the squadron group by cohort level.

TABLE 3 — BALANCE OF PRE-USAFA CHARACTERISTICS BY CLASS YEAR

	CY 2017	CY 2018			CY 2019			CY 2020		
	Mean	Mean	18-17	18-17/SD	Mean	19-17	19-17/SD	Mean	20-17	20-17/SD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Prior academics										
SAT Verbal	635.36	631.29	-4.07	-0.04	635.43	0.07	0.00	638.62	3.26	0.03
SAT Math	665.39	660.47	-4.92	-0.05	660.17	-5.22	-0.06	663.43	-1.95	-0.02
ACT Verbal	29.38	29.45	0.07	0.01	29.71	0.33	0.06	29.93	0.55	0.10
ACT Math	29.73	29.82	0.09	0.02	29.48	-0.25	-0.05	29.53	-0.20	-0.04
Academic composite	3350.04	3358.30	8.25	0.02	3355.25	5.20	0.01	3379.07	29.03	0.07
Credit hours validated	6.80	7.43	0.63	0.09	6.92	0.12	0.02	6.95	0.15	0.02
Panel B: Demographics										
Recruited athlete (=1)	0.24	0.23	-0.01	-0.02	0.24	0.01	0.01	0.23	-0.00	-0.01
Female (=1)	0.22	0.22	-0.01	-0.01	0.26	0.04	0.07	0.29	0.06	0.11
Asian (=1)	0.09	0.08	-0.01	-0.01	0.13	0.04	0.09	0.11	0.03	0.06
Black (=1)	0.06	0.05	-0.01	-0.03	0.06	-0.01	-0.02	0.05	-0.01	-0.03
Hispanic (=1)	0.08	0.07	-0.01	-0.02	0.08	-0.00	-0.01	0.09	0.01	0.02
White (=1)	0.76	0.70	-0.06	-0.10	0.65	-0.10	-0.16	0.70	-0.06	-0.09
Other (=1)	0.01	0.10	0.08	0.26	0.09	0.07	0.24	0.05	0.03	0.14
Attrited (=1)	0.13	0.13	-0.00	-0.01	0.12	-0.01	-0.03	0.10	-0.03	-0.07
Obs	1109		1098			1133			1078	

Notes: XX-17 is the mean difference between CY 20XX and CY 2017. XX-17/SD is the mean difference normalized by the standard deviation of the difference. Academic composite is a measure of prior academic performance including high school grades and standardized test scores.

TABLE 4 — COHORT INSTRUMENTAL VARIABLES: CREDIT HOURS AND SEMESTER SIGN OUT ACTIVITY

		All Sign Outs		Recreational Sign Outs	
	Credit Hours	Duration (Hours)	Trips	Duration (Hours)	Trips
	(1)	(2)	(3)	(4)	(5)
$\widehat{\text{Credit Hours}}$		-17.409	-0.522	-13.064	-0.356
		(6.065)**	(0.377)	(5.396)*	(0.360)
CY 2018	-2.098				
	(0.075)**				
CY 2019	-2.328				
	(0.149)**				
CY 2020	-2.471				
	(0.191)**				
Means of Dep. Var.					
CY 2017	18.21	654.05	20.53	559.91	18.96
CY 2018	17.23	587.90	18.55	494.02	16.85
CY 2019	18.43	472.21	14.15	386.04	12.54
CY 2020	17.75	366.69	12.38	287.03	10.68
F-stat	275.666				
Obs	12653	12653	12653	12653	12653

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows a negative instrumented effect of additional credit hours on students' time spent off-base per semester using graduating cohort as the first-stage instrument. All models include controls for semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, female, and athlete. Means of the outcome are show separately by graduation year. Standard errors are clustered at the squadron group by cohort level.

TABLE 5 — COHORT INSTRUMENTAL VARIABLES: ESTIMATES FOR UPPERCLASS STUDENTS BY ATHLETE STATUS

	Upperclass	
	Non-Athlete	Athlete
	(1)	(2)
Panel A: All Sign Outs, Duration (Hours)		
$\widehat{\text{Credit Hours}}$	-14.398	-28.640
	(7.199)*	(10.934)**
Mean of Dep. Var.	559.74	648.69
Panel B: All Sign Outs, Trips		
$\widehat{\text{Credit Hours}}$	-0.404	-1.321
	(0.496)	(0.431)**
Mean of Dep. Var.	18.63	18.24
Panel C: Recreational Sign Outs, Duration (Hours)		
$\widehat{\text{Credit Hours}}$	-12.869	-14.770
	(5.943)*	(9.274)
Mean of Dep. Var.	486.36	482.98
Panel D: Recreational Sign Outs, Trips		
$\widehat{\text{Credit Hours}}$	-0.292	-0.950
	(0.480)	(0.396)*
Mean of Dep. Var.	17.30	15.24
Obs	5453	1601

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows the instrumented effect of credit hours on students' time spent off-base per semester using graduating cohort as the first stage instrument, separately for upperclass non-athletes and athletes. All models include controls for semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, and female. Means of the outcome are show separately by graduation year. Standard errors are clustered at the squadron group by cohort level.

TABLE 6 — ELASTICITY OF LEISURE SUBSTITUTION

	ln (Sign Out Duration (Hours))	
	All	Recreational
	(1)	(2)
Panel A: Demographic Controls		
$\ln\left(\widehat{\text{Wage}}\right)$	-0.170	-0.149
	(0.009)**	(0.008)**
Panel B: Student Fixed Effects		
$\ln\left(\widehat{\text{Wage}}\right)$	-0.377	-0.322
	(0.018)**	(0.016)**
Number of Students	3540	3540
Obs	12422	12422

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows Frisch elasticities found by estimating Equation 6. Panel A includes controls for semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, female, and athlete. Panel B replaces individual controls with student fixed effects. Standard errors are clustered at the squadron group by cohort level.

TABLE 7 — CREDIT HOUR EFFECTS ON STANDARDIZED GPA, MILITARY PERFORMANCE, AND PHYSICAL FITNESS

	GPA		Military Performance		Physical Fitness Test	
	FE	IV	FE	IV	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Credit Hours	-0.084	-0.054	-0.002	-0.350	-0.027	-0.080
	(0.009)**	(0.019)**	(0.005)	(0.013)**	(0.006)**	(0.029)**
Number of Students	3608	3619	3591	3610	2757	3488
Obs	12654	12653	12589	12608	9329	10060

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows additional credit hours reduce students term GPA, performance in military duties, and physical fitness. All outcomes are internally standardized by the sample mean and standard deviation. Physical Fitness Test is the residual variation (before standardizing) in a student's Physical Education Average (PEA) to isolate the contribution of physical fitness scores. Odd-numbered columns include student fixed effects (see Section 6.1) while even-numbered columns estimate the effect using a cohort IV (see Section 6.3) conditional on semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, and female. Standard errors are clustered at the squadron group by cohort level.

Appendix A Appendix Figures and Tables

TABLE A1 — EFFECT OF COURSE OVERLOAD ON SEMESTER SIGN OUT ACTIVITY

	Duration (Hours)		Trips	
	FE	IV	FE	IV
	(1)	(2)	(3)	(4)
>18 Credit Hours	-17.634	-81.238	-0.635	-3.198
	(6.561)*	(26.109)**	(0.211)**	(1.620)*
Mean of Dep. Var. Among ≤18 Hours	501.91	502.40	16.26	16.27
Number of Students	3608	3619	3608	3619
Obs	12654	12653	12654	12653

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows the effect of an overloaded semester—defined as more than 18 credit hours—on students' time spent off-base per semester. Odd-numbered columns include student fixed effects (see Section 6.1) while even-numbered columns estimate the effect using a cohort IV (see Section 6.3) conditional on semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, and female. Standard errors are clustered at the squadron group by cohort level.

TABLE A2 — COURSE LOAD EFFECTS ON SEMESTER SIGN OUT ACTIVITY BY ACADEMIC COMPOSITE QUARTILES

	Bottom 25%		Second 25%		Third 25%		Top 25%	
	FE	IV	FE	IV	FE	IV	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: All Sign Outs, Duration (Hours)								
Credit Hours	-8.230	-21.769	-8.989	-14.484	-4.357	-7.890	-6.408	-23.115
	(2.370)**	(9.451)*	(2.128)**	(10.967)	(1.965)*	(12.423)	(2.431)**	(15.689)
Mean of Dep. Var.	516.19	516.61	503.12	503.28	493.90	494.26	476.47	476.47
Panel B: All Sign Outs, Trips								
Credit Hours	-0.204	-0.271	-0.321	-0.411	-0.103	-0.242	-0.286	-1.220
	(0.083)*	(0.403)	(0.087)**	(0.498)	(0.074)	(0.556)	(0.089)**	(0.700)+
Mean of Dep. Var.	14.94	14.95	15.70	15.71	16.17	16.17	16.07	16.07
Panel C: Recreational Sign Outs, Duration (Hours)								
Credit Hours	1.614	-13.444	-3.816	-14.242	-1.893	-6.039	-4.830	-13.761
	(2.275)	(8.259)	(2.095)+	(10.428)	(1.960)	(12.714)	(2.155)*	(15.477)
Mean of Dep. Var.	419.32	419.50	413.53	413.64	412.63	413.01	394.30	394.30
Panel D: Recreational Sign Outs, Trips								
Credit Hours	-0.051	-0.068	-0.226	-0.304	-0.057	-0.139	-0.266	-0.911
	(0.084)	(0.384)	(0.088)*	(0.477)	(0.075)	(0.547)	(0.086)**	(0.692)
Mean of Dep. Var.	13.19	13.20	13.97	13.98	14.62	14.63	14.47	14.47
Number of Students	913	911	908	907	904	903	898	898
Obs	3173	3165	3195	3191	3177	3173	3124	3124

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows the effect of additional of credit hours on students' time spent off-base by academic composite quartile which aggregates pre-admission academic ability using measures such as standardized test scores, high school GPA, and class rank. Odd-numbered columns include student fixed effects (see Section 6.1) while even-numbered columns estimate the effect using a cohort IV (see Section 6.3) conditional on semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, and female. Standard errors are clustered at the squadron group by cohort level.

TABLE A3 — ROBUSTNESS: REMOVE ATYPICAL STUDENTS

	Drop Prior Military		$\leq$ 15 Validation Credits	
	FE	IV	FE	IV
	(1)	(2)	(3)	(4)
Credit Hours	-6.422	-19.614	-6.703	-15.533
	(1.820)**	(5.196)**	(1.857)**	(6.662)*
Mean of Dep. Var.	499.239	499.485	498.967	499.231
Number of Students	2862	2871	3342	3352
Obs	10017	10020	11729	11727

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows our results are robust to the exclusion of students with atypical paths to USAFA. The first two columns remove any students with prior military experience that may have entered with some requirements already completed. The second two columns subsets to students who transferred or validated no more than 15 out of a possible 27.5 hours of required curriculum. Odd-numbered columns include student fixed effects (see Section 6.1) while even-numbered columns estimate the effect using a cohort IV (see Section 6.3) conditional on semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, and female. Standard errors are clustered at the squadron group by cohort level.

TABLE A4 — COURSE LOAD EFFECTS ON ACADEMIC PROBATION STATUS

	Full Sample		Upper, Non-Athletes		Upper, Athletes	
	FE	IV	FE	IV	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Credit Hours	0.001	0.005	-0.002	0.005	-0.003	0.004
	(0.001)	(0.002)**	(0.001)	(0.002)*	(0.003)	(0.004)
Number of Students	3623	3619	2068	2068	613	613
Proportion on probation	0.022	0.022	0.013	0.013	0.015	0.015
Obs	12669	12653	5453	5453	1601	1601

Notes: ** p<0.01, * p<0.05, + p<0.10. This table shows additional credit hours do not meaningfully impact the probability a student is placed on academic probation and consequently restricted from signing out. Odd-numbered columns include student fixed effects (see Section 6.1) while even-numbered columns estimate the effect using a cohort IV (see Section 6.3) conditional on semesters of tenure, calendar year fixed effects, academic composite, and interactions of semester, non-White, and female. Standard errors are clustered at the squadron group by cohort level.