

2019

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Recommended Citation

Emerson, Tisha L. N. and KimMarie McGoldrick. "Switching Majors – Into and Out of Economics." *The Journal of Economic Education* 50, no. 3 (2019): 321-332. <https://doi.org/10.1080/00220485.2019.1618763>.

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SWITCHING MAJORS—INTO AND OUT OF ECONOMICS

Short title for running header: Switching Majors

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Abstract: Using student transcripts from six institutions over a 23-year timespan, the authors investigate the movement of students into and out of the economics major. Considerable movement between majors occurs with 83 percent of economics graduates switching in after their first principles course. These eventual majors come from a variety of sources, but primarily from business, engineering, science & math. In an absolute sense, weaker students (as measured by cumulative GPA) switch into economics. However, students appear to move to disciplines of relative academic strength (as indicated by relative grades). While females from other majors are less likely to switch into economics, traditionally underrepresented minorities are largely attracted to economics from other disciplines at similar (or higher) rates to which they persist in originally declared majors.

Keywords: diversity, economics education, economics major, gender gap

JEL code: A2

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As evidenced by numerous investigations, economic educators have long been interested in understanding which students choose to study economics. Data for these studies are drawn from an array of sources including national surveys of economics departments (Siegfried and Walstad 2014; Emerson, McGoldrick, and Siegfried 2018), the National Center for Education Statistics' Baccalaureate and Beyond Longitudinal Study (Bosshardt and Watts 2005, 2008; Bosshardt and Walstad 2016), the Integrated Postsecondary Education Data System (Kasper 2008; Stock 2017), student records from an individual institution (Fournier and Sass 2000; Rask and Bailey 2002; Rask and Tiefenthaler 2008), and full transcript records for students at multiple universities (Mumford and Ohland 2011; Emerson, McGoldrick, and Mumford 2012)—each providing somewhat different insight into which students are studying economics. According to Allgood, Walstad, and Siegfried (2015), around 40 percent of all undergraduate students take at least one economics course. Despite this sizeable fraction of students enrolling in economics courses, very few (less than 2 percent) eventually earn a degree in economics. Several hypotheses have been proposed to explain why students do or do not major in economics—including competition from other disciplines, grading stringency in economics relative to other disciplines, teaching quality, relative tuition prices, and demographic trends. Notwithstanding the considerable body of work in this area, we still have yet to gain a clear understanding of the determinants of major choice.

In this current study, we analyze data from the Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD) in order to improve our understanding of which majors enroll in principles of economics courses and which students ultimately graduate with a major in economics. The most highly represented major in the principles of economics course is business, with large numbers also from engineering and science & math.¹ Students majoring in these other disciplines are relatively stronger than

declared economics majors as measured by their principles course performance, GPA and combined SAT scores. A larger proportion of economics graduates opt into the economics major after taking the introductory course (83%) than declare prior to enrollment and persist to graduation (17%). Those who opt into economics appear to be selecting into a discipline of their comparative advantage, as their economic principles grade and graduation GPA are higher than their cumulative GPA at the point of enrolling in the principles course. As measured by standardized test scores, though, in an absolute sense, stronger students from business and “other” majors switch into economics while weaker engineering students change their major to economics. Regarding students opting out of economics, aside from those switching to business, these students also appear to move to areas of relative academic strength. Finally, originally declared economics majors are equally likely to be an underrepresented racial or ethnic minority as other majors, but compared to most majors they are less likely to be female. The gender gap in economics is reinforced as those switching into the major are less likely to be female than those persisting in their original major and the gap is unaffected by those leaving economics for other majors.

BACKGROUND

The study of economics all starts with a single course—usually an introductory course, focusing on either micro or macroeconomics or a concepts course (which is often a one-semester survey of micro and macro). Estimates of the fraction of students who take at least one college-level economics course vary. Mumford and Ohland (2011) estimate that about half of the students in their subset of MIDFIELD institutions take an economics course at some point. For many (but not all), this is an introductory-level course. Bosshardt and Watts (2008) and Bosshardt and Walstad (2016) use responses to the National Center for Educational Statistics’ nationally

representative Baccalaureate and Beyond (B&B) study to estimate the extent of undergraduate economics coursework. Using the 1992–93 cohort of the B&B, Bosshardt and Watts (2008) report that 59.3 percent of students completed at least one economics course, while Bosshardt and Walstad (2016) find that 52 percent of the 2007–8 B&B sample did so. These values are higher than estimates using responses to the Universal Academic Questionnaire (UAQ). From the UAQ, which is mailed annually to all economics departments in the United States, Siegfried (2000) and Siegfried and Walstad (2014) estimate that 40 percent of undergraduates take an economics course at some point during their undergraduate careers. Although the estimates vary, they clearly indicate that somewhere around half of undergraduates enroll in at least one economics course.

While somewhere between 40 and 60 percent of undergraduates take at least one economics course, less than 2 percent of all graduates will earn a degree in economics (Allgood, Walstad, and Siegfried 2015; Siegfried 2014). Given the low rates of economics majors relative to enrollments in economic principles, students enrolling in principles must come from other major disciplines. Not surprisingly, the major with the largest fraction of students completing an economic principles course is business (Bosshardt and Watts 2008; Bosshardt and Walstad 2016). In their MIDFIELD sample, Mumford and Ohland (2011) find that 36 percent of principles enrollees plan to major in business, followed closely by engineering, math and physics with a combined 30 percent. Using the B&B data, Bosshardt and Watts (2008) find that other majors with substantial presences in economic principles include agriculture and natural resources and other social sciences; meanwhile, humanities, education and biological science majors are much less likely to enroll.

According to survey results reported by Siegfried and Raymond (1984), students make their decision to major in economics at different points in their college careers. Only 12 percent of economics majors enter college with the intention to major in economics, and another 19 percent decide to do so in their freshman year. Most economics majors make their major decision in their sophomore year (46%) and the remaining majors (23%) decide in their junior or senior year. While no similar recent surveys of majors address the timing of major decision, other studies support Siegfried and Raymond's findings that students may have plans to major in a discipline other than economics at the time they enroll in economic principles courses, thus considerable switching between majors does occur at some point (during or) after the course. Mumford and Ohland (2011) find that roughly two in three students who ultimately graduate with an economics degree declare economics as their major sometime after taking their principles of microeconomics course. These "converted" economics majors come from a variety of disciplines including business (18%) and engineering, math and physics (22%). Fournier and Sass (2000) present additional evidence of switching into economics. In their sample of Florida State University students, Fournier and Sass find that over 85 percent of students graduating with an economics degree switched into the major after enrolling in their first principles course. These converted majors originate predominantly from business (29%) and other social sciences (28%). Fournier and Sass further demonstrate that switching out of economics also occurs at relatively high rates with only half of those originally declared as economics majors graduating with a degree in economics. More than half of those who leave the economics major go to business or another social science.²

The observed movement between majors has inspired the development of several hypotheses regarding majors competing with economics for students. Salemi and Eubanks

(1996) proposed and provide evidence of what has come to be known as the “discouraged-business-major hypothesis.” Discouraged-business-majors are students who perform poorly in required courses and fail to meet business school entry requirements, and respond by opting to study economics based on the perception that economics is a close substitute for business. Asarta and Butters (2012), too, find (limited) evidence of discouraged-business-majors, but also find evidence that some strong business majors elect to switch from business to economics—thus, they find both positive and negative selection into economics.³ In both cases, there is a sense that students view business and economics as substitutes. Kasper (2008) and Stock (2017), however, suggest that economics and business are complements while economics and biology are substitutes. Stock also provides evidence indicating that, on average, “other” social sciences and education may likewise be substitutes for economics while economics may be complementary with math, engineering, computer science and technology (as second majors).

Performance in principles of economics is an important determinant of persistence in the major. Mumford and Ohland (2011) find that economics majors tend to outperform other majors (business, STEM, other) in microeconomic principles courses. Bosshardt and Watts (2008) find that students majoring in engineering, economics, biological sciences, mathematics, other sciences and business tended to perform best in principles while majors from education, psychology, communications, liberal studies, and the humanities performed the worst. In addition to differences in performance by declared major, course performance (as measured by grades) certainly plays a significant role in a student’s decision to persist in the study of a particular discipline. Students, especially females, are sensitive to grades in their introductory courses (Rask and Tiefenthaler 2008; Rask 2010; Goldin 2015) and, on average, students earn relatively lower grades in economics (Achen and Courant 2009). Thus, differential grade

performance across disciplines may partially explain which majors tend to opt into economics, and grade sensitivity may drive the relatively low rates of economics majors in general.

Important differences in the study of economics also exist by gender and racial/ethnic groups. Females and ethnic or racial minorities are less likely to study economics than white males (Bosshardt and Walstad 2016; Mumford and Ohland 2011; Emerson, McGoldrick, and Mumford 2012). When they do enroll in economics courses, females tend to underperform males (Lumsden and Scott 1987) and are less likely to continue in the course, when a significant gender difference was identified (Anderson, Benjamin, and Fuss 1994; Allione and Stein 2016; Stock et al. 2013). Further, some studies provide evidence that ethnic or racial minorities perform less well in introductory economics courses than their white counterparts (Emerson and English 2016; Emerson and McGoldrick 2017). Studies report mixed evidence of attrition by minorities with either no significant difference in withdrawal rates (Emerson and McGoldrick 2017) or an increased likelihood of attrition for minorities (Grimes and Nelson 1998), but most studies did not control for race and ethnicity. Ultimately, these factors result in an average of only 30 percent of bachelor's degrees in economics awarded to females (Emerson, McGoldrick, and Siegfried 2018). Comparing economics to other disciplines, women are even less well-represented in STEM, but are relatively better represented in business (Mumford and Ohland 2011). Rates of minority economics majors are even lower, with less than 15 percent of bachelor's degrees in economics awarded to individuals from traditionally underrepresented ethnic and racial groups (Bayer and Rouse 2016). Both females and minorities constitute considerably larger fractions of bachelor's degree recipients overall; 56 percent of bachelor's degrees are awarded to females (Emerson, McGoldrick, and Siegfried 2018) and 22 percent to minorities (Bayer and Rouse 2016).

DATA AND METHODOLOGY

In 1996, the National Science Foundation funded the creation of the Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD). The purpose of the MIDFIELD project was to facilitate the study of the engineering major. However, the dataset has, over time, served as a resource for the study of other majors as well, including economics. While the present set of institutions included in MIDFIELD stands at 11, the number of participating universities has varied over time, and thus, while records for original MIDFIELD institutions date back to 1987, institutions joining the database later have other (more recent) start dates. Each student record includes both academic (i.e., SAT, college courses and choice of major) and demographic (i.e., sex, minority status) information.

For the present study, we analyze data from six of the MIDFIELD institutions including Clemson, Georgia Tech, Purdue, University of Florida, UNC Charlotte, and Virginia Tech.⁴ Collectively, our data represent over 110,000 students who have taken at least one principles-level economics course. Each institution has a large engineering program, explaining its inclusion in MIDFIELD. Economics programs at the institutions vary in their location (housed in the business school or with social sciences) and the types of degrees (BA, BS, BBA) conferred. Nonetheless, analyses by institution do not vary materially from that of the sample as a whole. As such, only results for the entire sample are reported here.

The time period (1987–2010) generates both left and right censoring of some students' course records. For example, some students are observed as having enrolled in a principles course but have not graduated. We drop all students whom we fail to observe taking an economic principles course (which may be principles of micro or macroeconomics, or a one-semester concepts course) or graduating. Once adjustments for left and right censoring have been made,

we focus our analysis on the subset of 96,697 students who have enrolled in their first economic principles course. A student's first course in any discipline can have a profound impact on their view of the field and their persistence in studying that discipline. As such, we focus on the very first collegiate economics course that we observe a student complete.⁵

FINDINGS

We study students enrolling in their first economic principles course with particular attention to their declared major discipline both at the time of enrollment and graduation. Doing so allows us to identify the source of converted economics majors, where those who leave the economics major go, and to recognize any student-specific characteristics that may typify students opting into or out of the major.

Which Majors are Enrolling in Economic Principles?

Of the 96,697 students enrolling in their first principles of economics course, roughly one percent intended to major in economics. The most common majors of enrollees were business (26%), engineering (22%), and science & math (9%) with the remainder either undeclared (10%) or from a variety of other majors (32%).⁶ Declared economics majors tended to underperform students from each of these majors earning an average of a high C+ (2.45) in their principles course while students from other declared majors earned an average of a B- to B. Consistent with the weaker course performance, intended economics majors tended to have lower aptitudes than students from other majors as measured by their cumulative GPAs⁷ (business, engineering, science & math, other) and combined SAT⁸ scores (engineering, science & math, other). The differential SAT scores stem from different sources—economics majors have lower SAT math scores than engineering and science & math majors, but only lower SAT verbal scores than all other declared majors.⁹ While students declared as economics majors were as likely to be from a

traditionally underrepresented minority (i.e., African Americans, Hispanics, and Native Americans) as students from each of the other majors were, they were less likely to be Asian than were students majoring in engineering or science & math. Representation of females also differed by major. Students declared as economics majors on enrollment in principles were more likely to be female than those declaring a major in engineering, but were less likely to be female than those whose declared major was business, science & math, or other, or whose major was undeclared. The majority of intended economics majors took their first principles course in their freshman (39%) or sophomore (45%) year.¹⁰ While most other enrollees were also freshmen or sophomores, business majors were more likely to take their first principles course in their freshman year than were economics majors. Finally, 55 percent of declared economics majors at the time of their first principles course ultimately graduated with an economics degree. Not surprisingly, this far exceeds the fraction of economics degree awardees from any other intended major group, although all other groups also had some fraction of students ultimately earning an economics degree. See table 1.

[Insert table 1 about here]

Where did the “Converted” Economics Majors Originate?

Although 2,227 students in our sample graduated with a major in economics, there were only 699 declared economics majors at the time students were enrolled in their very first economic principles course. The increase in the number of economics majors suggests that a large number of students opted into the major at some point after they enrolled in their first economic principles course. Even the more than tripling of major numbers, however, understates the number opting into economics after their first principles course. We find that only 382 of those original 699 maintained their economics major declaration through to graduation. Thus, the total

number switching to economics is 1,845 students (i.e., 83% of those graduating with an economics degree).

We next investigate the source of these additional majors. Table 2 provides a breakdown of economic principles students from the most frequently represented major categories, differentiating those who maintained their original major through to graduation as compared to those who switched into economics. In general, for any given first-time economic principles student with a declared major other than economics, there is only a 1 to 2 percent chance that they will ultimately switch majors to economics. For those without a declared major, the chance is 5 percent. Further, in comparison, persistence rates are relatively low in economics. Only 55 percent of those declared as economics majors at the time of enrollment in their first economic principles course ultimately graduate with an economics degree, while 81, 79, 65, and 63 percent of those declared as business, engineering, science & math, and other, respectively, persist in their major area to graduation (all representing statistically significant differences).

[Insert table 2 about here]

When principles students did switch majors, converted majors transferred into economics from a variety of disciplines. Converted majors were drawn predominantly from business, engineering, and science & math, and constitute 22, 8, and 7 percent of economics graduates (and 27%, 10%, and 8% of converted majors), respectively. Conditional on a student switching from these majors, economics captures 10 percent of those leaving business but only 4 and 5 percent leaving engineering and science & math, respectively. Previously undeclared students who majored in economics constitute 20 percent of economics graduates (25% of converted majors). The remainder of economics majors switched to economics from a wide variety of other

majors and collectively make up 26 percent of economics graduates (31% of converted majors, and 5% of other majors who changed their major).

Students who persisted in their original major differ significantly, on some dimensions, from students with that major who switched into economics. While students who opted into economics from science & math performed equally well in their first principles course as students who persisted in their original major, this is not the case for business, engineering and the agglomeration of other majors. Students who switched into economics from engineering underperform compared to students who persisted in engineering while those opting into economics from business or the large mix of other majors outperform those who remained in their original major. Principles course performance is consistent with what we know about these students' general levels of aptitude as indicated by standardized test scores. For example, students opting into economics from engineering had lower combined (and math, specifically) SAT scores than those who persisted to graduation in engineering, while students converting to economics from business or the "other" major categories had higher SAT (combined, math, and verbal) scores than those who persisted in their original majors. As measured by GPA, however, economics appears to attract weaker students. Specifically, students transferring to economics from engineering, science & math, and the other majors category had a lower cumulative GPA (upon enrollment in their first economic principles course) and/or lower GPA at graduation than those who earned degrees in their original major. Even though it would appear that weaker students are disproportionately opting into economics, there is a silver lining. That is, students opting into economics after initially declaring majors in business, engineering, science & math, or other performed better in their economic principles course and their graduation GPAs were higher than their cumulative GPAs at the time they enrolled in their first economic principles

course. Finally, timing also appears to be an important factor. Students who opted into the economics major were more likely to have taken their first economic principles course in their freshman year and less likely to have taken it in their junior or senior year than those students who persisted in their original major.

Additionally, our results indicate some gender and racial selection differences across majors. A greater proportion of female students remained in their original majors than ultimately switched into economics. This gender difference contributes to the already present underrepresentation of women in the economics major. On a more positive note, there are few differences along racial or ethnic lines between students switching into economics and those persisting in their original major, but the existing differences promote diversity in the field. For example, a larger percentage of students from traditionally underrepresented minorities in business switched into economics than stayed in their original majors. In addition, students switching into economics from other majors were more likely to be Asian than those who persisted in those majors.

Where did the Economics Majors Go?

Of the 699 students declaring economics as their major at the time of their first economic principles course, only 382 persisted in their study of economics to graduation. Over 45 percent of students originally majoring in economics switched to another major. Business is the most common substitute major, capturing nearly 60 percent of students opting out of economics (27% of those originally declared as economics majors). The remaining 128 students who switched out of economics graduated in many different fields. See table 3.

[Insert table 3 about here]

Some significant differences exist between students who persisted in their study of economics and those who opted out. For example, students who switched to one of the many other majors underperformed in their economic principles class, as compared to those who continued in economics. These students also had lower SAT verbal scores and cumulative GPAs both upon enrollment in their first economic principles course and at graduation. Students switching from economics to business were not significantly different on these dimensions, but they had higher SAT math scores (although their combined and verbal SAT scores were not significantly different). The timing of enrollment in economic principles does differ between those who persisted in economics and those who switched, whereby students leaving the economics major were more likely to have taken their first economic principles course as freshmen and less likely to have taken it as juniors.

Interestingly, gender and racial differences are largely absent between those opting out of economics and those who persisted. For example, those who persisted in the major were equally likely to be female or from an underrepresented racial or ethnic minority as those who switched to a different major. This suggests that while there may be differences across these lines in attracting students to the economics major, students are not leaving the major differentially across these dimensions. The only difference that does emerge is that students leaving the economics major for business were slightly more likely to be Asian than those who persisted.

DISCUSSION AND CONCLUSION

In this study, we use student-level observations over the course of more than 20 years from six institutions. We add to existing knowledge regarding the majors from which principles of economics students are drawn, as well as the majors that serve as substitutes for economics as students opt into and out of the economics major. While our set of institutions may not be

representative of colleges and universities generally (they all have large engineering programs), much of our findings are consistent with the literature. In our data, economics majors constitute a small fraction of total college graduates and, not surprisingly, a similarly small proportion of enrollees in economic principles courses. Many students we observe in principles of economics had declared majors in business, engineering or science & math. Principles students from these majors tended to outperform students from economics, had higher aptitudes, were more likely to be female and were more likely to be freshmen. Given the relatively low initial number of economics majors and relatively low rates of persistence to graduation (just over half), it is fortunate that the large pool of business, engineering and science & math majors in principles courses constitute a more diverse body of students with skills well-suited for economics and thus a favorable set from which to attract majors. Further, because noneconomics majors often take economic principles early in their academic careers, they have greater flexibility should they wish to change majors and still graduate when planned.

Continued study in economics depends upon any number of variables, but it is certainly influenced by the student's performance and experience in their early courses. Since we observe considerable movement between majors after enrollment in a student's first economic principles course, we propose that a student's introductory course is of considerable importance in attracting and retaining majors (for further discussion of the role of a student's introductory course experience in persistence in a discipline, see Chambliss and Takacs 2014; Fournier and Sass 2000; Jensen and Owen 2001; Ost 2010). As such, continued study of student experiences in principles of economics (and how that experience could be adapted to better appeal to noneconomics majors) can contribute to our understanding of the major, growing the major, and building diversity within the major and the profession more generally. For example, because so

many principles students (and eventual majors) come from business, a potential avenue for future research involves a disaggregation of the business majors category. Most studies in this area, including ours, are limited by their inability to separate the business major into its relatively diverse specific majors (e.g., finance, marketing, accounting, management, etc.). Greater understanding of the principles experience by specific business majors would enhance our understanding of the economics major.

A large number of economics graduates already do opt-in from business, engineering, science & math, as well as students whose major was previously undeclared. While students who opted into the major have lower cumulative GPAs at the time they took their first principles course (in comparison to those who persist in their originally designated major), their course grade and graduation GPA was higher than their cumulative GPA upon enrolling in principles. This suggests that studying economics better suited their abilities. Therefore, while we in the economics profession may be disappointed that we are not attracting the stronger principles students (in an absolute sense), we may find consolation in the fact that students are moving to areas of their comparative advantage.

Patterns of switching into the major along gender and racial/ethnic lines provide mixed results in furthering diversification of the profession. We are not doing a terribly good job of attracting women as a larger proportion of females opted to remain in their original majors than to switch into economics. For example, roughly a third of those students switching into economics from business, science & math, and the mix of other majors were female while close to half of those remaining in their original majors were female. With males being two of every three students opting into economics from these majors, conversion of new majors reinforces the existing gender gap. On a more positive note, we do find in some cases that students from

traditionally underrepresented racial and ethnic groups and Asian students are more likely to switch to economics. For example, ten percent of students remaining in business are underrepresented racial and ethnic minorities, while nearly 20 percent of those switching from business to economics are members of this group. These findings suggest the importance of continued study of and effort into diversifying the economics profession—perhaps particularly along gender lines.

Building the major and diversifying the profession depend not only on attracting new majors, but also on retaining students in the major. Almost half of our sample of original economics majors fail to persist in the major to graduation. Of those opting out of the major, nearly 60 percent switch to business. Why this occurs is not readily obvious as few differences emerge between the students who persist in economics and those switching into business. The substitutability of economics for business, and vice versa, has considerable empirical support, but why a student selects one or the other remains to be fully understood. The remaining students who leave the economics major select a wide variety of other majors. These students are academically less suited for economics and may well be switching to a major of their comparative advantage. Females are equally likely to switch out of the economics major as to persist. The same is true regarding traditionally underrepresented minorities. In sum, the pool of students declaring economics as their major prior to enrollment in economic principles is small (relative to those declaring after principles) with most of those persisting in the major similar in characteristics to those who switch out.

NOTES

¹ Principles of economics includes micro or macroeconomic principles and a one-semester survey course is referred to as “concepts.”

² We note that while the Mumford and Ohland study employs a relatively large sample just shy of 130,000 students of which over 1900 are economics majors, the Fournier and Sass study has a much smaller sample that includes just over 2500 students and 100 economics majors.

³ The stronger evidence for the discouraged-business-major hypothesis in Salemi and Eubanks (1996) may stem from the fact that GPA requirements for business majors were higher than for economics majors at the institution from which their data were drawn, while GPA requirements were the same for both majors at the institution studied by Asarta and Butters (2012).

⁴ The MIDFIELD database includes comprehensive undergraduate student records for a total of 11 institutions (Clemson, Florida A&M, Florida State, Georgia Tech, North Carolina A&T, North Carolina State University, Purdue, the University of Florida, the University of Colorado, the University of North Carolina at Charlotte, and Virginia Tech). However, we exclude five of the institutions for a variety of reasons. First, both Florida A&M and North Carolina A&T are historically black universities (HBCUs). Because our analysis focuses, in part, on differences in the economics major across racial and ethnic groups, including the HBCUs would potentially have confounded our findings. Second, at both Florida State University and the University of Colorado, there are hurdles to declaring an economics major that result in no students in the introductory economics courses identified as economics majors. Given that we study the movement of students into and out of the major after the principles course, these barriers to entry would necessarily result in no observable exits from the major at these institutions. Third, the

available sample from North Carolina State University was extremely small. Due to these various issues, we omit these five institutions from our analysis.

⁵ We expect that, in most cases, this is the student's very first collegiate economics course.

However, our transcript records do not indicate courses transferred in from other institutions (whether they are taken pre- or post-matriculation). As a result, we cannot rule out the possibility that a student took a previous economic principles course (at a different institution) prior to our observing them in our dataset.

⁶ A student's declared major is defined as the major at the time that they enrolled in their first economic principles course.

⁷ Cumulative GPA is based on all courses taken prior to the introductory course. For students taking their first economic principles course in their first semester (14.0 percent), this value is missing.

⁸ Combined SAT score is defined as the combined SAT verbal and SAT math scores or the converted ACT scores for those taking only the ACT exam (see

<http://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html>

for conversion table). We also considered an alternative standardized SAT/ACT measure, but results were consistent with those for combined SAT, so we include only the more common measure here.

⁹ For students taking the SAT, administrative records contained both math and verbal component scores. Students taking the ACT, for whom we have converted their score to the equivalent SAT score, math and verbal component scores are missing. Since the number of missing component scores is sizeable (10,000+, the combined SAT sample size is 96,697 and the component SAT sample size is 89,308), we discuss findings for both the component and composite scores.

¹⁰ Three percent of intended economics majors (and less than 1% of those ultimately earning an economics degree) take their first economic principles course in their senior year. There are two likely contributing factors to this seemingly odd timing. First, we construct a student's year in school based on hours earned. Some students enter college with many hours and so, while some may be seniors by accumulated credit hours, they may well be in their third year of college with time remaining to complete the degree in four or five years. Second, some students simply realize their interest late in the game. In either case, this is a very small fraction of our sample.

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TABLE 1. Students Enrolled in their First Introductory Economics Course

	Economics					Undeclared	
	All Students	Majors	Business Majors	Engineering	Science & Math	Majors	Other
Course grade (4.0 scale)	2.73	2.45	2.63*	3.04*	2.92*	2.62*	2.58*
Cumulative GPA	2.72	2.61	2.65	2.79*	2.86*	2.57	2.72*
Concurrent credits	14.26	14.42	14.08*	14.70*	13.69*	13.53*	14.47
Female	0.40	0.31	0.46*	0.18*	0.50*	0.42*	0.47*
Underrepresented	0.09	0.09	0.10	0.08	0.10	0.10	0.10
Asian	0.06	0.05	0.04	0.08*	0.08*	0.06	0.04
Freshman	0.45	0.39	0.54*	0.34*	0.40	0.66*	0.41
Sophomore	0.37	0.45	0.40*	0.35*	0.35*	0.30*	0.38*
Junior	0.12	0.14	0.04*	0.18*	0.16	0.03*	0.15
Senior	0.06	0.03	0.01*	0.12*	0.09*	0.00*	0.06*
SAT/ACT	1133.09	1095.44	1105.31*	1207.15*	1160.31*	1101.71	1106.59*
SAT math	594.58	580.71	579.79	646.43*	604.48*	578.36	570.97*
SAT verbal	535.09	514.65	521.84*	559.36*	550.06*	513.79	530.79*
Graduated in economics	0.02	0.55	0.02*	0.01*	0.02*	0.05*	0.02*
Number of students	96697	699	25512	21622	8803	9194	30867
% of total sample	1.00	0.01	0.26	0.22	0.09	0.10	0.32

Notes: Observations include students enrolled in their first introductory course in economics (micro, macro or concepts) who ultimately graduated. Reported means for cumulative GPA are based on all courses taken prior to the introductory course; this value is missing if the student took this course in their first semester (available sample 82127). SAT/ACT is the combined SAT verbal and SAT math scores or the converted ACT scores for those taking the ACT exam. For students taking the SAT, administrative records contained both math and verbal component scores. For students taking the ACT, for whom we have converted their score to the equivalent SAT score, math and verbal component scores are missing (available sample 89308). Major is defined as the declared major at the time the student took their first introductory economics course.

*Means are significantly different from those associated with Economics Majors, at the 5% level using *t*-tests.

TABLE 2. Students Enrolled in their First Introductory Economics by Declared Major and Graduation Major

	Major at Time Taking Introductory Economics Course (top) and Graduation Major (bottom)									
	Business		Engineering		Science & Math		Other		Undeclared‡	
	Econ grad	BUS grad	Econ grad	ENG grad	Econ grad	S&M grad	Econ grad	Other grad	Econ grad	Econ grad
Course grade (4.0 scale)	2.57	2.70	2.81*	3.16	2.67*	3.05	2.99	2.63	2.88*	2.77
Cumulative GPA	2.66	2.67	2.72	2.92	2.10*	2.97	2.70*	2.79	2.67*	2.44
Concurrent credits	13.78	14.12	13.15*	14.81	13.58*	13.86	13.21*	14.69	13.88*	12.97
Female	0.29	0.46	0.32*	0.17	0.07*	0.50	0.35*	0.47	0.32*	0.28
Underrepresented	0.10	0.09	0.19*	0.07	0.10	0.10	0.12	0.10	0.11	0.12
Asian	0.03	0.04	0.03	0.09	0.10	0.08	0.10	0.04	0.06*	0.08
Freshman	0.28	0.53	0.73*	0.30	0.57*	0.32	0.66*	0.31	0.57*	0.70
Sophomore	0.47	0.41	0.25*	0.34	0.38	0.35	0.29	0.40	0.37	0.28
Junior	0.20	0.05	0.02*	0.21	0.05*	0.20	0.05*	0.20	0.06*	0.02
Senior	0.05	0.01	0.00*	0.15	0.01*	0.14	0.00*	0.09	0.00*	0.00
SAT/ACT	1097.85	1108.49	1131.36*	1216.86	1177.43*	1169.83	1167.42	1110.28	1140.81*	1114.61
SAT math	573.83	581.92	589.68*	652.17	616.50*	608.46	610.30	573.30	588.20*	582.61
SAT verbal	523.50	523.11	541.53*	563.58	559.04	556.23	558.81	532.14	550.56*	525.00
Graduation GPA	2.82	2.89	2.86	2.94	2.51*	3.07	2.91*	2.93	2.90	2.76
Number of students	382	20555	492	17097	175	5692	155	19581	570	453
% of original majors	0.55	0.81	0.02	0.79	0.01	0.65	0.02	0.63	0.02	0.05
% of economics grads	0.17		0.22		0.08		0.07		0.26	0.20

‡ All students who had not declared a major at the time they enrolled in the introductory course had declared a major by graduation. Thus, this column includes only those who switched into economics by graduation.

*Values are significantly different across graduation majors (for a given introductory course major), at the 5% level using *t*-tests.

TABLE 3. Declared Economics Majors at Time of Enrollment in their First Introductory Economics Course by Graduation Major

	Graduation Major		
	Economics	Business	Other
Course grade (4.0 scale)	2.57	2.53	1.99*
Cumulative GPA	2.66	2.60	2.46*
Concurrent credits	13.78	15.38*	14.90*
Female	0.29	0.35	0.32
Underrepresented	0.10	0.07	0.09
Asian	0.03	0.07*	0.05
Freshman	0.28	0.57*	0.44*
Sophomore	0.47	0.38*	0.46
Junior	0.20	0.05*	0.09*
Senior	0.05	0.01*	0.01*
SAT/ACT	1097.85	1107.51	1070.39
SAT math	573.83	595.20*	580.33
SAT verbal	523.50	513.45	490.08*
Graduation GPA	2.82	2.83	2.69*
Number of students	382	189	128
% of original econ majors	0.55	0.27	0.18

*Values are significantly different from those associated with students who had declared an Economics Major at the time they took their first introductory economics course and persisted to graduate as an Economics Major, at the 5% level using *t*-tests.