

**WHERE ARE THE WOMEN?  
THE GENDER GAP IN UNDERGRADUATE  
ECONOMICS AND FINANCE  
DEGREE SELECTION**

by

Laura Jeanne Ahlstrom

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economic Education

Summer 2018

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## **ACKNOWLEDGMENTS**

I would first like to thank my dissertation advisor, Dr. Carlos Asarta. Thank you for your wonderful guidance and support. I am so grateful for all of the feedback you gave me and for the many opportunities that you have provided me. Thank you for reminding me to “trust the process” when I was feeling anxious. I could not have completed this dissertation without your help and encouragement, and I will be forever grateful. I look forward to furthering important research in economic education with you.

I would also like to thank Dr. Charles Link, Dr. Elizabeth Farley-Ripple, and Dr. Simon Condliffe for serving as members of my dissertation committee. Thank you for the guidance and suggestions that you have provided. Your feedback has been very helpful and has improved this study considerably.

Thank you to Dr. Saul Hoffman for your support throughout my graduate school career. Thank you for believing that someone whose background was in education, rather than economics, could be successful in this degree. Thank you also to Dr. Bonnie Meszaros for your encouragement and for guiding me in my role as an economic educator. Additionally, thank you to Dr. James Butkiewicz for reading an initial draft of my job market paper and providing me with very useful comments.

I am grateful to the dedicated individuals in the Department of Economics and the School of Education who created this Ph.D. program in Economic Education. Thank you to the trailblazing women who were the first graduates of this degree program, Dr. Erin Yetter, Dr. Rebecca Chambers, and Dr. Amanda Jennings. I look

forward to working with all of you to promote effective and engaging economics instruction at all levels and on future research in our field. I also would like to thank my fellow Ph.D. students, Dr. Aida Odobasic, Dr. Kamilah Williams, Dr. Kawin Thamtanajit, Dr. Chao Wu, Dr. Julie Wise, Dr. Sarah Reed, Helen Seshie-Nasser, and Kievina Haynes, for being such amazing friends and confidantes.

I would also like to thank my brothers, Scott W. Ahlstrom and Lee M. Ahlstrom. Scott, thank you for all of your support in this process and for attending my proposal and defense presentations. Lee, thank you for editing my job market paper, proofreading my dissertation, and for always reminding me how proud of me our mother would be. Thank you also to my partner, Jason Bleacher. Thank you for listening to me talk about my research and for supporting me when I needed to vent. I am so excited to be taking this next step in my career with you by my side.

I dedicate this dissertation in memory of my parents, Dr. David H. Ahlstrom and Ms. Bernice “Chris” E. Ahlstrom. Mom and Dad, there will be another University of Delaware graduate in the family. I know you would both be proud. Mom, thank you for all of the love, support, and encouragement you gave me when I decided to leave my teaching career and pursue this doctoral degree. I only wish you could be here to see it come to fruition. I love you and miss you so much.

I also dedicate this study to my nieces, Rebekah L. Ahlstrom, Julia N. Ahlstrom, Lauren N. Ahlstrom, Brooke L. Ahlstrom, Sydney G. Ahlstrom, and to my nephew, Dash M. Ahlstrom. May you always pursue your dreams and let nothing stand in your way.

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## **ABSTRACT**

This study uses the academic records of approximately 15,000 students and a series of logistic regressions to examine male and female economics and finance course persistence and economics and finance degree selection via a combination of student, instructor, and structural characteristics. The findings are presented using a three-study format. The first study assesses gender differences in a student's choice of an economics degree from among a Bachelor of Science, a Bachelor of Arts, or an economics minor. Findings support prior research indicating that students' grades in economics courses are a significant determinant of both course persistence and degree selection. Women's choices are correlated with the grades they receive in their economics classes relative to the grades they earn in other departments' courses, while men's decisions are affected by both their absolute and relative economics grades. Additionally, women who choose an economics major by the time they complete their second economics course have a higher likelihood than their male counterparts of advancing to a subsequent economics course. Results also indicate that women's math and verbal abilities are significantly correlated with their choice of economics degree, but that men's degree selection processes are primarily influenced by their math aptitude. This study suggests that offering multiple types of economics degrees may encourage women with strong language skills to choose an economics major;

however, women may never consider an economics degree if they perceive low relative economics grades as a signal that they will not be successful in the major.

The second study assesses male and female students' economics degree selection based on the student's initial major at the time of matriculation into the University of Delaware. The results indicate that both male and female students whose initial major selection is economics are significantly more likely to graduate with a degree in economics. In addition, the findings indicate that students of both genders who initially select a non-economics major may be drawn into an economics major or minor. The findings also suggest that students' absolute and relative grades in their first college economics course, Introduction to Microeconomics, may have a significant effect on their likelihood of graduating with an economics degree.

The third study examines male and female students' finance course persistence and degree selection. The results suggest that female students who complete Principles of Finance are less likely to take an intermediate finance course and to complete a degree in finance. The results also indicate that students of both genders who matriculate as finance majors have a strong probability of taking additional finance courses and completing a finance degree. In addition, female students' persistence to an intermediate finance course is significantly correlated with their relative introductory finance course grade. The findings also suggest that the grades a student receives in his or her introductory economics courses may be significant indicators of their finance course persistence and degree completion.

## **Chapter 1**

### **INTRODUCTION**

#### **1.1 Overview of the Gender Gap in Economic and Finance Degree Attainment**

In 1971 the American Economic Association, founded in 1885, resolved the following: “Economics is not exclusively a man’s field” (CSWEP, 2016). It did so as part of its creation of the Committee on the Status of Women in the Economics Profession (CSWEP). The goals of CSWEP were, and still are, to reduce gender discrimination in the economics profession and to remedy the underrepresentation of women in economics at all academic levels. At the time, women earned less than 10% of all bachelor’s and doctoral degrees in economics and represented 6% of the faculty in college and university economics departments in the United States (Ceci, Ginther, Kahn, & Williams, 2014; Kahn, 1995). More recently in the field of finance, researchers have begun to form comparable women’s professional organizations to address the low percentage of females in finance. In 2015, the American Finance Association formed the Academic Female Finance Committee (AFFECT) with a goal of striving toward gender equality in finance and improving women’s advancement opportunities both for academics and practitioners (AFFECT, 2016; FIRN, 2016).

Despite the development of these organizations and efforts among professionals to improve women’s representation in the fields of economics and finance, large gaps in



undergraduate economics and finance degree attainment continue to persist. Although there have been some advancements in gender equality in economics and finance degree completion, women remain the minority (Catalyst, 2015; Ceci et al., 2014; National Center for Education Statistics, 2017; Oliver Wyman, 2016; von Hippel, Sekaquaptewa, & McFarlane, 2015). In economics, women now comprise about one-third of doctorates, an increase of approximately 5 percentage points in the past fifteen years, and in the last decade, the percentage of women earning PhDs in finance increased from 12% to 35% (Ceci et al., 2014; Griffith, 2013; National Center for Education Statistics, 2017). In contrast, however, in 2014 women obtained about 48% of all general business doctorates (National Center for Education Statistics, 2017). Beyond the realm of academia, data on employment from the financial sector suggests that women are underrepresented in economics- and finance-related professions. Only two of the twelve current Federal Reserve Bank Presidents are women (Federal Reserve Board, 2018). Among workers in the private financial services industry, women comprise 63% of the accountants and auditors but only 41% of the financial analysts (Catalyst, 2015). Moreover, on Wall Street approximately 15% of the stock traders are female, and women manage less than 10% of mutual funds in the United States (Lutton & Davis, 2015).

Given the high degree of gender disparity in participation in the economics and finance professions, recruitment of talented young women into these traditionally male academic and career fields is important. Women represent approximately 58% of all undergraduates, suggesting that economics departments could potentially recruit many women into the field (Ball, 2012; Ceci et al., 2014; Goldin, Katz, & Kuziemko, 2006). Yet just as at the graduate level, a gender gap in degree completion exists among

undergraduate economics and finance majors. What may be even more concerning is that despite the increase in doctorates earned by women in these subjects, the percentages of women obtaining undergraduate degrees in these fields has remained relatively stagnant for the past twenty years (Ball, 2012; Ceci et al., 2014; Goldin, 2013; Kim, Markham, & Cangelosi, 2002; McElroy, 2014; National Center for Education Statistics, 2017; Siegfried, 2016).

As Panel A of Figure 1.1 illustrates, the total number of economics bachelor's degrees conferred in the United States doubled between 1996 and 2016 (NCES: Digest of Education Statistics, 2017). Although the number of economics degrees awarded to women also doubled, Panel B indicates that the share of women has not seen a similar increase. In fact, women have comprised only approximately 30% of all economics bachelor's degree-earners for the last twenty years. Growth also occurred in the number of undergraduate finance degrees conferred in the United States, as indicated by Panel C. As in economics, the number of female finance degree recipients also increased; however, Panel D shows that women have obtained only about 30-35% of finance bachelor's degrees over this time. Furthermore, the proportion of women who were awarded economics and finance degrees has decreased since the early-2000s.

In economics, the size of the gender gap in undergraduate degree attainment differs depending on the type of university. Private institutions in the United States, for example, tend to have a smaller gap in degree completion than do public ones. In 2014, public universities graduated 31% females compared to 36% percent females at private institutions. Selective liberal arts colleges tend to have the smallest gap in economics degree attainment; women at these schools earned about 38% of the bachelor's degrees

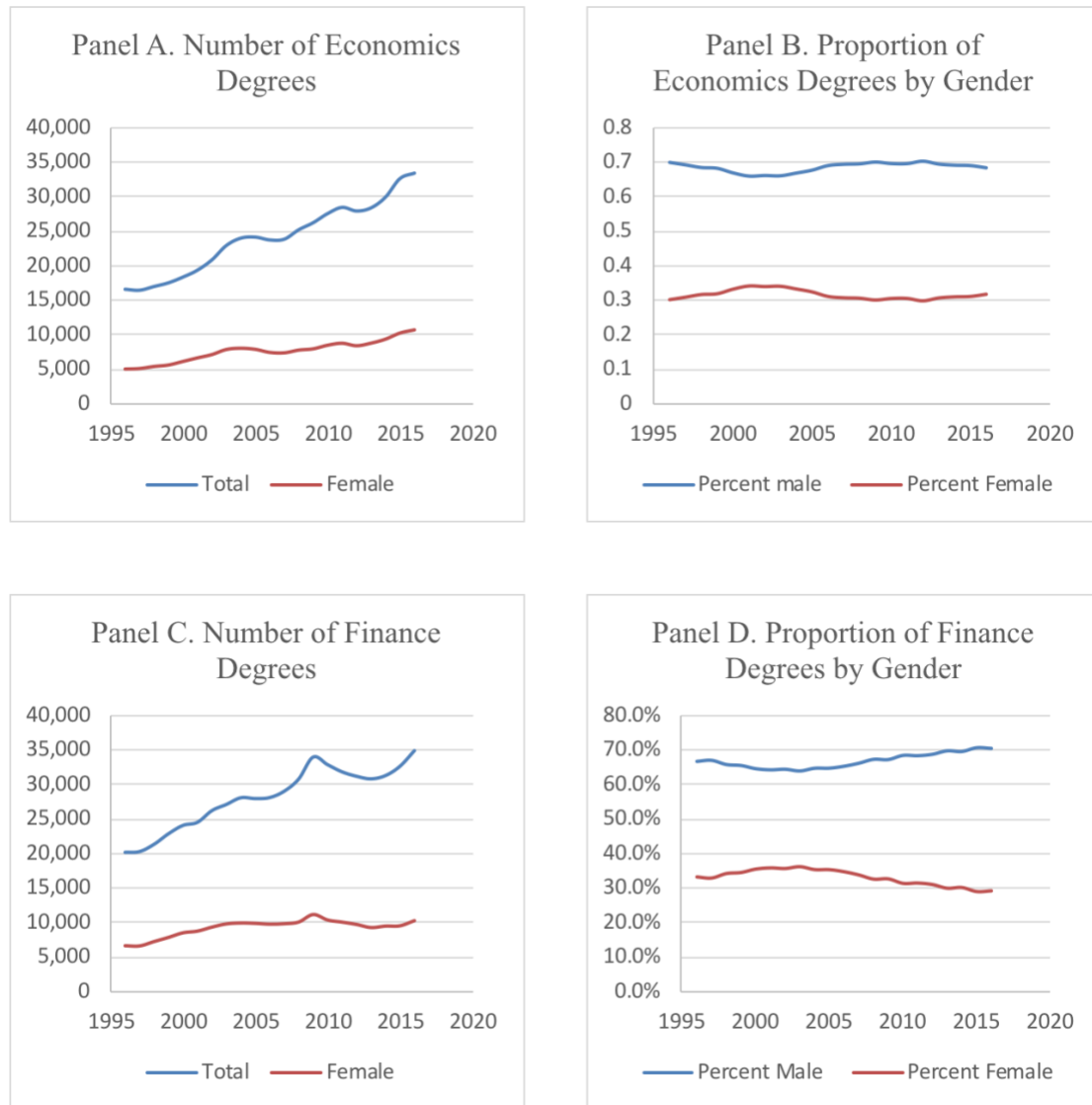


Figure 1.1 Economics and Finance Bachelor's Degrees Conferred in the U.S., 1996-2016

*Note:* Adapted from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 1996-2016.

awarded in economics (Siegfried, 2016). Conversely, other Baccalaureate colleges, both public and private, have a much larger gap in degree completion; women obtain only about 25% of economics degrees at these institutions (Goldin, 2013; Goldin, 2015a;

Siegfried, 2016). Unfortunately, comparable research into undergraduate finance degrees by type of university has not been conducted.

## **1.2 Purpose of the Study**

The reason for the gender gap in undergraduate degree attainment in these fields does not appear to be that women are uninterested in business-related or math-intensive careers. Women represent approximately half of all undergraduates in business and STEM (Science, Technology, Engineering, and Mathematics) fields, and the gender disparities in degree attainment in many of these majors have decreased over the last two decades (Ball, 2012; Ceci et al., 2014; Kim et al., 2002; Malgwi, Howe, & Burnaby, 2005). Evidence also suggests that women who earn high math SAT scores are more likely to pursue degrees in engineering and the physical sciences than in economics or finance (Ceci et al., 2014; Turner & Bowen, 1999). Since the gender gaps in degree attainment in some of these other math-intensive college majors are smaller and diminishing, a question arises. Why does such a large gender gap among undergraduate economics and finance majors persist? The overall purpose of this study is to explore this lack of gender diversity by assessing the factors that influence how males and females differentially navigate the process of choosing to complete a degree in economics and finance.

My study uses a three-essay format. In the first essay chapter, I assess how males and females differ in their economics course persistence, defined as a student's propensity to complete additional economics classes beyond an introductory course. I also analyze gender differences in students' probability of selecting among different types of economics degrees. In the second essay chapter, I examine the likelihood that

male and female students will earn an economics degree based upon their major at the time of matriculation and the grade they earn in Introduction to Microeconomics. The third essay chapter parallels the design of the first essay with a focus on finance students. In it, I analyze gender differences in students' finance course persistence and their probability of selecting a finance degree.

I build upon the existing literature by incorporating aspects of student and instructor attributes, including students' high school preparation and college course performance along with instructor gender and type (e.g., graduate student instructor). I also incorporate structural (class) characteristics, such as class size and the male-female student class ratio. The following research questions guide my dissertation.

1. How do student, instructor, and structural (class) characteristics differentially affect gender persistence in taking economics courses and the propensity to earn an economics degree?
2. How do a student's initial major selection and introductory microeconomics course grade differentially affect male and female students' propensities to earn an economics degree?
3. How do student, instructor, and structural (class) characteristics differentially affect gender persistence in taking finance courses and the propensity to earn a finance degree?

To provide context for the study overall, what follows is an explanation of why there is a need for increased gender equity in undergraduate degree completion in the fields of economics and finance as well as a brief description of the theoretical framework for the study.

### **1.3 Rationale for Increasing Gender Equity in Economics and Finance Degree Attainment**

Undergraduate students who earn degrees in economics and finance often pursue graduate studies in these fields or directly enter the business workforce (Allgood, Walstad, & Siegfried, 2015; Jones, Hoest, Fuld, Dahal, & Colander, 2008). Yet the small number of female undergraduate majors in these fields leads to women's underrepresentation in the financial services industry and a narrow pipeline into graduate degree programs (Bartlett, Ferber, & Green, 2009; Ceci et al., 2014; Keys & Turner, 2006; von Hippel et al., 2015). Education is an investment in one's human capital- skills, knowledge, and competencies- that yields both personal and societal returns (Gemici & Wiswall, 2014). Increasing the percentage of females who earn undergraduate degrees in economics and finance will benefit not only the women themselves but also the society at large (Post & Byron, 2015; van Staveren, 2014).

#### **1.3.1 Financial Benefits for Women**

Women who graduate with degrees in these fields may benefit financially through improved career opportunities and salaries. Evidence from the Bureau of Labor Statistics' job growth projections suggests that there will be greater demand for individuals with undergraduate degrees in economics and finance. For instance, some people with bachelor's degrees in economics work as market research analysts, an area that is expected to have a 19% increase in job growth over the next ten years. Economics and finance graduates also work in various positions in the financial investment industry, which is predicted to have some of the largest employment growth over that same time period. The demand for personal financial advisors, specifically, is expected to grow by approximately 30% (U.S. Bureau of Labor Statistics, 2015).

Furthermore, this growth of job opportunities in the financial investment industry may be significant, not only for female advisors, but also for female investors. Women have become an increasingly large percentage of the labor force. As a result, their roles as breadwinners and financial decision-makers have increased significantly. Currently women own about \$11.2 trillion of investable assets in the United States alone, which represents about 39% of the country's total financial assets (Hewlett, Moffit, & Marshall, 2014). Yet women also appear to feel dissatisfied with their financial advisors (Garmhausen, 2012; Hewlett et al., 2014; Insured Retirement Institute, 2013). Research suggests that women have differences in how they perceive wealth and have different investing goals and strategies than men (Garmhausen, 2012; Hewlett et al., 2014; Oliver Wyman, 2016). Moreover, a report by the Insured Retirement Institute (2013) found that 70% of women prefer working with female financial advisors, which may be due to gender differences in investment planning. Additionally, women may take a more holistic approach to their investment strategies (Garmhausen, 2012; Stendardi, Graham, & O'Reilly, 2006). Therefore, increasing the proportion of women earning finance and economics degrees may increase the number of women who enter these careers, benefitting both themselves and those who seek financial advice.

Another reason to increase the number of women in economics and finance is that the presence of more females in these fields may increase women's salaries. On average, salaries are higher for those who graduate with economics and finance degrees when compared to other business fields (PayScale, 2016). Moreover, women who major in economics tend to earn higher salaries and have higher levels of savings and home equity values when compared to women who receive general business degrees (Allgood,

Bosshardt, Van Der Klaauw, & Watts, 2011; Gemici & Wiswall, 2014). Nonetheless, the corporate and financial sectors in general have larger gender pay gaps than some other fields, such as the health care and technologies industries (Bertrand, Goldin, & Katz, 2010; Goldin, 2015b; Roth, 2003). These industries also often require long hours, offer fewer opportunities to work from home, and penalize work gaps taken for family leaves, thus creating a work culture that may be less supportive of women's needs (Bertrand et al., 2010; Oliver Wyman, 2016; van Staveren, 2014). An increased female presence in the corporate and financial sectors may help to change the culture and reduce pay inequalities (Walby, 2009). A recent study by Goldin (2015b) found that it could be possible to reduce the gender earnings gap by as much as 35% if women and men worked in industries at equal proportions. Increasing the number of women earning bachelor's degrees in economics and finance could therefore be a potential way of reducing the overall gender earnings gap in the United States.

### **1.3.2 Gender Diversity in Performance and Perspectives**

Recent research suggests that having increased gender diversity leads to more positive performance outcomes, both in academia and industry. In higher education, studies of business students who worked in mixed-gender teams exhibited better performance outcomes and higher grades in complex problem-solving situations (Fenwick & Neal, 2001; Umans, Collin, & Tagesson, 2008). In the workplace, a 2015 study by McKinsey & Company found that companies that were in the highest quartile of gender diversity were 15% more likely to have financial returns above their national industry rivals (Hunt, Layton, & Prince, 2015). Some evidence also suggests that having more gender diversity on corporate boards leads to increased firm financial success



(Erhardt, Werbel, & Shrader, 2003; Francoeur, Labelle, & Sinclair-Desgagn e, 2008; Post & Byron, 2015). One reason for these improved outcomes may be that diverse workgroups bring about greater informational diversity and ways of thinking. Mannix and Neale (2005) found that groups that are balanced with more diverse opinions tend to exhibit better problem-solving effectiveness. The professions of economics and finance often require problem-solving and complex decision-making, and they could benefit from an increased presence of women.

The implications of the need for diversity of thought and perspectives may be particularly important in economics. For instance, evidence seems to suggest that women and men may have different attitudes toward the traditional economic perspective. The notion of “economic man,” the central figure in mainstream economic thinking, who acts autonomously to make rational, utility-maximizing decisions may not be as relevant for women whose decisions may be influenced by their historically dependent status (Davis, 1997; Ferber, 1995; Hughes, 1998; Nelson & Goodwin, 2009; Nelson, 2008). In fact, a survey of professional economists suggested that a significantly large percentage of women disagreed with the assumption that rational behavior reflects human behavior (Davis, 1997; May, McGarvey, & Kucera, 2018). Additionally, males who conduct economics research tend to have a propensity to ignore “women’s topics,” such as women’s labor force participation and labor market discrimination, fertility and childbearing, the role of household and unpaid labor in the economy, and the impact of monetary and fiscal policies on women (Feigenbaum, 2013; Ferber, 1995; Nelson, 2008). These topics also tend to be ignored in introductory undergraduate economics classes, which may lead to females’ perspectives being marginalized (Bartlett, 1995; Feigenbaum,

2013; Ferber, 1995; Okoye, 2011; Robson, 2001; Stevenson & Zlotnick, 2018). The economics profession, therefore, may not be tapping into the potential for creativity and differing perspectives that could improve outcomes. For this reason, women may be less interested in pursuing an economics degree.

Diversity of opinion is also important in public policy making. Since many undergraduates with economics degrees find careers in government or public policy research, there is a need to balance male and female viewpoints. Recent research indicates male and female economists may have disparate views on public policy issues; female economists tend to lean more liberal, support more government intervention in the economy, and be more likely to be members of the Democratic Party than men (Hedengren, Milton, & Klein, 2010; Klein, Davis, & Hedengren, 2013). May, McGarvey, and Whaples (2014) found that there are many areas in which male and female economists tend to agree; however, in certain areas such as income distribution, the minimum wage, health care, and tax progressivity, females generally favor more liberal viewpoints. The authors also found that male economists were more likely to answer that the size of the government was “too large” whereas female economists tended to answer that the government’s size was “about right.” Furthermore, women also expressed stronger beliefs that job opportunities in the United States were not equal for males and females along with different beliefs about the causes of the gender wage gap. Increasing the number of women receiving undergraduate degrees in economics may thus help to promote more diverse economic policy views.

### **1.3.3 Gender Diversity in the Financial Industry**

The financial sector may also benefit from increased gender diversity. As stated previously, research indicates that men and women tend to have different strategies and perspectives on investment, with women being more cautious, taking more time to execute their trades, and making fewer trades in general (Barber & Odean, 2001; Eckel & Fullbrunn, 2015; Garmhausen, 2012; Stendardi et al., 2006). Women tend to be less competitive, and men tend to exhibit a greater level of overconfidence in their skills and decision-making processes, which does not always yield more positive outcomes (Barber & Odean, 2001; Gneezy, Niederle, & Rustichini, 2003; Niederle & Vesterlund, 2007). Additionally, women may be more risk-averse, although some of the research on this topic has yielded mixed results (Adams & Ragunathan, 2015; Charness & Gneezy, 2012; Oliver Wyman, 2016; Stendardi et al., 2006). These differences in female attitudes towards financial investment, however, may help to improve profits and returns on financial investments. For example, one study found that a greater presence of female fund managers helped to increase financial returns on investment assets (Barber & Odean, 2001).

Some recent research has suggested that the financial crisis of 2008-2009 could have been avoided had there been more female stock traders and fund managers, while other research has challenged this supposition (Adams & Ragunathan, 2015; Eckel & Fullbrunn, 2015; Nelson, 2012; Prügl, 2012; van Staveren, 2014; Walby, 2009). Due to the lack of female asset managers in the investment industry, empirical support for either hypothesis is lacking, but there is some evidence that an increased presence of women may lead to improved financial stability (Adams & Ragunathan, 2015; Eckel &

Fullbrunn, 2015; van Staveren, 2014). Eckel and Fullbrunn (2015) conducted an experimental study with college students and found that when women managed asset funds, asset price bubbles were reduced. Adams and Ragunathan (2015) found that banks with more female directors did not necessarily exhibit less risk-taking behavior during the financial crisis; however, they did have better performance, leading to less risk of failure. Yet evidence also suggests that women who achieve leadership roles in the financial sector may become fund managers through an intensive screening process, and women who demonstrate more stereotypical masculine qualities may be more likely to be promoted to leadership roles (Eckel & Fullbrunn, 2015; van Staveren, 2014).

There may also be a role for women in changing the culture of the financial industry, which may lead to improved decision-making. The industry may still suffer from stereotypes and a “macho” culture where character traits such as “dominant” and “aggressive” have been identified with successful leadership (Oliver Wyman, 2014). Past financial decisions have primarily been based on making money with very little care given to social responsibility or the actual impact on people (Barber & Odean, 2001; Graafland & van de Ven, Bert W., 2011; Oliver Wyman, 2016; von Hippel et al., 2015). Graafland and van de Ven (2011) argued that the financial crisis of 2007-2009 was the result of a moral crisis of responsibility in the credit industry and that cultural changes within the industry are needed to provide more financial stability. Some people have argued that an increased presence of women may bring about such cultural change (Walby, 2009). There is support for this view; research has shown that women have stronger opinions about business ethics and social responsibility than men (Ahmad & Seet, 2010; Cagle, Glasgo, & Holmes, 2008; Hadjicharalambous & Walsh, 2012). One

study even found that more gender diversity among corporate boards may decrease securities fraud (Cumming, Leung, & Rui, 2015). Furthermore, survey research within the industry indicates that future financial leaders will need to demonstrate more “feminine” character traits, such as patience, adaptability, and trustworthiness (Oliver Wyman, 2014). What seems apparent is that increasing the number of women working in financial fields may promote different ways of thinking and additional strategies toward financial investments, which may eventually bring about cultural changes within the industry.

#### **1.4 Theoretical Framework**

To understand the gender gap in degree attainment among undergraduate economics and finance majors, it is necessary to examine the reasons behind students’ choice of major. According to economic theory, students select their college major to maximize their utility and satisfaction (Ashworth & Evans, 2001; Okoye, 2011; Turner & Bowen, 1999). Although many factors influence men’s and women’s degree selection, prior research on gender differences in selecting an economics major has primarily focused on three broad categories. First, students develop preferences and expectations prior to college, which are influenced by parents and society, high school preparation and achievement, especially in mathematics, and personal and educational experiences (Alcock, Cockcroft, & Finn, 2008; Ashworth & Evans, 2001; Ballard & Johnson, 2005; Bansak & Starr, 2010; Morgan & Klaric, 2007; C. M. Steele, 1997; von Hippel et al., 2015). Second, students make academic decisions based on their experiences and performance in their college classes, which are affected by a variety of factors. For instance, the institutional setting, including characteristics of a particular university

and/or economics department along with course curriculum, affect the academic opportunities that are available to students (Asarta & Butters, 2012; Dean & Dolan, 2001; Goldin, 2013; Marangos, 2012; Salemi & Eubanks, 1996; Solnick, 1995). The college classroom environment, including class size, instructor-student interactions, and male-female student ratios, may also affect students' performance and sense of belonging (Crawford & MacLeod, 1990; Kokkelenberg, Dillon, & Christy, 2008; Luppino & Sander, 2015; Morris & Daniel, 2008; Raimondo, Esposito, & Gershenson, 1990). Additionally, instructor characteristics, such as gender, degree-level, and employment status, may influence students' performance and course-taking behavior (Bettinger, Long, & Taylor, 2016; Borjas, 2000; Finegan & Siegfried, 1998; Jensen & Owen, 2001; Norris, 1991; Rask & Bailey, 2002; Robb & Robb, 1999; Saunders & Saunders, 1999). Third, students often consider the post-graduation labor market for a potential major, including the possibility of finding a job, salary expectations, and workplace environment (Kim et al., 2002; R. E. Pritchard, Potter, & Saccucci, 2004; Worthington & Higgs, 2003; Worthington & Higgs, 2004).

While some researchers have explored the likelihood of choosing a major directly, others have examined it through the lens of persistence in taking economics courses (Emerson, McGoldrick, & Mumford, 2012; Horvath, Beaudin, & Wright, 1992; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). Evidence from these studies suggests that women are less likely to take an introductory economics course and are less likely to continue to take upper-level economics courses (Calkins & Welki, 2006; Dynan & Rouse, 1997; Emerson et al., 2012; Horvath et al., 1992; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). Often, women's lack of persistence has been attributed to lower

performance in economics courses; however, the results of performance studies have been mixed. Historically, women have earned lower grades in their introductory economics courses, but more recently women are performing equally as well or better than men (Arnold & Rowaan, 2014; Johnson, Robson, & Taengnoi, 2014; Rask & Tiefenthaler, 2008; Swope & Schmitt, 2006; Terry, 2002). Moreover, women who do persist in taking intermediate- and advanced-level economics classes tend to outperform their male counterparts (Asarta, Butters, & Perumal, 2014; Rask & Tiefenthaler, 2008). Additional research has provided support for the theory that it is not performance per se that decreases women's tendency to major in economics, but rather their expectations and responsiveness to their performance. Women may be more sensitive than their male counterparts to the grades they receive and may need to earn higher grades in economics to feel adequately prepared to take additional economics courses and to major in the subject (Ballard & Johnson, 2005; Horvath et al., 1992; Jensen & Owen, 2000; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). These studies suggest that, on some level, performance cues do tend to affect the likelihood of women majoring in economics. This study contributes to the literature by analyzing how students' course performance affects their economics and finance course persistence and their choice of degree.

Other researchers have explored the pathways through which students have entered the economics major as well as their tendencies to remain in the major once it has been selected. Much of this research has focused on students moving between business and economics majors (Asarta & Butters, 2012; Marangos, 2012; Mumford & Ohland, 2011; Salemi & Eubanks, 1996). Some evidence suggests that students who cannot fulfill the admissions requirements for a business degree select economics as a substitute major

(Marangos, 2012; Salemi & Eubanks, 1996). Business students who perform well in their economics courses may also be encouraged to switch into an economics major (Asarta & Butters, 2012). A few studies have assessed the propensity of students outside of business fields to select an economics major (Ashworth & Evans, 2001; Fournier & Sass, 2000; Kasper, 2008; Mumford & Ohland, 2011; Stock, 2017). Additional research has found that economics is a popular second major, particularly among women (Stock, 2017). While evidence suggests that females are less likely to choose economics as a major, men and women may be equally inclined to switch out of the economics major (Chizmar, 2000). More research, however, is needed on the paths that students take into economics and what factors affect the likelihood of students switching into an economics degree. Thus, this study extends the prior research by assessing how students' performance in their introductory microeconomics course affects their propensity to complete an economics degree.

In comparison to the amount of research on factors influencing students to major in economics, relatively few studies have been conducted on the factors that affect the selection of a finance major. Several studies have assessed the determinants that contribute to performance in introductory finance courses (Alcock et al., 2008; Borde, Byrd, & Modani, 1998; Chan, Shum, & Chhachhi, 2005; Didia & Hasnat, 1998; Seiver, Haddad, & Do, 2014; Sen, Joyce, Farrell, & Toutant, 1997). These studies, however, are not linked in any way to choosing to major in finance. Several studies have analyzed business students' choice of major in general (Kim et al., 2002; Kumar & Kumar, 2013; Loo, 2002; R. E. Pritchard et al., 2004). Two of them made some comparisons across business majors, including finance; however, these studies did not explore gender effects



(Kim et al., 2002; Loo, 2002). Only one study to date has examined gender differences in a student's decision to major in finance, and this research was based on a survey of students in Australia (Worthington & Higgs, 2003). Given the lack of research on finance majors specifically, this study explores previously uncharted areas in finance course persistence and major selection.

## **1.5 Outline of Research**

This dissertation is divided into six additional chapters. Chapter 2 provides an extensive review of the literature on the factors that contribute to a student's general selection of a college major as well as research on economics and finance degree selection more specifically. Chapter 3 offers an overview of the data and methodology used in the study. Chapters 4 through 6 present the specific methodology and results from each of the three essays. In Chapter 4, I examine how student, instructor, and structural characteristics affect undergraduate students' economics course persistence and economics degree selection. In Chapter 5, I analyze male and female students' propensities to earn an economics degree based on their major at matriculation and introductory microeconomics course performance. Chapter 6 presents the results from my analysis of how student, instructor, and structural characteristics influence undergraduate students' finance course persistence and finance degree selection. Chapter 7 concludes the dissertation with a discussion of the results and recommendations for future research.

## **Chapter 2**

### **LITERATURE REVIEW**

In this section, I discuss the prior literature related to college degree selection. In section 2.1, I review the theoretical approaches to college degree selection used by economists, educators, and social science researchers. In section 2.2, I explore issues related to gender differences in the areas of achievement, self-efficacy, interests, and values. Section 2.3 discusses the type of factors that influence students' college major selection. Finally, in sections 2.4 and 2.5, I examine the factors associated with choosing to major in economics and finance, respectively.

#### **2.1 Theoretical Approaches to College Degree Selection**

Researchers have explored the various influences on students' selection of college degrees from a variety of perspectives. Although social scientists and education scholars use different methodologies, most of the studies emphasize how students evaluate the available information and choose their degrees from a set of alternatives based on their personal preferences. Economists primarily use forms of rational choice models based on the principle of random utility-maximization (Ashworth & Evans, 2001; Gemici & Wiswall, 2014; Montmarquette, Cannings, & Mahseredjian, 2002; Turner & Bowen, 1999). They often use these models to assess how individual ability and institutional factors affect a student's choice of college major. On the other hand, psychologists, sociologists, and educational researchers tend to consider college major selection through

the lens of individual identity and achievement, emphasizing social cues, motivational beliefs, and biological and contextual influences (Ceci et al., 2014; Correll, 2001; Correll, 2004; Eccles, 2009; Riegle-Crumb, King, Grodsky, & Muller, 2012; Wang, Eccles, & Kenny, 2013).

In this section, I describe the primary theoretical models used by economists and education researchers to analyze college degree selection. First, I present the econometric model of utility-maximization. Second, I describe the educational model of expectancy-value theory.

### **2.1.1 Random Utility-Maximization Theory**

The basic economic perspective suggests that individuals make rational decisions based on self-interest. People assess the costs and benefits of alternative possibilities and choose what offers them the greatest amount of present and future utility. The random utility-maximization model is applied to discrete choices, where individuals have many alternatives and must select one (Ben-Akiva & Lerman, 1985).<sup>1</sup> Upon entering college, individuals have a large possible set of majors, denoted  $C$ . They also face personal constraints, such as aptitude and interests, that determine their personal college major choice set  $C_i \subseteq C$ . Student  $i$  will then choose the major believed to provide the greatest amount of utility expressed as

$$U_{ij}, \quad j \in C_i \tag{2.1}$$

where  $U$  represents the utility an individual receives from choosing major  $j$ . Since students have many options within set  $C_i$ , they will select major  $j \in C_i$  if and only if

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<sup>1</sup> Although some students graduate with more than one major, this study will focus on college degree selection as a discrete choice.

$$U_{ij} \geq U_{ik}, \quad \text{all } k \neq j, j \in C_i \quad (2.2)$$

Thus, a student will choose major  $j$  as long as it provides them with utility that is greater than or equal to an alternative major  $k$ .

Because utility cannot be directly observed or measured, economists define utility indirectly by analyzing the attributes of both the individual and the alternatives. The indirect utility function for college major selection can be expressed as

$$U_{ij} = U(X_i, Z_{ij}) \quad (2.3)$$

where  $X_i$  is a vector of characteristics of student  $i$ , and  $Z_{ij}$  is a vector of attribute values for major  $j$  as viewed by the student.

When looking at a sample of students, we may find that people with similar choice sets, personal characteristics, and goals choose different majors. These choices result from unobserved factors that yield different utilities. Thus, utility is the sum of observable characteristics, denoted as  $V$  and unobservable, or random, characteristics denoted as  $\varepsilon$ . The random utility model is then written as

$$U_{ij} = V(X_i, Z_{ij}) + \varepsilon(X_i, Z_{ij}) = V_{ij} + \varepsilon_{ij} \quad (2.4)$$

Utility cannot be observed with certainty, so economists introduce probabilities into the model to account for inconsistencies in choices among identical individuals. Probabilities represent the likelihood that a student will choose a particular major. By introducing probability  $P$  into the random utility model, equation 2.4 above can be rewritten as

$$P(j|C_i) = \text{Prob} [V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik}, \text{ all } k \in C_i] \quad (2.5)$$

In essence, the random utility-maximization model estimates the probability that a student will choose major  $j$  if the probability of the predicted utility from that major is greater than or equal to the predicted utility from all other alternatives.

### **2.1.2 Expectancy-Value Theory**

Educational psychologists have analyzed college degree selection through the lens of expectancy-value theory, which suggests that students' academic choices are motivated by their desire for achievement and success (Wang & Degol, 2013; Wang et al., 2013). According to the theory, achievement-related choices are tied to two sets of beliefs (Eccles, 2009). First, individuals develop expectations about their potential for success based on perceptions of their personal skills, characteristics, and competencies. Second, people form a set of subjective task values, including the importance, enjoyment, usefulness, and cost associated with various alternatives. In this model, students' college major selection is based on both the expectation they will be successful in the major as well as the degree to which they value the major.

A person's expectations and values are tied to their sense of identity, both personal and collective (Eccles, 2009). Personal identity, which Eccles refers to as the "ME self," is what people believe makes them unique and valuable. Collective or social identity, the "WE self," represents the ways a person identifies with a valued group or relationship based on ethnicity, nationality, gender, social class, religion, culture, and family. From a psychological or sociological perspective, identity development is influenced by education, experiences, cultural norms, social roles, and other external factors (Cheryan & Plaut, 2010; Eccles, 2009; C. M. Steele, 1997). Identity shapes individuals' beliefs about who they are and who they want to become (Eccles, 2009).

Thus, perceptions of identity and factors influencing identity formation shape a person's achievement-related beliefs and behaviors, including their academic decisions.

A student's college degree selection is connected to perceptions of their ability, interest, values, and sense of identity (Cheryan & Plaut, 2010; Good, Rattan, & Dweck, 2012; Murphy, Steele, & Gross, 2007; C. M. Steele, 1997; von Hippel et al., 2015; Wang & Degol, 2013; Wang et al., 2013). It is also related to their expected proficiencies and satisfaction in their career pursuits. In order to understand why males and females pursue different college majors, it becomes important to understand how men and women may be different in these areas. In the next section, I explore these areas of gender difference.

## **2.2 Gender Differences in Intellectual Ability, Motivational Beliefs, and Values**

Gender is shaped by socialization and cultural beliefs; it is a construct tied to one's sense of identity that exists above and beyond a person's biological sex (Eccles, 2009; C. M. Steele, 1997; Su, Rounds, & Armstrong, 2009). A significant amount of research has been conducted in gender differences about areas related to ability or aptitude, including the role of confidence and self-efficacy beliefs as well as cultural biases and stereotypes (Correll, 2001; Good et al., 2012; Lapan, Shaughnessy, & Boggs, 1996; Spencer, Steele, & Quinn, 1999; Wang et al., 2013). Additionally, other researchers have explored how males and females differ in their subject-area and career interests along with differences in lifestyle and occupational values (Gemici & Wiswall, 2014; Kiefer & Sekaquaptewa, 2007; Lapan et al., 1996; Su et al., 2009). Evidence suggests that there are indeed significant gender differences in these areas.

### **2.2.1 Achievement and Ability**

A person's ability or aptitude, as evidenced by performance, is a significant determinant of college major selection (Ashworth & Evans, 2001; Ceci et al., 2014; Correll, 2001; Dynan & Rouse, 1997; Eccles, 2009; Emerson et al., 2012; Lapan et al., 1996; Solnick, 1995; Wang et al., 2013). In particular, students' mathematics ability may have a significant effect on their selection of quantitative-oriented majors. Historical analyses of mathematics performance from large samples of standardized exams, such as the SATs and GREs, have suggested that males have a slight advantage in average math performance (Ceci et al., 2014; Hyde, Fennema, & Lamon, 1990; Hyde, Mertz, & Schekman, 2009; Lindberg, Hyde, Petersen, & Linn, 2010). Hyde et al. (1990) found that by the time students reached high school age, men outperformed women, particularly in problem-solving tasks. However, recent research suggests that the gender gap in math performance has decreased. Studies using state standardized tests as well as national assessments, such as the National Assessment of Educational Progress (NAEP), have found that females on average have reached parity with males in math (Hyde et al., 2009; Lindberg et al., 2010; National Assessment of Educational Progress (NAEP), 2015).

Although recent research on mean math scores reveals no significant gender differences, men may be more likely to earn scores in the upper right tail of scoring distributions (Ceci et al., 2014; Ellison & Swanson, 2010; Hyde et al., 2009; Riegle-Crumb et al., 2012; Spencer et al., 1999). In one study, males were about 2.1 times more likely to score an 800 on the math SAT than females (Ellison & Swanson, 2010). Research also suggests that test difficulty may reveal gender differences such that women may tend to underperform relative to men on more difficult math tests but perform

equally as well on easier ones (Spencer et al., 1999). For instance, among students who completed the prestigious and challenging American Math Competition (AMC), the male-female ratio at the mean test score was 4 to 1 (Ellison & Swanson, 2010).

Although a large body of literature has analyzed the influence of students' actual aptitude in mathematics as a major factor in college major selection, some researchers have argued that students' comparative advantage in ability is a more important determinant than their absolute ability advantage. In other words, students' relative abilities- their comparison of quantitative and verbal skills- may matter more than their actual abilities (Davison, Jew, & Davenport, 2014; Riegle-Crumb et al., 2012; Turner & Bowen, 1999; Wang et al., 2013). Evidence suggests that females on average have a comparative advantage in reading relative to math whereas males tend to have a comparative advantage in math (Davison et al., 2014; Riegle-Crumb et al., 2012; Wang et al., 2013).

### **2.2.2 Personal Efficacy and Sense of Identity**

Evidence indicates that the link between ability and academic performance may be strongly connected to one's perceived ability and sense of identity, both individual and collective (Eccles, 2009; Good et al., 2012; Kiefer & Sekaquaptewa, 2007; Lapan et al., 1996; Nosek et al., 2009; Spencer et al., 1999; C. M. Steele, 1997; Wang & Degol, 2013). Students who believe that they are less competent in a skill area, that others have greater competence than they do, or that their performance is tied to a social identity, such as gender, often do not perform as well (Nosek et al., 2009; Spencer et al., 1999). Additionally, individuals who do not feel a sense of belonging to a particular academic domain or that a certain career path is inconsistent with their identity often choose not to



pursue those academic and career fields (Cheryan & Plaut, 2010; Correll, 2001; Correll, 2004; Good et al., 2012; Kiefer & Sekaquaptewa, 2007; Lapan et al., 1996; Murphy et al., 2007; von Hippel et al., 2015; Wang & Degol, 2013). People are likely to choose a degree based on their perceived ability to succeed along with how much they feel they fit in and can be valued in a particular field. Thus, a student's personal efficacy, gender identification, and sense of belonging may play a role in college degree selection over and above that of actual ability or achievement.

*2.2.2.1 Performance Self-Efficacy.* Individuals develop their personal efficacy through performance feedback, socialization, and cultural beliefs, including gender norms and stereotypes (Eccles, 2009; C. M. Steele, 1997). Efficacy is tied to expectations and confidence in one's ability, and men and women may develop dissimilar perceptions of their ability. Some research indicates that males may generally exhibit greater confidence and higher personal efficacy (Beyer, 1999; Beyer, 1998; Niederle & Vesterlund, 2007). Men may also have greater efficacy in particular subject areas, especially those linked to fields that are considered more "masculine," such as math and science (Correll, 2001; Lapan et al., 1996). Women may also display greater tendencies to underestimate their abilities, possibly because they may be more likely to exhibit negative recall biases. In other words, women may be more sensitive to perceived mistakes in task performance than males (Beyer, 1998). Gender differences in performance efficacy may also be due to varying perceptions of causal attributes. One study found that women more frequently connected high grades in their courses with effort, whereas men related course success to their personal ability (Beyer, 1999). Women also attributed course failures to difficulty of the course content, while males ascribed failure to a lack of studying and low interest.

Expectations and efficacy are also tied to performance evaluations. Women may be more sensitive than men to performance feedback in the form of grades or other evaluative measures from professors (Beyer, 1999; Beyer & Langenfeld, 2000; Correll, 2004; Ost, 2010; Rask & Tiefenthaler, 2008; Sabot & Wakeman-Linn, 1991). Research by Beyer and Langenfeld (2000) indicates that women may react in a more polarized fashion to performance feedback. Compared to males, females predicted higher grades on an English paper when performance feedback was positive but lower grades when the feedback was negative. Women may also be more likely than men to perceive themselves as a failure when they receive lower grades and express greater concerns over future performance, especially in math (Beyer, 1999). Other evidence suggests that women may rely more heavily than men on performance feedback for self-assessments of their abilities (Correll, 2001).

*2.2.2.2 Stereotypes and Academic Identification.* Another collection of research has linked performance and ability self-efficacy to cultural beliefs, particularly gender stereotypes about ability (Correll, 2004; Kiefer & Sekaquaptewa, 2007; Nosek et al., 2009; Spencer et al., 1999). Much of this research focuses on the impact of stereotype threat (Murphy et al., 2007; Spencer et al., 1999; C. M. Steele, 1997). Stereotype threat occurs when an individual's identity includes membership in a particular group (gender, race, religion, etc.), and the person perceives that they may be viewed according to a negative stereotype about their group. People may fear being judged according to stereotypes even when they personally do not believe or accept the group stereotypes, which may hamper their achievement (C. M. Steele, 1997).

Women may exhibit a stereotype threat in traditionally male academic fields, such as math, causing them to underperform relative to men (Spencer et al., 1999; J. Steele, James, & Barnett, 2002). In particular, when stereotypes are made explicit, they may significantly affect both students' ability self-efficacy and their performance (Correll, 2004; Spencer et al., 1999). In one study, male and female students with strong math ability performed equally well on a math test when they were told that the test yielded no gender differences, but when the students were told that gender differences in math performance exist, women significantly underperformed relative to their male counterparts (Spencer et al., 1999). Although no statement was made as to which gender performed better, female students who were interviewed indicated they had perceived the statement to advantage men. In a follow-up experiment, Spencer et al. (1999) found that women who completed a math test under a condition where gender was not mentioned at all performed significantly worse than men, while no gender differences in performance were found when the students were told that men and women have equal math ability. Students' academic performance may be influenced by implicit gender biases even when they disavow having internalized any stereotypical beliefs (Kiefer & Sekaquaptewa, 2007; Nosek et al., 2009). Women may exhibit strong implicit gender biases in fields such as math and science, and higher implicit bias is associated with lower performance, even after controlling for prior achievement (Kiefer & Sekaquaptewa, 2007).

Cultural beliefs and gender stereotypes may also impact women's identification, or "sense of belonging," within particular academic domains (C. M. Steele, 1997). Traditional gender roles may be internalized, leading men and women to associate particular academic disciplines as masculine or feminine, which sends the message that

certain groups are less valued or accepted (Cheryan & Plaut, 2010; Eccles, 2009; Good et al., 2012; Murphy et al., 2007; von Hippel et al., 2015). While stereotype threat may depress women's academic performance in certain subjects, lower sense of belonging may lead to their under-participation in them (Murphy et al., 2007). When compared to male students, female students may have a lower sense of belonging in STEM fields and are more likely to feel dissimilar to individuals who choose to major in these fields (Cheryan & Plaut, 2010; Good et al., 2012). Women may also perceive math-related careers as less feminine or that they may have to appear unfeminine in order to be successful in more masculine career fields (von Hippel et al., 2015). Furthermore, regardless of ability, women with strong gender identification may be significantly less likely to pursue math-related fields, possibly because they perceive the gender stereotypes as more self-relevant than their less gender-identified peers (Kiefer & Sekaquaptewa, 2007).

### **2.2.3 Interests and Values**

While students' beliefs about expected performance and the possibility of being successful in a particular academic domain can increase the utility of choosing a major, a significant amount of evidence suggests that people's interests and values also affect their choice of particular majors or careers. Women, in general, may be less interested than men in vocational careers involving math-related activities, while men tend to exhibit stronger interests in math, science, and engineering (Gemici & Wiswall, 2014; Kiefer & Sekaquaptewa, 2007; Lapan et al., 1996; Su et al., 2009). Furthermore, gender differences in interests may be much more important in determining college major selection than skill or ability differences (Gemici & Wiswall, 2014). Individual self-

perceptions may also be strongly correlated with academic and career interest (Kiefer & Sekaquaptewa, 2007; Lapan et al., 1996).

Men and women may be drawn to careers that emphasize different spheres of influence. According to a meta-analysis by Su et al. (2009), men seem to express greater interest in working with things and data, while women are more interested in working with people and ideas. Women may be more likely to choose careers that allow them to help people, such as the education and health professions (Bansak & Starr, 2010; Su et al., 2009). Men may have greater preferences towards investigative careers, including working with data and research, or enterprising fields where they can serve in leadership roles (Berings & Adriaenssens, 2012; Su et al., 2009). Men may also be more inclined to see themselves working with engineers, stockbrokers, and economists, compared to women who may view themselves as working with journalists, psychologists, and teachers (Bansak & Starr, 2010).

Survey research has also suggested that men and women have disparate work values. Although there are different definitions of work values, they have been generally defined as preferences for certain working conditions, outcomes, and job characteristics as well as philosophies toward work, social responsibility, and ethics (Berings, De Fruyt, & Bouwen, 2004). Gender differences appear to exist in some work value areas, including the degree of competition, teamwork, and structure within the workplace. Women may favor more cooperative working environments, and men may have stronger preferences towards careers that offer greater job status and stronger earnings potential (Berings & Adriaenssens, 2012; Konrad, Ritchie, Lieb, & Corrigan, 2000; Lips & Lawson, 2009). These value differences are also connected to socialization through

gender roles and stereotypes and may be formed by the time a child has reached early adolescence (Konrad et al., 2000).

Researchers have also explored gender disparities in ethics. These studies primarily indicate that women have higher levels of ethical sensitivity than men (Ahmad & Seet, 2010; Berings & Adriaenssens, 2012; Cagle et al., 2008; Hadjicharalambous & Walsh, 2012). In one study, female college students rated the following types of scenarios as much more unethical than men: padding an expense account, taking credit for someone else's work, blaming one's work errors on an innocent coworker, inflating job experience on a resume, and authorizing a subordinate to violate company rules and policies (Hadjicharalambous & Walsh, 2012). Business ethics and career interest may be strongly correlated. People with higher degrees of business ethics may be more likely to pursue social careers, such as teaching, whereas a significant negative correlation may exist between ethics and enterprising careers, such as stockbroker, financial advisor, entrepreneur, and manager (Berings & Adriaenssens, 2012). Thus, women may be more inclined to self-select into social careers because they have a greater ethical sensitivity. Men who display low business ethics may be more likely to pursue enterprising careers, particularly those in the finance sector.

### **2.3 General Factors Influencing Students' Choice of Major**

Students' selection of their college majors is influenced by a variety of factors, including characteristics of the students, instructors, and peers. Students' personal interests and values, self-assessments of ability, expectations about future career opportunities, and parental influence all affect their choice of major (Beggs, Bantham, & Taylor, 2008; Calkins & Welki, 2006; Easterling & Smith, 2008; Kim et al., 2002;

Kumar & Kumar, 2013; Lapan et al., 1996; Malgwi et al., 2005). In addition, a student's academic preparation and performance both prior to and during college is a significant determinant of major selection (Avery, Gurantz, Hurwitz, & Smith, 2016; Butcher, McEwan, & Weerapana, 2014; Correll, 2001; Davison et al., 2014; Griffith, 2010; Ohland, Zhang, Thorndyke, & Anderson, 2004; Riegle-Crumb et al., 2012; Riegle-Crumb, King, & Moore, 2016). Evidence also suggests that a student's race and gender may influence their degree selection (Dickson, 2010; Kumar & Kumar, 2013; Malgwi et al., 2005). Students are also influenced by their instructors, who may serve as role models, as well as by the quality of their peers (Bettinger & Long, 2005; Bettinger & Long, 2010; Bettinger et al., 2016; Carrell, Page, & West, 2010; Griffith, 2013; Griffith, 2014; Luppino & Sander, 2015; Ost, 2010; Rask & Bailey, 2002). In this section, I address the various factors that influence students' college major selection, emphasizing the choice of quantitative majors. I include students' interests and values, perceptions of ability, and pre-college performance and preparation along with college experiences, including achievement, instructor, and peer effects.

### **2.3.1 Interests, Values, and Expectations**

When undergraduate students are asked to rank their reasons for selecting their college majors, interest in the subject and coursework tend to receive the highest rankings, while job characteristics and career potential are often the second most important factors (Beggs et al., 2008; Easterling & Smith, 2008; Malgwi et al., 2005; Zafar, 2013). Male and female students tend to rank subject interest similarly, but significant gender differences emerge in terms of workplace preferences and the importance of compensation (Malgwi et al., 2005; Montmarquette et al., 2002; Wang et

al., 2013; Zafar, 2013). Men often rank potential for job opportunities and career advancement significantly higher than women (Malgwi et al., 2005; Montmarquette et al., 2002). Additionally, the pecuniary aspects of the workplace, including expected earnings and social status associated with employment, may be much more important to men than women (Montmarquette et al., 2002; Zafar, 2013). Women, on the other hand, may value non-pecuniary aspects, such as enjoying their future work, as more important than monetary ones (Zafar, 2013).

Individuals who select a business major may choose their degree for different reasons than other students. For instance, Easterling and Smith (2008) surveyed students from a variety of majors and found that students who chose business degrees had the lowest rankings for interest in the subject and how well they thought their major fit with their personality and aptitude. Business students also rated career potential, including job availability and earning a high salary, as more important than students in all other majors. They were also much less likely to consider their future career to be a “calling” (Easterling & Smith, 2008).

Students’ occupational values may also affect their major selection, and gender may be an important determinant of these values. Wang et al. (2013) found that individuals who value working with people may be less likely to choose to major in a STEM field, while those who value working with things were more inclined to choose a STEM major. In another study, Zafar (2013) found that females were more likely than males to choose a major and future career that would allow them to balance career and family life. Furthermore, male engineering majors were significantly more likely than female engineering majors to believe that their career would allow them to balance



family and work life (Zafar, 2013). Women may thus be discouraged from pursuing degrees in fields where they perceive future occupational conditions may create conflict between career and family goals.

Students' expected performance and ability self-efficacy also affect their choice of degree. As discussed previously, research suggests that males and females differ with regard to their self-efficacy, particularly in quantitative subjects (Correll, 2001; Good et al., 2012; Lapan et al., 1996). Evidence also indicates that students with higher math and science ability self-efficacy beliefs are significantly more likely to choose a STEM major, regardless of their actual math skills (Lapan et al., 1996; Wang & Degol, 2013). In fact, math ability self-efficacy may be an even stronger determinant of selecting a STEM major than math SAT scores (Wang & Degol, 2013). In addition, Correll (2001) found that math self-efficacy is positively associated with choosing a quantitative major, while English self-efficacy was negatively correlated with selecting a major in a quantitative field. Women's weaker math self-efficacy may be directly correlated with their lower likelihood of selecting a math-intensive major (Carrell et al., 2010).

### **2.3.2 Pre-college Performance and Preparation**

Individuals' interests, values, and self-efficacy beliefs are often formed during their adolescent years, prior to entering college (Lapan et al., 1996). As a result, students' academic experiences prior to college may have a strong effect on their choices of major. Research suggests that preparation and achievement in high school courses affect students' choices of major (Correll, 2001; Riegle-Crumb et al., 2012; Wang et al., 2013). Moreover, high school students who take college-level classes, such as Advanced Placement courses, in a particular subject may be more inclined to major in that academic

field (Avery et al., 2016; Griffith, 2010; Morgan & Klaric, 2007). Additional research has found that students' performances on standardized exams may significantly affect their choices of major (Correll, 2001; Davison et al., 2014; Rask & Bailey, 2002; Riegle-Crumb et al., 2012; Turner & Bowen, 1999; Wang & Degol, 2013). There may also be gender differences in the degree to which pre-college experiences and achievement influence a student's choice of major (Davison et al., 2014; Griffith, 2010; Malgwi et al., 2005; Turner & Bowen, 1999).

*2.3.2.1 High School Courses.* Students who have a greater interest in quantitative majors may be more likely to take advanced courses in science and math compared to those who are less interested in these fields. Women's college major selections, in particular, may be highly influenced by their high school course selections. Malgwi et al (2005) found that females ranked having completed a related subject in high school as a significantly more important determinant of college major selection than men. Evidence also indicates that students who take calculus courses are significantly more likely to choose a quantitative major (Correll, 2001; Riegle-Crumb et al., 2012). Women, however, may take fewer math credits in high school and be less likely to take advanced math courses, including calculus (Lapan et al., 1996; Riegle-Crumb et al., 2012). In addition, completing a high school calculus course may have a significant effect on women's college major selection. In one study, women who completed high school calculus were three times more likely to choose a quantitative major than women who did not, while men who completed calculus were only two times more likely than their male peers to choose a quantitative major (Correll, 2001).

Additionally, students who take Advanced Placement (AP) courses in a subject may also be more likely to major in that academic field. AP courses are essentially college-level courses taken during high school. Griffith (2010) found that students who took more STEM AP courses were more likely to major in a STEM field, and results were significant for both males and females. On the other hand, students who earn Advanced Placement credit may be less likely to choose a business major (Ball, 2012). This result, however, may not be surprising for two reasons. First, research has shown that students may have a strong propensity to pursue majors in subjects in which they take Advanced Placement exams (Mattern, Shaw, & Ewing, 2011; Morgan & Klaric, 2007). Second, the College Board has not developed any AP courses in business fields. Students may take AP Macroeconomics or AP Microeconomics, but many high schools may not offer these courses.

*2.3.2.2 Standardized Test Scores.* In addition to high school course grades, students' performance on standardized exams taken during high school may also impact their choice of major (Davison et al., 2014; Lapan et al., 1996; Luppino & Sander, 2015; Rask & Bailey, 2002; Turner & Bowen, 1999; Wang et al., 2013). A student's performance on both math and English assessments may have a highly significant impact on major selection. Several studies indicate that higher math scores are positively correlated with selecting a quantitative major, while higher verbal scores appear negatively correlated with choosing a quantitative field (Correll, 2001; Davison et al., 2014; Luppino & Sander, 2015; Rask & Bailey, 2002; Turner & Bowen, 1999). Moreover, students' relative performance on these exams may be more important than their absolute scores alone. Students who have a comparative advantage on the math SAT

may be significantly more likely to choose a STEM major, whereas those who have a comparative advantage on the verbal SAT may be more likely to choose a non-STEM major (Davison et al., 2014; Turner & Bowen, 1999; Wang et al., 2013). Davison et al. (2014) found that students' SAT scores were also significant predictors of choosing a business major. Students' math SAT scores were found to be positively correlated with selecting a business major, while their verbal SAT scores were negatively associated with business major selection. Relative to students majoring in a STEM field, however, business majors had significantly lower math SAT scores, suggesting that students with the strongest math ability may choose majors in math, engineering, or the sciences (Davison et al., 2014).

Gender differences in relative performance on standardized exams may affect college major selections. Traditionally female majors, such as the humanities and education, tend to attract individuals with a comparative advantage on the verbal SAT (Davison et al., 2014). On the other hand, both male and female students who select a business major earn higher math exam scores relative to their verbal test scores (Davison et al., 2014). Some evidence suggests that women may be less inclined than men to choose a major in a quantitative field, even when they earn high math scores. Turner and Bowen (1999) found that women who earned a math SAT score above 750 were still more likely than men with similar math ability to matriculate into majors in the humanities, psychology, and life sciences.

Other research indicates that students who take AP exams in an academic domain often major in a closely related subject in college, particularly when they earn high scores (Avery et al., 2016; Mattern et al., 2011; Morgan & Klaric, 2007). AP exam scores are

reported on a scale from 1 to 5. Students' integer scores are based on a combination of their raw scores from a multiple-choice and a free-response section. Evidence suggests that AP exam performance may be positively correlated with majoring in a related subject. Students who earn a score of 5 may be significantly more likely to major in a related subject than students who earn a score of 1 (Mattern et al., 2011). Furthermore, students who earn a score of 5 on an exam may be more inclined to major in a related subject relative to students who earn a 4 on the same exam (Avery et al., 2016).

AP exam scores are a signal to students representing their content mastery and ability to perform in a college-level course, but the use of integer scores may distort information. Every year the College Board determines "cut scores" for each exam. Thus, depending upon the threshold scores, students who earn similar raw scores may receive different integer scores. Earning a score of 4 rather than 5, or a score of 3 rather than 4, may distort students' ability self-perception (Avery et al., 2016). Moreover, this information distortion may be most important when students who take multiple AP exams attempt to assess their comparative advantage. The authors found that students who earn high integer scores on non-STEM exams may be drawn away from pursuing STEM fields, even when they score well on STEM exams (Avery et al., 2016).

### **2.3.3 College Experiences and Academic Climate**

For some students, the college experience may represent a journey of self-discovery as they attempt to determine the major that suits them best. Students' high school experiences may affect a student's initial choice of college major. Their experiences in college, however, may affect their endurance in their initial major and their probability of switching majors. Evidence suggests that a large percentage of

students- as many as 40% perhaps- may switch majors (Astorne-Figari & Speer, 2017; Dickson, 2010; Kugler, Tinsley, & Ukhaneva, 2017). Students who matriculate into certain fields may have a higher probability of continuing in that major. For instance, students who matriculate as business majors may be much more likely to graduate with a business degree than students whose initial major selection is in the natural sciences or engineering (Dickson, 2010). In one study, 10-15% of students who matriculated as engineering majors changed their major two or more times before graduation (Ohland et al., 2004).

Additionally, women in traditionally male fields may be likely to change their major. Women are significantly more likely than men to switch out of fields, such as engineering and computer sciences, but less likely to switch out of the humanities (Dickson, 2010). Some research also indicates that women in traditionally male majors may feel less welcome in their academic environment and that these experiences may lead to women's underrepresentation in these fields (Cheryan & Plaut, 2010; Morris & Daniel, 2008; Ramsey, Betz, & Sekaquaptewa, 2013; J. Steele et al., 2002; Walton, Logel, Peach, Spencer, & Zanna, 2015). Women who select traditionally male majors may experience a "chilly climate," a term coined by Hall and Sandler (1982) to refer to an individual's perception of being unwelcome in a particular academic environment. A chilly classroom environment may result from overt discrimination from professors, including sexist jokes, disparaging remarks about women, and ridiculing women's scholarship. However, it may also be communicated in more subtle ways, such as through professors using a patronizing tone toward female students, interrupting female students more frequently, and using classroom examples that reinforce stereotypical gender roles

(Hall & Sandler, 1982). One study found that women in traditionally male majors perceived much higher levels of current and expected future gender discrimination as well as stereotype threat than their female peers in traditionally female majors (J. Steele et al., 2002). Feelings of being unwelcome may heighten women's negative perceptions of majors with a much higher percentage of men, resulting in less interest in these fields and lower expectations for success (Cheryan & Plaut, 2010; Walton et al., 2015).

#### **2.3.4 College Achievement**

Research suggests that students' grades in their college courses may be a significant determinant of their major choice (Ashworth & Evans, 2001; Butcher et al., 2014; Emerson et al., 2012; Rask & Bailey, 2002; Riegle-Crumb et al., 2016). In general, students may be less inclined to persist in academic domains when they receive lower grades in their introductory courses (Sabot & Wakeman-Linn, 1991). Students' grades in courses within their selected major may also be positively correlated with persistence in that major (Chizmar, 2000; Griffith, 2010; Ohland et al., 2004; Ost, 2010; Riegle-Crumb et al., 2016). Alternatively, when students' non-major course grades increase relative to their major course grades, they may be more likely to change majors (Griffith, 2010; Ost, 2010). These results indicate that course performance represents information about students' comparative advantage in certain subjects. As a result, students may tend to move towards majors where they perceive they have greater ability.

Grading differentials across departments, however, may distort students' perceptions of their comparative advantage and impact their choice of college major (Butcher et al., 2014; Ost, 2010). Departmental grading disparities are apparent at a number of colleges and universities. Humanities courses typically yield higher grades,

while math and science courses generally have lower ones (Butcher et al., 2014; Kostal, Kuncel, & Sackett, 2016; Parekh, 2002; Rojstaczer & Healy, 2010; Sabot & Wakeman-Linn, 1991). Students may be more attracted to leniently graded courses as well as higher grading departments (Bar, Kadiyali, & Zussman, 2009; Butcher et al., 2014; Sabot & Wakeman-Linn, 1991). Additionally, students who have an interest in an academic field may fail to pursue it for fear that their cumulative GPA may suffer, putting them at a comparative disadvantage with their peers (Parekh, 2002).

Evidence also suggests that policies to reduce grading disparities may lead to a redistribution of students across majors. For instance, when officials at Wellesley College, an all-female liberal arts college, designed a policy to reduce grade inflation and departmental grading disparities, it had a significant impact on students' major selection (Butcher et al., 2014). The policy required high-grading departments, such as the humanities and non-economics social sciences, to reduce their average course grades. After the policy was implemented, these departments experienced an average reduction in the number of majors by approximately 31%. The authors found significant movement into the initially lower-grading departments, including math, the sciences, and economics. These results suggest that women may be highly sensitive to their relative course grades, a finding supported by other research (Ost, 2010; Rask & Bailey, 2002; Riegle-Crumb et al., 2016). In addition, women may be more likely than men to switch out of majors they perceive to be too difficult (Malgwi et al., 2005).

### **2.3.5 Instructor Effects**

*2.3.5.1 Instructor Gender Effects.* College instructors set the environment for students in their courses. The extent to which a professor fosters a positive learning



environment through student-instructor interaction and student engagement may affect students' interest, performance, and persistence in an academic field. Female professors may create more positive environments, offering more personalized interactions with students even in larger classes (Crawford & MacLeod, 1990; Stout, Dasgupta, Hunsinger, & McManus, 2011). Female students may be especially responsive to female professors. One study found that female calculus students participated in class more frequently and over time sought more help after class when they had a female instructor (Stout et al., 2011). In contrast, women became less likely to participate in classes taught by male professors and stopped seeking additional help from them. Male students' behavior, however, was less affected by instructor gender (Stout et al., 2011).

Professors may serve as role models for students, providing evidence of behaviors required for success and examples that someone like themselves (e.g. an instructor of the same gender) can be successful in a particular academic or career path (Bettinger & Long, 2005; Carrell et al., 2010; Rask & Bailey, 2002). Women, particularly those who are minorities in many highly quantitative academic domains, may benefit from greater exposure to same-sex role models by an increased sense of belonging, social group membership, and self-efficacy (Lockwood, 2006; Stout et al., 2011). Same-gender role models may also serve as examples for female students of women who overcame gender-related barriers in traditionally male fields (Lockwood, 2006). Evidence also suggests that students who take a course with a same-gender instructor are less likely to drop the course (Hoffmann & Oreopoulos, 2009a). Moreover, women who take introductory courses with female instructors may have a greater likelihood of taking subsequent courses in the same discipline, though the effects may vary based on subject area

(Bettinger & Long, 2005; Carrell et al., 2010; Hoffmann & Oreopoulos, 2009a). For example, women with strong math ability who have female professors in their introductory math and science courses may be significantly more likely than their lower-ability counterparts to take subsequent math and science courses (Carrell et al., 2010). In addition, a student's major selection may be positively associated with taking courses from same-gender instructors (Rask & Bailey, 2002; Carrell et al., 2010).

The presence of same-gender instructors, alone, may not influence students' college major selection (Canes & Rosen, 1995; Griffith, 2014). Instructor gender may influence students' major choice indirectly through grade assignment (Griffith, 2014). Some evidence suggests that students receive higher course grades from same-gender instructors, particularly in gender-atypical majors (Carrell et al., 2010; Griffith, 2013; Griffith, 2014; Hoffmann & Oreopoulos, 2009a; Hoffmann & Oreopoulos, 2009b). In one study, female students taught by a female professor in a department with a majority of male majors received a grade boost equivalent to a difference between earning a B- and a B; male students with male professors in female-dominated fields had similar increases in grades (Griffith, 2013). Research on faculty role models and gender, however, has yielded mixed findings. Some studies find only minor evidence for gender role model effects and that the results seem dependent upon subject areas (Bettinger & Long, 2005; Hoffmann & Oreopoulos, 2009a). The overall findings, however, seem to indicate that role model effects are strongest for female students having same-gender professors.

*2.3.5.2 Instructor Type Effects.* The type of instructor with whom students take a course may also influence grades and course completion. Students may be negatively

affected by an increased presence of part-time, adjunct instructors, particularly in terms of course persistence and graduation rates (Bettinger & Long, 2010; Ehrenberg & Zhang, 2005). Students who take courses with adjunct faculty may be less likely to choose that subject for their college major, although results may vary based on academic domain (Bettinger & Long, 2010). The positive effects of adjuncts may be strongest in professional fields, such as engineering, education, and business, where adjunct instructors may be working in their career field while teaching part-time (Bettinger & Long, 2010; Hoffmann & Oreopoulos, 2009b). These instructors may bring important industry knowledge into the classroom, which benefits students (Bettinger & Long, 2010).

There has been limited research on graduate student instructors, but some studies suggest that graduate student instructors may serve as role models, encouraging students to take additional courses in a subject (Bettinger et al., 2016; Fournier & Sass, 2000). Students who take courses with graduate instructors may also be significantly more likely to major in that academic domain, perhaps because graduate students provide more opportunities for student engagement or award higher grades than faculty members (Bettinger et al., 2016). Women may also be highly influenced by same-gender graduate students. For instance, Griffith (2010) found that having a larger percentage of female doctoral students in STEM fields increased the persistence of undergraduate women in STEM majors. Additionally, the presence of same-gender graduate students may be an even more significant predictor of undergraduate students' academic choices than the presence of same-gender faculty (Griffith, 2010).

### **2.3.6 Peer Effects**

Other factors besides course grades and instructor characteristics also impact students' major selections. In particular, students may be influenced by peer attributes and interactions. Students' persistence in their majors may be positively correlated with peer persistence (Ost, 2010). Students may be also be more likely to choose a major in which there is a larger proportion of same gender peers (Dynan & Rouse, 1997; Emerson et al., 2012; Rask & Bailey, 2002). Evidence suggests that peer effects have the strongest influences on women. Women may be more likely to take additional courses in a subject when there are a greater number of women in their courses (Brasfield, Harrison, & McCoy, 1993; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). In addition, women who enter traditionally male majors may be positively influenced by peer persistence in a major (Ost, 2010).

Students may also be influenced by peer ability. Low achieving students may benefit from taking courses with stronger peers, leading to higher grades and greater persistence within a major (Carrell, Fullerton, & West, 2009; Ost, 2010). Other research suggests that weaker students may react to better performing peers by changing their major, especially in highly competitive STEM fields (Luppino & Sander, 2015). Students who are exposed to exemplary peer performance may become discouraged about their potential for success in a subject; they may also experience reduced academic identification with the field, resulting in lower performance and a stronger tendency to withdraw from courses in that subject (Rogers & Feller, 2016). The impact of peer ability may also have heterogeneous effects by gender, academic domain, and college selectivity (Ashworth & Evans, 2001; Han & Li, 2009; Luppino & Sander, 2015; Ost, 2010).

Female students may be more strongly influenced by peer ability than men and may be more likely to persist in a gender-atypical major when they are exposed to higher ability peers (Han & Li, 2009; Ost, 2010).

## **2.4 Factors Affecting the Choice of Economics as a Major**

Although there is a small body of literature examining the gender disparities in economics degree attainment among undergraduate students, prior studies all conclude that a significant gender gap in economics major selection exists. Women are consistently less likely to choose economics than business, social sciences, humanities, and life sciences majors (Bayer & Rouse, 2016; Fournier & Sass, 2000). Women are also less likely to take introductory economics courses and take subsequent economics courses (Calkins & Welki, 2006; Dynan & Rouse, 1997; Emerson et al., 2012; Horvath et al., 1992; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). A number of factors influence gender differences in economics course persistence and major selection, including interest in economics, self-efficacy expectations, course grades and grade responsiveness, instructor attributes, and peer effects (Ashworth & Evans, 2001; Bettinger & Long, 2005; Dynan & Rouse, 1997; Emerson, McGoldrick, & Siegfried, 2018; Emerson et al., 2012; Fournier & Sass, 2000; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). In this section, I will explore how these various factors contribute to economics major selection.

### **2.4.1 Interests and Expectations**

Survey research has explored gender differences in students' perspectives about economics and how their attitudes and opinions may discourage them from majoring in economics. Findings indicate that women find economics courses to be less practical, less relevant to their lives and careers, and less interesting than their courses in other subjects

(Bansak & Starr, 2010; Bollinger, Hoyt, & McGoldrick, 2009; Jensen & Owen, 2000; Jensen & Owen, 2001). Some students may never even consider majoring in the subject. Calkins and Welki (2006) found that approximately two-thirds of non-economics majors indicated they never considered majoring in economics. Compared to non-economics majors who had considered majoring in economics, students who never considered an economics degree were significantly more likely to consider economics to be too difficult and confusing, to require a business degree, and to involve too much math. Additionally, a larger percentage of women than men indicated that they had never considered economics as a major (Calkins & Welki, 2006).

Students' perspectives about economics are influenced by experiences in their introductory economics course. Female students' opinions about economics may become more negative as a result of their introductory course experiences (Bansak & Starr, 2010; Bollinger et al., 2009; Calkins & Welki, 2006). In one study, after controlling for course performance and demographic characteristics, men's attitudes toward economics improved as a result of their experiences in an introductory economics course, while women's attitudes declined (Bollinger et al., 2009). In fact, the percentage of women who expressed agreement with the statement "I hate economics" increased after they completed their first economics course. Women are also more likely than men to express that their grades in economics courses are too low (Bansak & Starr, 2010; Calkins & Welki, 2006; Jensen & Owen, 2001).

Female students may tend to have more negative opinions about economics because they are interested in topics that are often not included in many economics course curricula (Bansak & Starr, 2010; Ferber, 1995; Jensen & Owen, 2003). For

instance, women express greater interest in economics issues with a social impact, such as poverty, inequality, race/ethnicity, discrimination, and gender differences in labor markets. Men, on the other hand, are more interested in financial topics, including global capital markets, international trade, and social security reform (Bansak & Starr, 2010). Female students are also significantly more likely to believe that economics requires too much math, too many courses, and offers fewer elective courses than other subjects (Calkins & Welki, 2006). Moreover, women who choose an economics major may feel less satisfaction with their programs than their male counterparts, particularly due to the lack of variety in the course offerings. In one study, female economics majors indicated that economics programs need to change their emphasis by catering to a broader range of interests and by emphasizing citizenship preparation and living within a diverse, global society (Jones et al., 2008).

Men and women may differ in their economics ability self-efficacy. Confidence in economics ability is a significant predictor of economics course persistence and the intent to major in economics. Women exhibit less confidence in their economic understanding than men (Jensen & Owen, 2000; Jensen & Owen, 2001; Nowell & Alston, 2007). Women also tend to view economics as more difficult and less easy to understand (Bansak & Starr, 2010; Bollinger et al., 2009), and they express greater discomfort with graphs and more fear of freezing up on economics exams (Cohn, Cohn, Balch, & Bradley, 2004; Jensen & Owen, 2001). Furthermore, while male students tend to over-predict their economics course grades, women often expect lower grades than men in their economics courses, especially in their introductory ones (Ballard & Johnson, 2005; Grimes, 2002; Jensen & Owen, 2001; Nowell & Alston, 2007). The role of expectations

in economics grades may be self-fulfilling. In one study, students who expected a lower grade in their first economics course performed significantly worse than those with higher-grade expectations (Ballard & Johnson, 2005).

#### **2.4.2 Precollege Preparation and Ability**

Gender differences in math preparation and ability may be one reason for the gender gap in economics course persistence and degree selection, but research findings are mixed. Some evidence suggests that women with higher math SAT scores may be more likely to take economics courses and major in economics (Dynan & Rouse, 1997; Rask & Tiefenthaler, 2008). However, findings also indicate that math performance on standardized exams may only explain a small part of the gender gap in economics course persistence and the decision to major in economics (Dynan & Rouse, 1997; Emerson et al., 2012; Horvath et al., 1992; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). For instance, using a decomposition analysis, Turner and Bowen (1999) found that less than 1% of the gender gap among economics majors could be explained by differences in men and women's math SAT scores. Additionally, some evidence indicates that women with high math SAT scores may be less likely to persist in enrolling in additional economics courses beyond the first one (Horvath et al., 1992; Rask & Tiefenthaler, 2008).

Students also make academic decisions based on their relative math and English abilities. Both male and female students who have a comparative advantage in math over English are more likely to take subsequent economics courses and to major in economics. For example, Rask and Tiefenthaler (2008) found that students' math SAT scores positively affect economics course persistence, while verbal SAT scores are negatively correlated with persistence in economics courses. Ashworth and Evans (2001) found that



students with higher scores on standardized math exams relative to their scores on English exams are more likely to choose economics degrees than arts or humanities degrees. Women tend to have a comparative advantage in English over math (Davison et al., 2014; Turner & Bowen, 1999). As a result, they may be less likely to take economics courses and choose economics as a major.

Other proxies of students' abilities, such as their high school coursework and achievement, may also affect students' selections of economics as a major. Students who take a high school economics course are more likely to major in economics than business (Ashworth & Evans, 2001; Bansak & Starr, 2010; Lopus, 1997). Research also shows that students may have a strong propensity to pursue majors in which they take Advanced Placement (AP) exams (Mattern et al., 2011; Morgan & Klaric, 2007). In fact, students who pass an AP Microeconomics or Macroeconomics exam with a score of a 4 or 5 are more inclined to major in economics (Avery et al., 2016; Morgan & Klaric, 2007). Since many states do not require students to take a high school economics course (Council for Economic Education, 2018), it is possible that students who do, especially those who take an AP-level course, may have a stronger interest in economics than students who do not take an economics course in high school.

Additionally, students' high school preparation may also affect the grades they earn in college economics courses. For instance, students who take high school calculus and those with higher math SAT scores tend to earn higher grades in their economics courses, both at the introductory level and in advanced-level classes (Ballard & Johnson, 2005; Easterling & Smith, 2008; Elzinga & Melaugh, 2009; Swope & Schmitt, 2006). Students who have taken a high school economics course may perform better than

individuals who had no prior economics exposure in introductory economics courses, though findings are mixed (Ashworth & Evans, 2001; Ballard & Johnson, 2005; Brasfield et al., 1993; Lopus, 1997; Melican, Debebe, & Morgan, 1997). Some evidence suggests that students who have completed a high school economics course start college courses with more knowledge of economics topics than their peers but do not necessarily have any significant differences in knowledge gained by the end of a college course (Lopus, 1997). High school economics courses may also differ in content and quality, yielding mixed results in college economics courses (Lopus, 1997; Walstad, 2001).

### **2.4.3 College Achievement**

Students' experiences in their college economics courses affect their propensity to select economics as a major. Very few students matriculate into college as economics majors (Fournier & Sass, 2000). Many students switch out of their initial major selection into an economics major or add economics as a second major (Fournier & Sass, 2000; Stock, 2017; Mumford & Ohland, 2011). Introductory economics course experiences may be especially important for these students. In one study, over 85% of students who graduated with an economics degree declared economics as their major after taking introductory macroeconomics and microeconomics, and these students were drawn from a diverse variety of prior majors (Fournier & Sass, 2000). Students' grades in their introductory economics courses are positively correlated with economics course persistence and major selection (Ashworth & Evans, 2001; Dynan & Rouse, 1997; Emerson et al., 2012; Fournier & Sass, 2000; Horvath et al., 1992; Rask & Tiefenthaler, 2008). In addition, the grades students earn in other departments' courses influences their

selection of an economics major (Asarta & Butters, 2012; Emerson et al., 2012; Rask & Tiefenthaler, 2008; Salemi & Eubanks, 1996).

*2.4.3.1 Economics Course Grades.* Evidence suggests that gender disparities in economics course performance may exist, but the findings are mixed. Some studies indicate that women tend to earn lower grades than men in their introductory economics courses (Ballard & Johnson, 2005; Dynan & Rouse, 1997; Elzinga & Melaugh, 2009; Emerson et al., 2012). Other research, however, has found that women perform as well as or even better than their male counterparts in their introductory economics courses (Rask & Tiefenthaler, 2008; Swope & Schmitt, 2006; Terry, 2002). Additionally, women may outperform men in their intermediate and upper-level economics courses (Asarta et al., 2014; Rask & Tiefenthaler, 2008). Furthermore, a recent meta-analysis of studies on the gender gap in economics performance from 1980 to 2013 suggests that while most of the older studies indicate males outperform females, the gender performance gap has been shrinking (Johnson et al., 2014). In fact, these findings indicate that since 2005 there has been a notable increase in research showing women outperforming men in their economics courses.

Women may also be more sensitive to their economics grades than men. Female students may need higher grades than male students in order to persist in taking additional economics courses and to select economics as a major (Emerson et al., 2012; Goldin, 2013; Goldin, 2015a; Owen, 2010; Rask & Tiefenthaler, 2008). Women who receive low grades in their economics courses may be less likely to take additional courses in economics, while male students may continue to persist in taking subsequent economics courses regardless of poor performance (Goldin, 2013; Rask & Tiefenthaler,

2008). Yet higher grades alone do not necessarily predict greater course persistence, particularly for women. Although students who earn higher grades in their first economics course are more likely to continue in economics, the probability of persistence is still lower for females, even among those who earn letter grades of an “A” (Horvath et al., 1992). Women who receive low grades in economics courses may also be more likely to switch out of the economics major, while low-performing male students may be more likely to continue to major in economics (Rask & Tiefenthaler, 2008). On the other hand, Chizmar (2000) found that male and female students who selected economics as a major were equally likely to persist in the major. High-performing female students may also be more likely to choose an economics major when they receive information about the grade distribution within their principles of economics class and are personally encouraged to select economics as a major (Avilova & Goldin, 2018).

Course grades also provide students with signals of success in a field of study as well as information to students about their comparative advantages in a particular academic domain. Students with higher grades in their economics courses relative to their grades in other departments’ courses are significantly more likely to take subsequent economics classes (Emerson et al., 2012; Horvath et al., 1992; Rask & Tiefenthaler, 2008; Robb & Robb, 1999). They are also more likely to major in economics (Emerson et al., 2012; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). In contrast, students who have lower GPAs in their economics courses compared to their overall cumulative GPA are more likely to switch out of an economics major (Chizmar, 2000). Relative economics course grades are a stronger determinant of economics course persistence and major selection for women than men, however (Emerson et al., 2012; Rask &

Tiefenthaler, 2008). Consequently, women may choose to major in fields outside of economics because earning relatively higher grades in other domains may be perceived as evidence of stronger academic ability.

*2.4.3.2 Non-Economics Course Grades.* Other research has emphasized students who choose between business and economics degrees. Some students who initially matriculate as business majors may become “Discouraged-Business-Majors,” i.e. students who cannot fulfill the requirements of a business major and select economics instead (Asarta & Butters, 2012; Marangos, 2012; Salemi & Eubanks, 1996). Salemi and Eubanks (1996) coined this term after comparing economics and business majors using data from a university where the economics department was in the arts and sciences college rather than in the business college. Because the arts and sciences college required lower academic standards for admission, the authors found evidence that students who could not complete the more stringent business school standards ended up moving into the less-demanding economics major. Marangos (2012) also found Discouraged-Business-Major effects. He focused on students who had declared an intention to major in business but were not admitted into the business school upon matriculation. Approximately 42% of those who majored in economics, which was not part of the business college, were students who could not meet the admissions requirements for the business school.

On the other hand, some research suggests that earning high grades in economics courses may encourage students who are initially interested in majoring in business to switch into economics, thus becoming “Encouraged-Business-Majors.” Asarta and Butters (2012) discovered evidence for this hypothesis; some students who had originally

declared a major in business and switched into economics experienced an increase in their GPA after the switch. They also found that economics majors had higher grades in required economics courses and higher overall GPAs in general, suggesting that higher ability students might be more likely to move into economics. However, unlike the previously mentioned studies where the economics and business departments were in separate colleges within the university, the data used in this study came from a university where the economics and business departments were both in the college of business. It is possible that the administrative location of the economics department may significantly change the nature of the economics curriculum (Dean & Dolan, 2001), accounting for the different results. Other evidence indicates students may be more inclined to choose a business major when it is offered at a university, but economics may substitute for business at colleges that do not offer any degrees in business (Brasfield, Harrison, McCoy, & Milkman, 1996).

#### **2.4.4 Instructor Effects**

Economics instructors also significantly influence student course persistence and major selection, specifically through a role model effect. Studies examining the impact of instructor gender have had mixed results, but some research suggests that female students may be more encouraged to major in economics if they had a female instructor for their introductory economics course (Bettinger & Long, 2005; Rask & Bailey, 2002; Saunders & Saunders, 1999). One study found that women were more likely to take economics if they had a female instructor and if other women at their institution were studying the subject (Ashworth & Evans, 2001). At the same time, other research suggests that the percentage of female faculty within an economics department is not correlated with

attracting more female students (Canes & Rosen, 1995; Emerson et al., 2018; Robb & Robb, 1999). Although there may not be a role model effect for faculty, female students may view women working in the field of economics as role models. In one study, two women who graduated with economics degrees from the university were invited to speak to about the importance of economics in their careers (Porter & Serra, 2017). The authors found that there was no significant effect on male students, but female students were significantly more likely to enroll in additional economics courses and to express interest in selecting an economics major.

Economics students may also be influenced by instructor type. In particular, students may also be more likely to continue to take economics courses and major in economics if they take their principles courses with a graduate student instructor. Research suggests that graduate students serve as role models for undergraduates, encouraging students to take additional courses in a subject (Bettinger et al., 2016). Some studies have also analyzed the impact of foreign-born graduate student instructors. Evidence suggests that foreign-born graduate teaching assistants, particularly those who are less fluent in English, may negatively affect students' economics course achievement (Borjas, 2000; Fleisher, Hashimoto, & Weinberg, 2002; Norris, 1991). In addition, an increased presence of adjunct instructors may negatively affect students' course persistence (Bettinger & Long, 2010; Ehrenberg & Zhang, 2005).

#### **2.4.5 Structural Characteristics**

The structural characteristics of economics classes may also affect students' economics course persistence and their selection of an economics major. Some research indicates that students perform better if they are in smaller introductory economics

classes (Arias & Walker, 2004; Emerson et al., 2012; Kokkelenberg et al., 2008). In addition, students who complete principles of economics courses in larger classes perform significantly worse in their intermediate theory courses (Raimondo et al., 1990). Other evidence suggests that male students who take an introductory economics course in a larger class have a greater likelihood of enrolling in a subsequent economics course; however, class size may not be a significant predictor of women's economics course persistence (Emerson et al., 2012; Rask & Tiefenthaler, 2008).

In addition to class size, the percentage of women in a student's economics class may affect economics course persistence. Findings indicate that both male and female students are less likely to take a second economics course if there are more women than men in their introductory economics class (Emerson et al., 2012; Rask & Tiefenthaler, 2008). On the other hand, women who take an intermediate-level economics course with a larger percentage of female students may have a higher probability of selecting an economics major (Emerson et al., 2012). Women may also be more likely to choose an economics minor if they have more women in their economics courses (Rask & Tiefenthaler, 2008). The evidence for structural effects on economics course persistence and degree selection, however, is limited.

## **2.5 Factors Affecting the Choice of Finance as a Major**

In the previous section, I explored the various influences on students' selections of economics as their major. In this section, I will analyze the factors influencing finance majors. Finance majors, in particular, may be more attracted by the potential for higher paying careers and may have stronger interests in working in the financial industry relative to students who choose to major in other business subdisciplines (Kim et al.,



2002; Worthington & Higgs, 2003). Women are also significantly underrepresented in finance, compared to other business majors (Ball, 2012; Roach, McGaughey, & Downey, 2012; Worthington & Higgs, 2003). Although there has been limited research on factors influencing finance major selection, based on research about the impact of students' course grades influencing college major selection, students' performance and experiences in their introductory finance classes may be significant (Ashworth & Evans, 2001; Malgwi et al., 2005; Ohland et al., 2004; Riegle-Crumb et al., 2016). Male and female students may also have different perceptions of their finance courses (Krishnan, Bathala, Bhattacharya, & Ritchey, 1999; Worthington & Higgs, 2003).

### **2.5.1 Interests and Expectations**

Finance majors may be influenced by different factors than other business majors (Kim et al., 2002; Roach et al., 2012; Worthington & Higgs, 2003). For instance, one study compared students who selected various business subdisciplines and found that finance majors were more influenced by the potential for high projected earnings, were more confident that their choice of major would lead to a successful career and were less likely to be concerned that their major was a “good fit” for their abilities (Kim et al., 2002). Roach et al. (2012) found that finance majors rated the lifestyle, respect, and prestige associated with the major higher than students in other business majors, although finance majors were most similar to accounting majors. Finance majors may also have greater preferences for working with logic and within more structured environments than other business majors (Worthington & Higgs, 2003).

Given that women are highly underrepresented in finance, gender differences in reasons for selecting finance may be substantial. In general, women may be less

interested in finance-related topics, a factor that may discourage women from majoring in finance (Jensen & Owen, 2001). Topics specifically related to finance, such as the stock market and global capital markets, may be less interesting to women than men (Bansak & Starr, 2010). Females may also perceive finance to be more conceptual, more repetitive, and duller than males (Worthington & Higgs, 2003). On the other hand, one study found that women who chose a finance major did so because they appreciated the intellectual challenge, while males who chose a finance major were significantly more influenced by their friends' opinions (Lowe & Simons, 1997). Women may also be less inclined to pursue finance degrees out of fear of stereotype threat, which may be greatest among women with strong gender identification (von Hippel et al., 2015).

Additionally, women may be less inclined to major in finance because of perceptions about the highly competitive corporate and financial careers in which finance graduates often work. Experimental research indicates that women are less competitive than men (Niederle & Vesterlund, 2007) and may perform worse in mixed-gender groupings when their compensation is chosen through competitive, tournament-style payment schemes (Gneezy et al., 2003). Given that the corporate and financial professions are very competitive and require a significant amount of work hours, women in these fields are often found to work fewer hours and also have experienced more periods of non-work, in some cases due to having children (Bertrand et al., 2010). Women in finance also often earn lower wages than males (Bertrand et al., 2010; Goldin, 2015b; Joshi, Jooyeon, & Hyuntak, 2015; Roth, 2003).

### **2.5.2 College Achievement**

Some research has explored student success in finance courses (Borde et al., 1998; Chan et al., 2005; Didia & Hasnat, 1998; Seiver et al., 2014; Terry, 2002). Students with strong quantitative skills may be likely to earn higher grades in their introductory finance courses (Chan et al., 2005; Didia & Hasnat, 1998). Also, students who earn higher grades in their first accounting course, which is often a prerequisite for the introductory finance course, may have stronger performance in finance courses (Borde et al., 1998; Didia & Hasnat, 1998). Students who transfer from a community college may tend to have lower performance in introductory finance courses (Borde et al., 1998; Chan et al., 2005).

Performance in introductory finance courses may also vary by gender, but results are inconsistent. Some studies have found that men significantly outperform women in their introductory finance courses (Borde et al., 1998; Chan et al., 2005; Terry, 2002). On the other hand, two other studies found that men only slightly outperformed women, and the findings were not statistically significant (Didia & Hasnat, 1998; Seiver et al., 2014). Additionally, female students may benefit from taking finance courses with same-gender instructors. Female students who took an introductory finance course with a female professor did better than women who had a male professor, and the results indicated no evidence of gender bias in the professors' grading (Henebry & Diamond, 1998).

Beyond performance, students' adverse experiences with their finance courses may cause undergraduates to shy away from majoring in finance. Using a pre- and post-course survey design of students who took principles of finance, one study found that both genders viewed their introductory finance course as challenging, highly quantitative

and theoretical, and one of the most difficult courses ever taken (Krishnan et al., 1999). In addition, post-survey results indicated that students found the course less useful than they had previously expected. Prior to taking the finance course, approximately 36% of students said they would take it even if it were not required, but after completing the course, over half of students would not take it unless it were required (Krishnan et al., 1999).

Women may be less likely to pursue degrees in finance if they experience bias in their finance courses. Bauer and Dahlquist (1999) argue that people's perceptions of finance as being a male-dominated field may negatively influence females from choosing to take finance courses. Women may also lack female role models and may face "glass walls" in their finance classrooms. For example, the authors found that problem sets and examples presented in one leading introductory finance textbook incorporated twice the number of male characters as female ones (Bauer & Dahlquist, 1999). Furthermore, textbook examples reinforced gender stereotypes. Males were portrayed as professional athletes, company presidents, doctors, investors, and wealthy stock purchasers, while women were more often depicted as making choices between marriage over education, running beauty shops, and as needing more help with financial decisions.

## **Chapter 3**

### **DATA AND METHODOLOGY**

This chapter includes a discussion of the dataset and methodology used in this dissertation. Section 3.1 provides background information and enrollment data for the University of Delaware and Alfred Lerner College of Business and Economics, as well as the coursework requirements for all Lerner College students and those earning degrees in finance and economics. Section 3.2 describes the student, instructor, and class data sets used in this study. Section 3.3 discusses the methodological framework used in the three essays included in this dissertation.

#### **3.1 Background**

##### **3.1.1 University of Delaware**

The data used to conduct this study comes from the University of Delaware (UD), a land grant and comprehensive public university. The University offers programs at its main campus in Newark, Delaware for both undergraduate and graduate students as well as opportunities for continuing studies students. There is also an undergraduate Honors Program. Additionally, the University operates an undergraduate Associate in Arts Program (AAP) at several satellite campuses in Delaware. The AAP allows Delaware students to complete their first two years of college coursework without relocating to the main campus. University faculty teach all the courses in the AAP, which are the same as the courses offered at the main campus. Course credits earned through the AAP fulfill

core requirements for an associate's degree as well as a bachelor's degree, and students can transition to the Newark campus to complete their four-year degree.

The University offers more than 150 undergraduate majors, which are divided among six Colleges. Students may be admitted into a College or major directly, or they may matriculate as an undeclared major under the University Studies designation.

Admission to UD requires students to submit the Common Application, an essay, two letters of recommendation, and their high school transcript. They must also submit their SAT or ACT scores. Students who are admitted to UD generally have a high school GPA in the range of 3.55 to 3.95 (Admissions Requirements, 2018). For students admitted to the main campus in Fall 2016, the average reading, math, and writing SAT scores were 600, 603, and 586, respectively. By comparison, the SAT scores for students admitted to the Associate in Arts Program were 475, 467, and 457, respectively (Institutional Research and Effectiveness, 2017b).<sup>2</sup> Students who are accepted to the Honors Program have higher high school GPAs and SAT/ACT scores than other admitted students. In Fall 2017, the University offered admission to about 63% of the approximately 27,000 undergraduate applicants, and about 4,700 of them accepted the admissions offer (Institutional Research and Effectiveness, 2018).

The total student enrollment in Fall 2017 is described in Table 3.1. The Newark campus had a student population of approximately 18,000 undergraduates and 4,000 graduates, while around 800 students were enrolled in the Associate in Arts Program.

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<sup>2</sup> Beginning with students admitted in Fall 2017, the SAT was revised to consist of two sections worth a total of 1600 points, rather than three sections worth 2400 points. In Fall 2017, the mean math SAT score was 620 for Newark campus students, while the mean verbal SAT score was 621. For AAP students, the mean math and verbal SAT scores were 527 and 533, respectively.

Table 3.1 University of Delaware Fall 2017 Enrollment by Gender

	<b>Male</b>	<b>Female</b>	<b>Total</b>
Undergraduate	7,693	10,450	18,144 <sup>#</sup>
Graduate	1,947	2,073	4,024 <sup>#</sup>
Associate in Arts Program	397	407	804
Professional and Continuing Studies	361	440	802 <sup>#</sup>
<b>University Total</b>	<b>10,398</b>	<b>13,370</b>	<b>23,774<sup>#</sup></b>

*Note:* Adapted from UD Facts & Figures 2017-2018 (Institutional Research and Effectiveness, 2018)

Approximately 800 students were also enrolled in Professional and Continuing Studies programs. Female students are the majority in all categories. Women represented approximately 58% of undergraduate enrollment at the Newark campus and about 51% the AAP students.

Figures 3.1 and 3.2 present the race/ethnicity for students at the Newark campus and the Associate in Arts Program, respectively. Over 70% of the students at the main campus are white compared to 61% of AAP students. Additionally, a higher percentage of students of African American and Hispanic descent are enrolled in the Associate in Arts Program, while the main campus has a larger proportion of Asian students. About 5% of students enrolled at the Newark campus are international students. Additional UD enrollment data indicates that a higher proportion of students who matriculate into the AAP are first-generation students and from low-income families, relative to the Newark campus students (Institutional Research and Effectiveness, 2018).

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<sup>#</sup> A small number of students are listed in UD records as unknown gender.

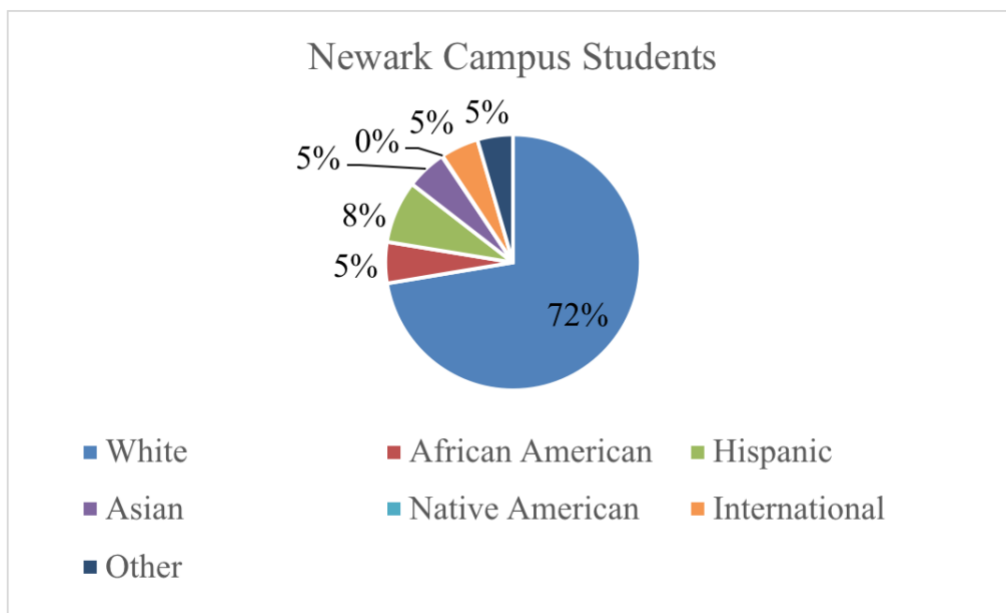


Figure 3.1 UD Student Enrollment by Race/Ethnicity, Newark Campus, Fall 2017

*Note:* Adapted from UD Facts & Figures, 2017-2018 (Institutional Research and Effectiveness, 2018)

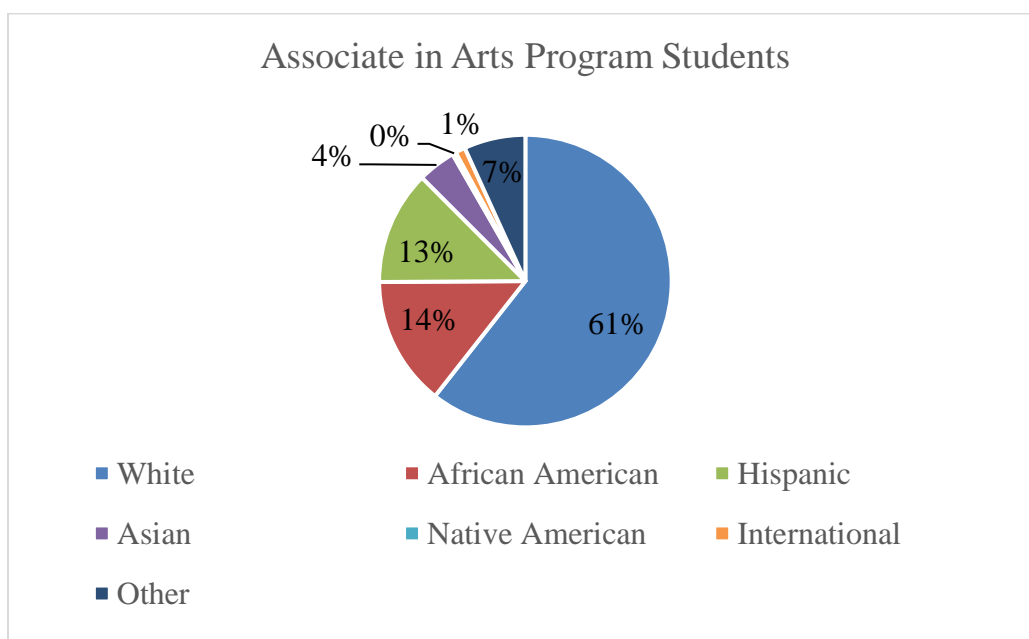


Figure 3.2 UD Student Enrollment by Race/Ethnicity, AAP, Fall 2017

*Note:* Adapted from UD Facts & Figures, 2017-2018 (Institutional Research and Effectiveness, 2018)



### **3.1.2 Alfred Lerner College of Business and Economics**

The Alfred Lerner College of Business and Economics offers 15 undergraduate and 10 graduate degrees within five academic departments: Accounting and Management Information Systems, Business Administration, Economics, Finance, and Hospitality Business Management. Lerner College also supports interdisciplinary programs and the opportunity for students to select more than one major or choose from among a large collection of minors. Additionally, students who are working towards a degree outside of Lerner College or who are working adults may complete a 13-credit certificate program in Business Essentials. Students may matriculate into a specific major within Lerner College or as a ‘business undeclared’ student within the Department of Business Administration.

Table 3.2 identifies the departmental enrollment by gender for Lerner College in Fall 2017. During that fall semester, 3,456 students were enrolled in a program within Lerner College. The overall percentage of women enrolled is approximately 42%, although the percentage of female students varies significantly by department. Women represent the majority in Business Administration and in Hospitality Business Management; however, only about one-quarter of students in the Department of Economics and approximately 27% of students in the Department of Finance are female.

Except for students admitted into the Department of Hospitality Business Management, all students who matriculate into Lerner College in the fall of their freshman year may change their major without restrictions by October 1 of their

Table 3.2 Alfred Lerner College of Business and Economics Fall 2017 Enrollment by Gender

Department	Male	Female	Percent Female	Total
Accounting and Management Information Systems	304	243	44.4%	547
Business Administration	424	571	57.4%	995
Economics	265	86	24.5%	351
Finance	584	215	26.9%	799
Hospitality Business Management	233	234	50.1%	547
Certificate of Business Essentials	205	92	31.0%	297
<b>Total</b>	<b>2,015</b>	<b>1,441</b>	<b>41.7%</b>	<b>3,456</b>

sophomore year.<sup>3</sup> Sophomore business undeclared students must also declare their major by this date. Beyond that time, Lerner College students may declare or change their major subject to the admissions requirements established by each of the five departments. Table 3.3 describes the admissions criteria for the departments in Lerner College. Students who initially matriculate into a major outside of Lerner College may transfer into a business or economics major, subject to the departmental admissions criteria.

The majors offered by Lerner College are popular at UD. In Fall 2017, finance, marketing, accounting, and economics were among the twenty-five most popular majors (UD Facts & Figures, 2017-2018). The B.S. in Finance is the most popular degree, while the Department of Economics has the fewest majors within Lerner College and the smallest proportion of female majors. In Fall 2017, approximately one-quarter of economics majors were female, a percentage much lower than the national average

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<sup>3</sup> Students admitted into the Department of Hospitality Business Management may change their major to another business area but must apply and are subject to the departmental admissions criteria.

Table 3.3 Admissions Criteria, Lerner College of Business and Economics by Major

<b>Department</b>	<b>Credit Hours Completed at UD</b>	<b>Economics Requirement</b>	<b>Math Requirement</b>	<b>Minimum GPA to Apply</b>
Accounting	28	ECON 101 and ECON 103, both with C- or better	Either MATH 221 or MATH 241, with C- or better	3.2
Economics-B.A.	28	ECON 101 and ECON 103, both with C- or better	One of: MATH 114, MATH 115, MATH 117, MATH 221, or MATH 241, with C- or better	2.0
Economics-B.S.	28	ECON 101 and ECON 103, both with C- or better	Either MATH 221 or MATH 241, with C- or better	2.0
Finance and Financial Planning	28	ECON 101 and ECON 103, both with C- or better	Either MATH 221 or MATH 241, with C- or better	Admitted before Fall 2015- 2.8, Admitted Fall 2015- 3.2
Hospitality Business Management	15	None	None	Up to 60 credit hours-2.5, with 60 credit hours or more-3.0
International Business, Management, Marketing	28	ECON 101 and ECON 103, both with C- or better	Either MATH 221 or MATH 241, with C- or better	2.8
Management Information Systems	28	ECON 101 and ECON 103, both with C- or better	Either MATH 221 or MATH 241, with C- or better	2.7

*Note:* Adapted from Program Check Sheets, available at [my.Lerner.udel.edu](http://my.Lerner.udel.edu), 2018

*Note:* ECON 101- Introduction to Microeconomics; ECON 103- Introduction to Macroeconomics; MATH 114- College Mathematics and Statistics; MATH 115- Pre-Calculus; MATH 117- Pre-Calculus for Scientists and Engineers; MATH 221- Calculus 1; MATH 241- Analytic Geometry and Calculus A

among comparable doctoral universities (Siegfried, 2016). Figure 3.3 displays the quantity of male and female students who were enrolled as economics majors at UD between 2009 and 2017. While the number of male economics majors nearly doubled, the quantity of female economics majors grew by only about two-thirds, from 52 students in 2009 to 86 students in 2017. As a result, the proportion of female economics majors declined during this time.

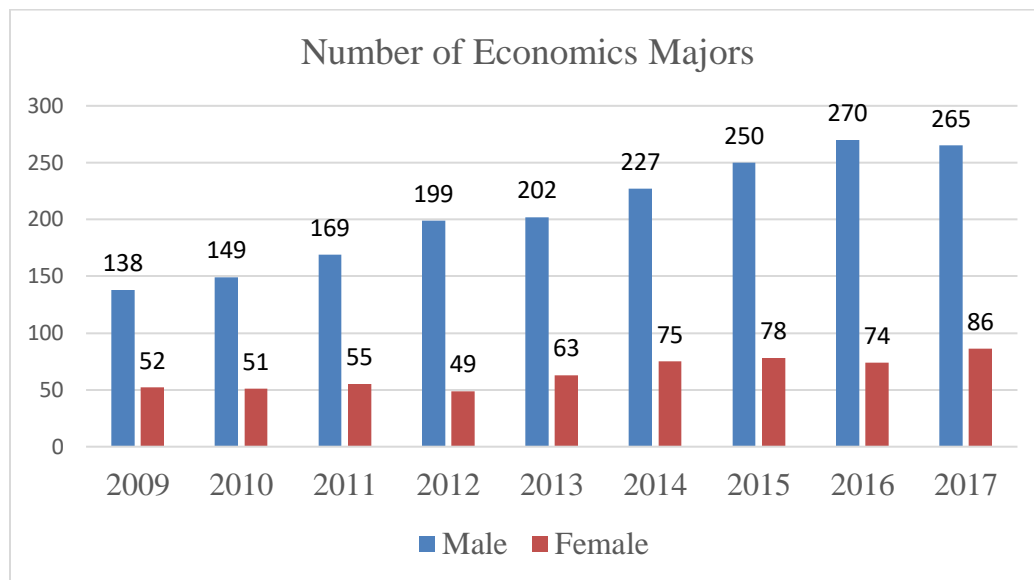


Figure 3.3 Number of Economics Majors at UD from 2009-2017

*Note:* The number of economics majors is measured in the fall semester of each year. Adapted from Office of Equity and Inclusion Annual Reports, 2009-2017 (Institutional Research and Effectiveness, 2017a)

In contrast, the Department of Finance has the second highest number of majors within Lerner College and the second smallest proportion of female majors. In Fall 2017, approximately 27% of finance majors were female. Figure 3.4 displays the quantity of male and female students who were enrolled as finance majors at UD between 2009 and 2017. Both the number of male and female finance majors increased during this time, but the proportion of female finance majors ranged from 25-30%.

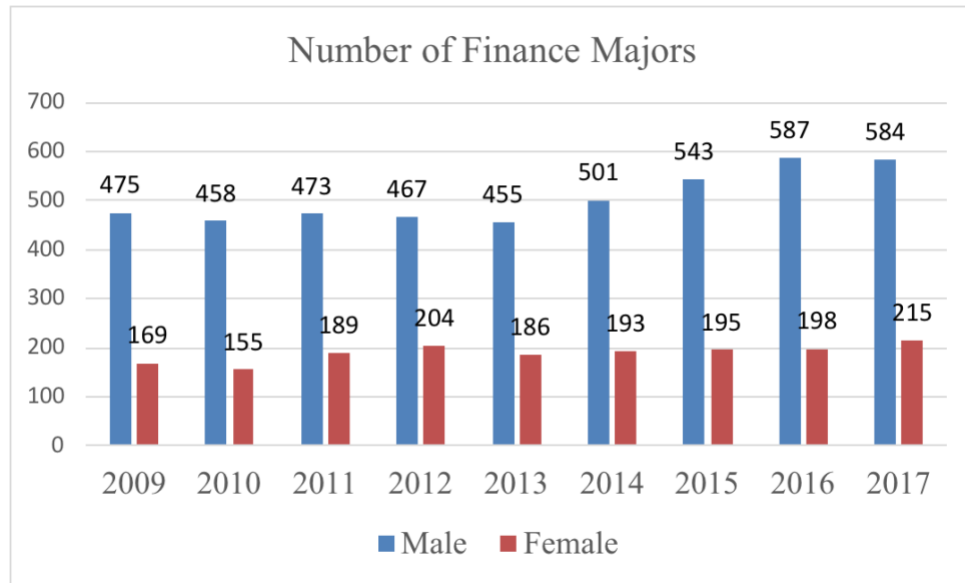


Figure 3.4 Number of Finance Majors at UD from 2009-2017

*Note:* The number of finance majors is measured in the fall semester of each year. Adapted from Office of Equity and Inclusion Annual Reports, 2009-2017 (Institutional Research and Effectiveness, 2017a)

### 3.1.3 University of Delaware Degree Requirements

Students who matriculate into the University of Delaware for a baccalaureate degree must maintain a 2.0 cumulative GPA. They must also complete one semester of Freshman English (ENGL 110) and a minimum of 12 credits in breadth courses in four categories, including three credits in the Social and Behavioral Sciences.<sup>4</sup> These courses must be passed with a C- letter grade or better. In addition, students must complete a one-semester First Year Seminar course as well as a three-credit Discovery Learning Experience, such as an internship, study abroad, or independent study (Academic Requirements for Graduation, 2018). Students who are admitted into the Honors Program

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<sup>4</sup> Introduction to Microeconomics and Introduction to Macroeconomics are included in the approved list of breadth courses in the Social and Behavioral Sciences category.

may earn an Honors Degree by completing 30 credits of Honors courses and achieving a GPA of 3.4 or above. Bachelor's degrees must be completed within seven calendar years of admission (Academic Requirements for Graduation, 2018).

*3.1.3.1 Lerner College Degree Requirements.* In addition to the University requirements established for all students, each degree within the College of Business and Economics has its own requirements. All Lerner College students must pass Introduction to Microeconomics (ECON 101) and Introduction to Macroeconomics (ECON 103) with a C- letter grade or better. Additionally, all Lerner College students must complete Introduction to Statistical Methods I and II (MATH 201 and MATH 202), and most Lerner College students must also pass a course in calculus, either Calculus I (MATH 221) or Analytic Geometry and Calculus A (MATH 241), with a C- letter grade or better.<sup>5</sup> All non-economics students must also complete a collection of required business courses that make up the core business curriculum. These core courses span several departments within Lerner College, and all must be passed with a C- letter grade or better. The required courses include Accounting I and II (ACCT 207 and ACCT 208, which represent financial and managerial accounting) and Principles of Finance (FINC 311) as well as additional courses in marketing, business administration, and management information systems.

*3.1.3.2 Economics Degree Requirements.* Students may choose from three different economics degrees: a Bachelor of Science (B.S.) in economics, a Bachelor of Arts (B.A.) in economics, and a minor in economics. Both the B.S. and B.A. degrees

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<sup>5</sup> Students who select a B.A. in Economics or a B.S. in Hotel, Restaurant, and Institutional Management are not required to complete a calculus course.

require completion of 30 credit hours in economics, including introductory courses in microeconomics and macroeconomics as well as courses in intermediate microeconomic and macroeconomic theory. Students in the B.S. major must take Quantitative Microeconomic Theory (ECON 301), but students in the B.A. major may choose between ECON 301 and a non-quantitative Intermediate Microeconomic Theory (ECON 300) course. Beyond these required courses, economics majors must take six additional advanced economics electives, two of which must be at the 400-level. All economics courses must be passed with a C- letter grade or better. For the B.S. degree, students must complete a course in calculus and fulfill a quantitative proficiency requirement of nine additional credits in mathematics or business courses that require calculus. The B.A. degree does not require calculus but does require demonstrated proficiency in an ancient or modern foreign language at the intermediate-level or better. Both economics degrees require the completion of 120 total credits.

Students who select the minor in economics must complete eighteen credits in economics, including Introduction to Microeconomics (ECON 101) and Introduction to Macroeconomics (ECON 103). They must also take one intermediate-level microeconomics course, selecting from among four alternatives, including the non-quantitative and quantitative intermediate microeconomics courses (ECON 300 and 301) that must be completed by the economics majors, Managerial Economics (ECON 255), or Intermediate Microeconomic Public Policy (ECON 251). In addition, economics minors must complete three additional economics courses at the 300- or 400-level. All courses must be passed with a C- letter grade or better. There is no math or language requirement for the economics minor.

*3.1.3.3 Finance Degree Requirements.* Lerner College offers a B.S. in Finance and began offering a B.S. in Financial Planning and Wealth Management in Fall 2014.<sup>6</sup> Students who elect to major in finance must complete the core business curriculum as well as a series of intermediate and advanced finance courses. The first finance course, Principles of Finance (FINC 311), is part of the core business curriculum. To prepare students for the quantitative nature of this finance course, they must complete Accounting I (ACCT 207) and Introduction to Statistical Methods I (MATH 201) as prerequisites. Thus, the earliest that a student can take Principles of Finance is during the second semester of their sophomore year. Students who choose to earn a finance degree must also complete Intermediate Financial Management (FINC 312), Investments (FINC 314), and one additional economics course, Banking and Monetary Policy (ECON 308). Finally, finance majors must take three elective courses offered by the Department of Finance. The B.S. in finance degree requires completion of 121 university credits, which is one more credit than is required for the bachelor's degrees in economics. There is no minor in Finance.

## **3.2 Data**

The data are from institutional records for approximately 18,000 undergraduate students who took economics and finance courses at the University of Delaware (UD) between Fall 2006 and Fall 2015. Each student record contains demographic characteristics, measures of ability and high school preparation, and college coursework. The student records are augmented by data regarding course instructors and class

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<sup>6</sup> Because the B.S. in Financial Planning and Wealth Management is a relatively new major and has slightly different requirement than the B.S. in Finance major, these students are excluded from the student sample.



enrollments to assess the effect of instructors and structural characteristics. All data come from computerized records retrieved from the University of Delaware's Office of Institutional Research and Effectiveness. To ensure confidentiality, all student and instructor information was coded with an identification number.

### **3.2.1 Student Data Set**

Given that students generally receive some form of exposure to a subject prior to selecting it as their major, the student sample includes only students who took at least one economics course at UD. Although some students may have had their initial economics experience in high school, many matriculating freshmen have no formal exposure to the field prior to college. All states include economics in their curricular standards, but not all of them require school districts to implement the economics standards. Furthermore, less than half of the states require school districts to offer a high school economics course, and even fewer states require students to complete an economics course in high school to graduate (Council for Economic Education, 2018). Presumably, students who choose not to take any economics courses in college are either uninterested in doing so or do not need to take them to fulfill any requirements. These individuals, however, will not earn an economics or finance degree and are thus excluded from the sample. The final student sample includes students who took their introductory economics courses at UD as well as students who fulfilled the introductory economics credit requirements by earning a passing score on the AP Microeconomics and/or AP Macroeconomics exams.

As part of my analysis, I include student demographic characteristics because evidence suggests that demographic characteristics, such as gender, race/ethnicity, and age, affect the selection of an economics major (Dynan & Rouse, 1997; Emerson et al.,

2012; Rask & Tiefenthaler, 2008). I also incorporate measures of pre-college student ability and preparation, including high school SAT scores.<sup>7</sup> While some studies of economics majors have only included math SAT scores, I include both math and verbal SAT scores. Research suggests that math SAT scores are positively correlated with choosing quantitative majors, such as finance or the B.S. in economics, while verbal SAT scores tend to be negatively correlated with these majors (Correll, 2001; Davison et al., 2014; Rask & Tiefenthaler, 2008; Turner & Bowen, 1999). Additionally, the verbal SAT scores may also serve to distinguish between those who select the B.A. in economics and those who select the B.S. degree because of the foreign language requirement.

Students' Advanced Placement (AP) Macroeconomics and/or AP Microeconomics exam scores are also included as measures of students' preparation for and prior interest in economics. The AP exams are developed by the College Board and are intended to assess students on their mastery of curricula that would be taught in introductory microeconomics and macroeconomics courses. The exams consist of 60 multiple-choice questions, which account for two-thirds of a student's raw score, and three free-response questions, which account for the other one-third of the raw score. Raw scores are converted to an integer score on a scale of 1 to 5. A score of 5 translates as "extremely well qualified," while a score of 1 represents "no recommendation." An AP exam score of 3 is equivalent to a college course grade ranging between a B- and a C letter grade. Students may take either the AP Macroeconomics exam, the AP Microeconomics exam, or both. At UD, students who earn a score on the AP

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<sup>7</sup> I include only students' SAT exam scores. Although some students in the sample took both the SAT and the ACT exams, many students took only the SAT exams. No student took only the ACT exams.

Microeconomics exam of 3, 4, or 5 may receive equivalency for Introduction to Microeconomics; a similar score on the AP Macroeconomics exam allows a student to receive equivalency for Introduction to Macroeconomics.

Additionally, I incorporate student college performance variables, including cumulative GPA and specific course grades, which have been found to influence the selection of an economics major (Asarta & Butters, 2012; Emerson et al., 2012; Fournier & Sass, 2000; Horvath et al., 1992; Marangos, 2012; Rask & Tiefenthaler, 2008; Salemi & Eubanks, 1996). I also control for students' class year at the time their economics and finance courses were taken. Controlling for class year is important because students who take these courses as juniors and seniors are presumably less likely to select an economics or finance major. Finally, I include students who participated in the University of Delaware's Associate in Arts Program. Since students who matriculate into the AAP have lower mean verbal and math SAT scores than students who begin at the Newark campus, they may perform worse in their introductory economics courses (Elzinga & Melaugh, 2009; Swope & Schmitt, 2006), or they may be less likely to take additional courses and earn an economics degree (Bayer & Rouse, 2016; Elzinga & Melaugh, 2009; Goldin, 2013). The data set also includes information on students' major upon matriculation and any changes they made to their academic plan, which will allow me to assess if students switched into an economics or finance major at some point during their time at University of Delaware.

### **3.2.2 Instructor and Class Data Sets**

In addition to the student records, I also have information for course instructors as well as data on structural characteristics, such as class size. Instructor data includes

courses taught by subject, academic term, and section number. Additionally, instructors have been classified by type: professor, adjunct faculty, or graduate student instructor and by gender. Faculty may influence students by serving as role models, though findings are mixed (Carrell et al., 2010; Griffith, 2013; Griffith, 2014; Robb & Robb, 1999). Students' may also perform better in classes with graduate student or adjunct instructors (Bettinger & Long, 2010; Bettinger et al., 2016; Fournier & Sass, 2000). The class data includes the overall headcount and the numbers of male and female students enrolled in each course and section. Some research has suggested that class size or the male-female student ratio may influence the selection of an economics major, but the results are mixed (Dynan & Rouse, 1997; Emerson et al., 2012; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008).

### **3.3 Methodology**

When students choose their college major, they select from among a finite set of degrees offered at their college or university. The methodology of this dissertation is based on econometric discrete choice modeling, which contends that a student will first determine a personal set of possible majors and then select the major that will provide them the greatest amount of present and future utility.<sup>8</sup> I analyze my data using two logistic regression models based on random utility maximization (RUM) theory, which is presented in Section 2.1.1. In this section, I first describe the different types of variables that are used in RUM modeling and then explain the binary and multinomial logistic regression models I use in this dissertation.

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<sup>8</sup> For purposes of this research, a student who has two or more majors, one of which is in economics, will be counted as an economics major.

### 3.3.1 Random Utility-Maximization Theory

When students select their major, they consider both their personal characteristics and the characteristics of the available majors. Individual-specific attributes include students' demographic characteristics, such as gender and ethnicity as well as interests, ability, and achievement. Major-specific characteristics include coursework and grade requirements along with class sizes, the quality of the faculty, and gender balance among students within the major. Some of these characteristics are directly observable, such as gender or class size, while others are not directly observable, such as student interest (Heiss, 2002). Random utility theory indicates that students who have similar individual characteristics may decide to pursue different majors (Ben-Akiva & Lerman, 1985; Heiss, 2002). For instance, students may have the same verbal and math SAT scores, but they may choose different majors because they have different preferences based on other unobservable characteristics.

The basis for my analysis are the deterministic utility components  $V_{ij}$  where  $i$  represents the characteristics of the student and  $j$  represents the attributes of the major. The deterministic part of a student's utility function can be expressed as

$$V_{ij} = V(X_i) + V(S_j) + V(X_i, S_j) \quad (3.1)$$

where  $V(X_i)$  is the portion of utility associated with characteristics of student  $i$ ,  $V(S_j)$  is the portion of utility associated with characteristics of major  $j$ , and  $V(X_i, S_j)$  is the portion of the utility that results from interactions between the individual-specific and the major-specific characteristics. Because students have other possible major choices, denoted  $k$ , it is assumed that they will select the major that best suits the condition such that

$$V_{ij} > V_{ik} \quad (3.2)$$

A student's major selection can be assessed by comparing the probability that an individual will select one major over the other. The probability that a student would select major  $j$  rather than an alternative major  $k$  can be written as follows

$$\Pr(ij) = \Pr(V_{ij} > V_{ik}) \quad (3.3)$$

For student  $i$ , the probability of choosing major  $j$  is based on the probability that major  $j$  will offer greater utility than major  $k$ .

### 3.3.2 Logistic Regression Models

Logistic regression models are used to estimate the probability of choosing some response based on a collection of independent variables. The dependent response variable is categorical and can be dichotomous, as in a binary logit model, or have more than two outcome categories, as in a multinomial logit model (Ben-Akiva & Lerman, 1985). In this section, I will briefly describe these two models and how I will apply them to different portions of my analysis.

*3.3.2.1 Binary Logit.* Part of the process of selecting a college major involves taking coursework at different levels. A student may elect to take a first course in economics or finance, either as a requirement or as an elective. After completing the first course, the student may choose either to take or not take an additional course. Because part of my research is related to course persistence in economics and finance, the binary logit model allows me to determine the probability that a student will take (or not take) additional coursework in these fields. In the binary logit model, the response  $y_i$  has only two outcomes, which are defined as

$$y_i = \begin{cases} 1 & \text{if student } i \text{ takes an additional course} \\ 0 & \text{otherwise} \end{cases}$$

Thus, the probability that an individual will choose to take an additional course is based on a set of  $X_i$ , a vector of values for the explanatory variables for student  $i$ . The probability that this individual would choose to take an additional course can be expressed as

$$Pr(y_i = 1|X_i) = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)} \quad (3.4)$$

In the binomial logit model, the error terms are assumed to be independently and identically distributed with an extreme value distribution (Ben-Akiva & Lerman, 1985).

*3.3.2.2 Multinomial Logit.* The process of undergraduate degree completion for many students represents a journey. While some students earn a degree in the major they select upon matriculation, other students may initially select a major and then change majors one or more times before graduating. Some academic departments also offer different types of degrees, and students may switch between them. For example, a student may matriculate into the B.A. in economics degree but graduate with the B.S. in economics degree. Additionally, many students choose more than one major and more than one minor.

In this study, I use multinomial logistic regression to analyze students' selection among the various types of economics degrees and to examine the pathways students take into the economics major. The multinomial logit model allows for analysis of responses such as these where the dependent variable  $y_i$  takes on two or more possible outcomes (Ben-Akiva & Lerman, 1985). For analyzing students' economics degree selection, response  $y_i$  has four outcomes, which are defined as

$$y_i = \begin{cases} 1 & \text{if student } i \text{ earns a B. S. in economics} \\ 2 & \text{if student } i \text{ earns a B. A. in economics} \\ 3 & \text{if student } i \text{ earns a minor in economics} \\ 4 & \text{if student } i \text{ earns no economics degree} \end{cases}$$

The multinomial logit model assumes that all explanatory variables are individual-specific (Ben-Akiva & Lerman, 1985). Therefore, the probability that student  $i$  selects some degree  $j=1, \dots, J$  can be written as

$$\Pr(y_i = j) = \frac{\exp(X_i\beta)}{\sum_{j=1}^J \exp(X_i\beta)} \quad (3.5)$$

where  $X_i$  represents a vector of student-specific variables.



## **Chapter 4**

### **THE GENDER GAP IN UNDERGRADUATE ECONOMICS COURSE PERSISTENCE AND DEGREE SELECTION**

This chapter assesses the gender gap in the economics course persistence of undergraduate students, defined as taking additional economics classes after completing an initial course, as well as gender disparities in students' economics degree selection. The research is guided by the following question identified in Section 1.2: How do student, instructor, and structural (class) characteristics differentially affect gender persistence in taking economics courses and the propensity to earn an economics degree?

#### **4.1 Introduction**

Women represent approximately 58% of all undergraduates, suggesting that colleges and universities have many potential female recruits into economics (Ball, 2012; Ceci et al., 2014; Goldin, Katz, & Kuziemko, 2006). Yet nationwide women have comprised only one-third of all economics bachelor's degree-earners in the United States for over twenty years (Ball, 2012; Ceci et al., 2014; Goldin, 2013; Kim et al., 2002; McElroy, 2014; National Center for Education Statistics, 2017; Rask & Tiefenthaler, 2008; Siegfried, 2016). The percentage of women earning economics degrees has also declined slightly since the early-2000s, despite increases in the overall number of economics majors (Bayer & Rouse, 2016; Siegfried, 2016). Many women may never even consider majoring in economics (Calkins & Welki, 2006). They are also

significantly less likely than men to take an introductory economics course and have a lower likelihood of economics course persistence (Dynan & Rouse, 1997; Emerson et al., 2012; Fournier & Sass, 2000; Horvath et al., 1992; Rask & Tiefenthaler, 2008).

Using a series of binary logit models, this chapter examines how student, instructor, and structural (class) characteristics differentially affect the likelihood of taking additional courses beyond introductory microeconomics. The data includes students who take all economics courses through UD as well as those who pass an Advanced Placement (AP) economics exam. Additionally, I use a multinomial logit model to assess how student characteristics and college coursework influence the type of economics degree students select.

Findings are consistent with prior research indicating that female students are less likely to persist in economics courses beyond those required by their major and are less likely to earn an economics degree than male students. Students' grades in their economics courses are significant predictors of course persistence for both men and women. Women's course persistence is significantly correlated with their relative economics course grades in comparison to their grades received in other departments' courses. Men's persistence is strongly affected by both their absolute and relative economics course grades. Female students who declare an economics major by the time they take their second course have a higher likelihood than their male counterparts of taking an additional economics course and graduating with an economics degree. Finally, men's choice of economics degree is significantly correlated with their math abilities, while women's degree selection is affected by both their math and verbal aptitudes. In particular, women with a higher math SAT score are more likely to choose a quantitative

B.S. degree in economics, while women with a higher verbal SAT are more likely to select a B.A. degree in economics.

## **4.2 Data**

The data used in this chapter are from institutional records for approximately 15,000 undergraduate students who completed economics courses at UD between Fall 2007 and Fall 2015. The student sample includes only students who took at least one economics course at UD. The final student sample includes students who took Introduction to Microeconomics at UD as well as students who passed AP Microeconomics and/or AP Macroeconomics prior to entering the University. The student records are supplemented with data on instructor and structural (class) characteristics. Table 4.1 defines the student, instructor, and class variables used in this study.

### **4.2.1 Descriptive Statistics**

Table 4.2 provides the descriptive statistics by gender for students who took all coursework at UD. Panel A provides the statistics for students who completed Introduction to Microeconomics. Panel B shows the statistics for students who completed Introduction to Macroeconomics, for which Introduction to Microeconomics is a prerequisite. Among students who take Introduction to Microeconomics ( $n=12,815$ ) and Introduction to Macroeconomics ( $n=7,211$ ), women represent approximately 48% and 46%, respectively. In both Panels A and B, male students are significantly older on average. In addition, men have significantly higher mean SAT math scores, and the mean

Table 4.1 Summary of Variables

Variable	Description
Age at Micro	Student's age in years at Introduction to Microeconomics (microeconomics)
Age at Macro	Student's age in years at Introduction to Macroeconomics (macroeconomics)
Age at Int Micro	Student's age in years at intermediate (int.) microeconomics
Minority	1 if student is non-white
SAT Math	Student's SAT Math score
SAT Verbal	Student's SAT Verbal score
HS Econ Required	1 if student's state required economics course for high school graduation
Economics Entry	1 if student matriculated as an economics major
Business Entry	1 if student matriculated as a business major
AP Micro Pass	1 if student passed AP Microeconomics exam (grade=3,4,5)
AP Micro/Macro Pass	1 if student passed both AP economics exams (grade=3,4,5)
Non-Fresh at Micro	1 if student has greater than 27 cumulative credits at microeconomics
Non-Fresh at Macro	1 if student has greater than 27 cumulative credits at macroeconomics
Senior at Int Micro	1 if student has 90 or more cumulative credits at int. microeconomics
Econ Major at Macro	1 if student is an economics major when taking macroeconomics
Econ Major at Int Micro	1 if student is an economics major when taking int. microeconomics
Bus Major at Macro	1 if student is a business major when taking macroeconomics
Micro Grade	Student's microeconomics course grade
Macro Grade	Student's macroeconomics course grade
Int Micro Grade	Student's int. microeconomics course grade
Relative Micro Grade	Student's micro grade/cum GPA from micro term without micro grade
Relative Macro Grade	Student's macro grade/cum GPA from macro term without macro grade
Relative Int Micro Grade	Student's int. micro grade/cum GPA from int. micro term without int. micro grade
Micro Repeater	1 if student repeated microeconomics
Macro Repeater	1 if student repeated macroeconomics
AAP at Micro	1 if student took microeconomics through the Associate in Arts Program
AAP at Macro	1 if student took macroeconomics through the Associate in Arts Program
Calculus	1 if student took a calculus course or passed an AP Calculus exam (grade=5)
Fem Micro Prof	1 if microeconomics instructor was a female professor
Fem Macro Prof	1 if macroeconomics instructor was a female professor
Fem Micro Adjunct	1 if microeconomics instructor was a female adjunct
Fem Macro Adjunct	1 if macroeconomics instructor was a female adjunct
Male Micro Adjunct	1 if microeconomics instructor was a male adjunct
Male Macro Adjunct	1 if macroeconomics instructor was a male adjunct
Fem Micro Grad TA	1 if microeconomics instructor was a female graduate student
Fem Macro Grad TA	1 if macroeconomics instructor was a female graduate student
Male Micro Grad TA	1 if microeconomics instructor was a male graduate student
Male Macro Grad TA	1 if macroeconomics instructor was a male graduate student
Micro Class Size	Number of students in microeconomics class
Macro Class Size	Number of students in macroeconomics class
Micro Percent Female	Percentage of female students in microeconomics class
Macro Percent Female	Percentage of female students in macroeconomics class
B.S. Econ	1 if student graduated with a Bachelor of Science in economics
B.A. Econ	1 if student graduated with a Bachelor of Arts in economics
Econ Minor	1 if student graduated with a minor in economics

Table 4.2 Summary Statistics for Students Who Took All Courses at UD

	Male Students		Female Students		Mean
Variable	Mean	SD	Mean	SD	Diff.
Panel A: Took Introduction to Microeconomics					
Minority	0.199	0.399	0.191	0.393	
Age at Micro	18.465	0.848	18.354	0.806	***
SAT Math	620.076	76.865	594.359	75.000	***
SAT Verbal	582.051	78.109	588.793	79.940	***
HS Econ Required	0.172	0.377	0.194	0.396	**
Economics Entry	0.020	0.139	0.006	0.077	***
Business Entry	0.358	0.479	0.287	0.452	***
Econ Major at Micro	0.022	0.145	0.008	0.087	***
Bus Major at Micro	0.359	0.480	0.296	0.457	***
Non-Fresh at Micro	0.469	0.006	0.520	0.006	***
Micro Grade	2.703	0.859	2.656	0.864	**
Relative Micro Grade	0.965	2.653	0.848	0.238	***
Micro Repeater	0.015	0.120	0.011	0.104	
AAP at Micro	0.071	0.256	0.064	0.003	
Fem Micro Prof	0.041	0.198	0.041	0.199	
Male Micro Adjunct	0.031	0.174	0.009	0.092	**
Fem Micro Adjunct	0.051	0.219	0.013	0.112	*
Male Micro Grad TA	0.195	0.396	0.162	0.368	*
Fem Micro Grad TA	0.098	0.297	0.054	0.226	
Micro Class Size	141.446	114.379	145.246	115.028	***
Micro Percent Female	0.457	0.081	0.484	0.080	***
N	6,720		6,095		
Panel B: Took Introduction to Macroeconomics					
Minority	0.196	0.397	0.176	0.381	*
Age at Macro	18.844	0.867	18.682	0.766	***
SAT Math	622.053	73.715	601.383	68.530	***
SAT Verbal	583.871	75.750	592.568	75.821	***
HS Econ Required	0.185	0.388	0.202	0.402	
Econ Major Entry	0.022	0.146	0.008	0.086	***
Bus Major Entry	0.455	0.498	0.395	0.489	***
Econ Major at Macro	0.046	0.210	0.019	0.137	***
Bus Major at Macro	0.456	0.498	0.420	0.494	**
Non-Fresh at Macro	0.912	0.005	0.971	0.003	***
Macro Grade	2.858	0.817	2.871	0.801	
Relative Macro Grade	0.978	0.253	0.905	0.222	***
Macro Repeater	0.011	0.102	0.008	0.088	
AAP at Macro	0.035	0.185	0.027	0.162	
Fem Macro Prof	0.071	0.257	0.075	0.263	
Male Macro Adjunct	0.012	0.1808	0.015	0.123	
Fem Macro Adjunct	0.027	0.163	0.023	0.149	
Male Macro Grad TA	0.287	0.452	0.289	0.453	
Fem Macro Grad TA	0.079	0.269	0.097	0.296	**
Macro Class Size	139.680	118.024	135.381	117.581	
Macro Percent Female	0.438	0.091	0.474	0.090	***
N	3,878		3,333		

Note: Gender mean differences significant at \*<0.05 \*\*<0.01 \*\*\*<0.001

SAT verbal score is significantly higher for women at each course level. The mean math and verbal SAT scores increase for students of both genders who complete Introduction to Macroeconomics. Panel A indicates that a significantly larger share of the female students come from states that required a high school economics course for graduation. This variable, however, is not significant for male and female students who take Introduction to Macroeconomics.

In both panels, a significantly smaller proportion of students who matriculate as economics majors are female, and men are also significantly more likely to select business as their initial major. Male students also represent a significantly higher proportion of economics and business majors at the time of taking Introduction to Microeconomics and Introduction to Macroeconomics. Additionally, compared to their male counterparts, a larger proportion of female students take both introductory economics courses after their freshman year. Male students, on average, earn a higher Introduction to Microeconomics grade than female students, but there is no significant gender difference in students' average Introduction to Macroeconomics course grades. When comparing students' economics course grades with the grades received in other courses taken during the same term, male students earn significantly higher relative grades in both Introduction to Microeconomics and Introduction to Macroeconomics. In addition, students of both genders earn higher absolute and relative grades in Introduction to Macroeconomics compared to those who complete Introduction to Microeconomics.

Significant gender differences also exist among the instructor and class variables. While no significant gender difference exists in the share of students who complete Introduction to Microeconomics with a female professor, more men take their

introductory microeconomics course with an adjunct faculty member of either gender or with a male graduate student instructor. In Panel B, a larger percentage of women take Introduction to Macroeconomics with a female graduate instructor. There is no significant gender difference in the proportion of students who complete Introduction to Macroeconomics with a female professor, male or female adjunct instructor, or male graduate student instructor. Panel A shows that women are also more likely to have a larger average Introduction to Microeconomics class size, while this variable is not significant in Panel B. Relative to male students, female students have a significantly larger percentage of women in both of their introductory courses.

The summary statistics for students who received course equivalencies for the two introductory courses via Advanced Placement (AP) credit are listed in Table 4.3. Panel A represents the full sample of students, including both those who took Introduction to Microeconomics at UD and those who received course equivalency by earning a passing grade on the AP exams. Panel B shows the statistics for students who completed Introduction to Macroeconomics, and Panel C shows the data for students who took an intermediate microeconomics course.<sup>9</sup>

In the full student sample from Panel A, gender gaps in average male and female SAT scores are evident as are significant gender differences in the share of students who matriculate as economics or business majors. The results from Panel A also indicate that men have significantly higher pass rates for AP Microeconomics alone and for the combined AP economics courses. In contrast, a significantly larger percentage of male

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<sup>9</sup> Data for students who completed one of four intermediate microeconomics courses are represented.

Table 4.3 Summary Statistics for Students Who Earned Course Equivalency

	Male Students		Female Students		Mean
Variable	Mean	SD	Mean	SD	Diff.
<u>Panel A: Full Sample</u>					
Minority	0.205	0.404	0.199	0.399	
SAT Math	618.652	85.437	591.416	82.360	***
SAT Verbal	580.921	86.118	585.253	86.425	**
HS Econ Required	0.158	0.364	0.184	0.387	***
Economics Entry	0.023	0.150	0.007	0.026	***
Business Entry	0.342	0.475	0.276	0.447	***
AP Micro Pass	0.008	0.091	0.004	0.061	***
AP Micro/Macro Pass	0.015	0.122	0.005	0.067	***
N	7,977		6,988		
<u>Panel B: Took Introduction to Macroeconomics</u>					
Minority	0.201	0.401	0.179	0.384	*
SAT Math	621.365	74.890	600.172	69.322	***
SAT Verbal	583.477	77.195	591.388	76.269	***
HS Econ Required	0.173	0.378	0.192	0.394	*
Economics Entry	0.022	0.147	0.007	0.085	***
Business Entry	0.427	0.495	0.373	0.172	***
AP Micro Pass	0.008	0.089	0.002	0.049	***
AP Micro/Macro Pass	0.001	0.004	0.001	0.028	
N	4,409		3,726		
<u>Panel C: Took Intermediate Microeconomics</u>					
Minority	0.205	0.404	0.200	0.400	
SAT Math	645.180	74.542	633.964	72.203	***
SAT Verbal	597.431	79.692	611.088	83.834	***
HS Econ Required	0.162	0.369	0.165	0.372	
Economics Entry	0.055	0.229	0.058	0.234	
Business Entry	0.324	0.468	0.244	0.43	***
AP Micro Pass	0.007	0.081	0.004	0.067	
AP Micro/Macro Pass	0.043	0.203	0.027	0.162	*
N	1,946		671		

Note: Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

students who take Introduction to Macroeconomics (shown in Panel B) are more likely to pass AP Microeconomics than women, but there is no significant gender difference in the percentage of students who pass the combined AP exams. Among students who enroll in an intermediate microeconomics course (Panel C), men are significantly more likely than



women to have passed both AP economics exams. Additionally, Panel C indicates that male students continue to remain a significantly larger share of students who matriculate as business majors, while there is no significant difference in the proportion of male and female students who initially select economics as their major.

Table 4.4 provides the descriptive statistics for students who completed an intermediate microeconomics course and received a degree from the University of Delaware. There is no significant gender difference in male and female verbal SAT scores, but men's mean math SAT score is greater than women's mean score. No significant gender difference exists for students who matriculate as economics majors. Conversely, a significantly larger share of male students are economics majors at the time of completing an intermediate microeconomics course. In addition, men are more likely than women to be business majors at entry and at the time of taking an intermediate microeconomics course.

No significant gender disparities exist in the proportion of students who complete an intermediate microeconomics course during their senior year or in students' grades in intermediate microeconomics, either in absolute or relative terms. On the other hand, a higher percentage of men take calculus at the University or received calculus course equivalency by passing an AP Calculus exam in high school. Men are also significantly more likely than women to select the B.S. in economics degree. In addition, more than twice the number of men choose the B.S. degree over the B.A. degree. The proportion of women choosing to minor in economics, however, is significantly larger than the percentage of male economics minors.

Table 4.4 Summary Statistics for Students Who Completed an Intermediate Microeconomics Course and Graduated

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.195	0.397	0.198	0.399	
Age at Int. Micro	20.249	0.961	19.940	0.955	***
SAT Math	643.995	85.415	631.742	82.885	*
SAT Verbal	597.637	87.711	607.838	88.461	
HS Econ Required	0.183	0.387	0.168	0.375	
Economics Entry	0.041	0.199	0.054	0.227	
Business Entry	0.375	0.484	0.223	0.417	***
Econ Major at Int Micro	0.395	0.489	0.312	0.464	**
Bus Major at Int Micro	0.489	0.500	0.366	0.483	***
Senior at Int Micro	0.539	0.499	0.529	0.500	
Int Micro Grade	2.782	0.841	2.877	0.825	
Relative Int Micro Grade	0.893	0.217	0.891	0.210	
Calculus	0.689	0.471	0.598	0.491	*
B.S. Econ	0.255	0.436	0.153	0.361	***
B.A. Econ	0.119	0.324	0.126	0.332	
Econ Minor	0.380	0.486	0.465	0.500	**
N	876		333		

Note: Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

Table 4.5 describes the summary statistics for students who completed an intermediate microeconomics course and graduated from UD with an economics major. In contrast with the larger sample of students who graduated with any degree, presented in Table 4.4, there is no significant gender difference in the mean math SAT scores among students who graduated with an economics major. The female mean verbal SAT score, however, is significantly greater than the male mean verbal SAT score. Approximately 16% of the female students who graduated with an economics major were economics majors at matriculation, compared to only 8% of the male students. Conversely, female students who graduated with an economics major were significantly

Table 4.5 Summary Statistics for Students Who Graduated with an Economics Major

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.196	0.397	0.194	0.397	
Age at Int. Micro	20.116	0.968	19.667	0.948	***
SAT Math	635.535	80.594	624.194	80.411	
SAT Verbal	595.413	86.164	624.409	86.483	*
HS Econ Required	0.196	0.397	0.151	0.360	
Economics Entry	0.080	0.050	0.161	0.370	*
Business Entry	0.282	0.451	0.108	0.312	***
Econ Major at Int Micro	0.921	0.271	0.936	0.247	
Bus Major at Int Micro	0.327	0.470	0.161	0.370	***
Senior at Int. Micro	0.379	0.486	0.301	0.461	
Int Micro Grade	2.677	0.790	2.914	0.808	*
Int Micro Relative Grade	0.888	0.199	0.902	0.206	
Calculus	0.673	0.470	0.516	0.502	*
B.S. Econ	0.682	0.466	0.548	0.500	*
B.A. Econ	0.318	0.466	0.452	0.500	*
N	327		93		

Note: Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

less likely to have selected business as their initial major. Over 28% of the male students chose business as their initial major, whereas only about 11% of the female students did. Female students earned a significantly higher average intermediate microeconomics grade, but there is no significant gender difference for the mean relative intermediate microeconomics grades. Relative to their female peers, a significantly larger share of the male students completed calculus and graduated with a B.S. degree in economics. Additionally, over two-thirds of the male students selected the B.S. degree. On the other hand, 45% of the women chose the B.A. degree in economics, which represents a significant gender difference in the type of economics major selected.

### 4.3 Methodology

Following prior research on students' economics course persistence (Emerson et al., 2012; Rask & Tiefenthaler, 2008), I use a series of binary logistic regressions to assess students' propensity to continue taking economics courses beyond their first.<sup>10</sup> Students' degree selection is then modeled using a multinomial logit regression, conditional upon students having completed an intermediate microeconomics course. Figure 4.1 shows the progression of economics courses and degree selection modeled in this chapter.

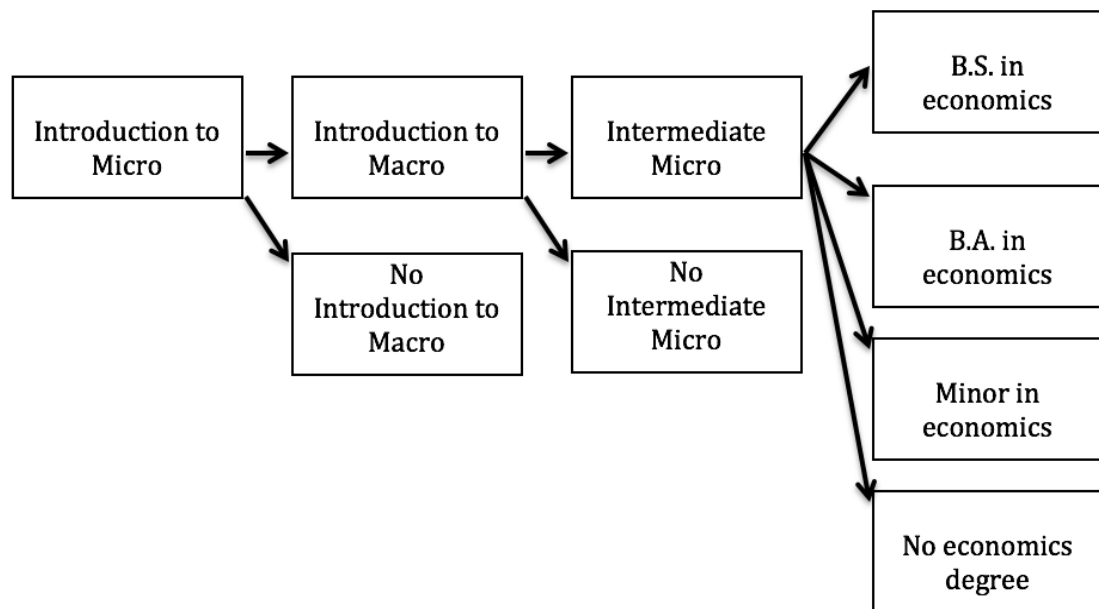


Figure 4.1 Economics Course Persistence and Degree Selection

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<sup>10</sup> These two studies used binary probit models, but binary logistic regression provides a better fit for the data used in this study.

Introduction to Microeconomics is a prerequisite for Introduction to Macroeconomics; therefore, I measure the probability of a student enrolling in macroeconomics conditional upon their having successfully completed microeconomics. Although only Introduction to Microeconomics is a prerequisite for intermediate microeconomics, most students complete both introductory economics courses before taking an intermediate microeconomics course. For this reason, I model the probability of taking an intermediate microeconomics course conditional upon students having completed Introduction to Macroeconomics.

#### **4.3.1 Introduction to Macroeconomics Course Persistence**

The binary logit analysis for students' persistence to Introduction to Macroeconomics is presented in equation 4.1. The model includes student demographic characteristics, including their minority status and age at the time of taking Introduction to Microeconomics. In addition, I include students' math and verbal SAT scores. Students' SAT scores are reported in units of 10 (e.g. 600 and 610), therefore, students' math and verbal SAT scores were divided by 10. To control for students' prior exposure to economics, I include a dummy variable for whether a student's home state requires high school students to complete a course in economics as a condition for graduation. I also control for prior interest in economics or business with dummy variables based on a student's initial major at matriculation. In addition, I control for students' class year at the time of completing Introduction to Microeconomics.

I also include students' absolute and relative Introduction to Microeconomics course grades. All course grades are measured on a scale of zero to 4.0, which represents a letter grade of an A. Students may also receive plus and minus grades. For example, a

student may earn a B+, B, or B- letter grade; however, there is no A+ letter grade.

Dummy variables to control for students who repeated Introduction to Microeconomics or took it through the Associate in Arts Program (AAP) are also included. Recognizing that male and female students may have different propensities to persist in taking economics courses, I estimate separate models for males and females.

$$\begin{aligned} \Pr^{M,F}(Macro_i = 1) = & \beta_0 + \beta_1 Minority + \beta_2 Age\ at\ Micro + \beta_3 Age\ at\ Micro^2 + \\ & \beta_4 SAT\ Math + \beta_5 SAT\ Verbal + \beta_6 HS\ Econ\ Required + \\ & \beta_7 Economics\ Entry + \beta_8 Business\ Entry + \beta_9 Non-Fresh\ Micro + \\ & \beta_{10} Micro\ Grade + \beta_{11} Relative\ Micro\ Grade + \beta_{12} Micro\ Repeat + \\ & \beta_{13} AAP\ at\ Micro \end{aligned} \quad (4.1)$$

I estimate three different models for equation 4.1. In Model 1, the student sample includes only students who completed Introduction to Microeconomics at the University of Delaware. The student sample for Model 2 includes students who passed an AP Microeconomics exam with a score of 3 or better. Model 3 uses the same student sample as in Model 1, but the student characteristics are augmented with instructor and structural variables. The instructor variables include the gender and type of instructor (professor, adjunct instructor, or graduate student instructor) with whom students completed Introduction to Microeconomics. The structural variables include the class size and percentage female in a students' Introduction to Microeconomics course.

#### **4.3.2 Intermediate Microeconomics Course Persistence**

The binary logit regression for students' persistence to an intermediate microeconomics course, conditional upon having completed Introduction to Macroeconomics, is represented in equation 4.2. Based upon their degree selection,

students may complete one of four intermediate microeconomics courses. B.S. in economics majors must take Quantitative Microeconomic Theory (ECON 301), while B.A. in economics majors may take either ECON 301 or the non-quantitative Intermediate Microeconomic Theory (ECON 300). Students who choose a minor in economics may take ECON 301 or 300, or they may complete Managerial Economics (ECON 251) or Intermediate Microeconomics Public Policy (ECON 255). For students who completed more than one intermediate microeconomics course, I used the highest-level course for which they received a C- or better letter grade.

$$\begin{aligned} \Pr^{M,F}(Int\ Micro_i = 1) = & \beta_0 + \beta_1 Minority + \beta_2 Age\ at\ Macro + \\ & \beta_3 Age\ at\ Macro^2 + \beta_4 SAT\ Math + \beta_5 SAT\ Verbal + \\ & \beta_6 Econ\ Major\ at\ Macro + \beta_7 Bus\ Major\ at\ Macro + \\ & \beta_8 Non-Fresh\ Macro + \beta_9 Macro\ Grade + \beta_{10} Relative\ Macro\ Grade + \\ & \beta_{11} Macro\ Repeat + \beta_{12} AAP\ at\ Macro \end{aligned} \quad (4.2)$$

The regression controls for a student's minority status, age at the time of completing Introduction to Macroeconomics, and math and verbal SAT scores. In addition, a student's class year at the time of taking Introduction to Macroeconomics and their absolute and relative Introduction to Macroeconomics course grades are included. I also control for whether a student was an economics or business major during the semester in which they took Introduction to Macroeconomics as well as dummy variables to control for students who repeated Introduction to Macroeconomics or took it as part of the Associate in Arts Program. As with the Introduction to Macroeconomics regression in equation 4.1, I estimate three different models. The student sample for Model 1 includes students who took both Introduction to Microeconomics and Introduction to

Macroeconomics at UD, while Model 2 adds students who passed either AP Microeconomics only or both AP economics courses. Model 3 uses same student sample as in Model 1, incorporating the instructor and structural characteristics for students' Introduction to Macroeconomics courses.

#### 4.3.3 Economics Degree Selection

Next, I use a multinomial logistic regression to model students' choice of degree, conditional upon them having completed an intermediate microeconomics course. This estimation includes only students who took all of their economics courses at UD. In choosing a degree, students may select between a B.S. and a B.A. in economics, an economics minor, or a non-economics degree. Because the B.S. in economics requires students to complete Quantitative Microeconomic Theory (ECON 301), which requires calculus, I include a dummy variable to control for whether or not a student took a calculus course, either at UD or by receiving credit from a passing grade on an AP Calculus exam. As in the prior models, I estimate the marginal effects separately for male and female students as presented in equation 4.3.

$$\begin{aligned} \Pr^{M,F}(B.S./B.A./Minor/Non_i = 1) = & \beta_0 + \beta_1 Minority + \beta_2 Age \text{ at Int Micro} + \\ & \beta_3 Age \text{ at Int Micro}^2 + \beta_4 SAT \text{ Math} + \beta_5 SAT \text{ Verbal} + \\ & \beta_6 Econ \text{ Major at Int Micro} + \beta_7 Senior \text{ at Int Micro} + \\ & \beta_8 Int \text{ Micro Grade} + \beta_9 Relative \text{ Int Micro Grade} + \beta_{10} Calculus \end{aligned} \quad (4.3)$$

Finally, I use a binary logit model to compare the differences between men and women who graduated with either a B.S. in economics or a B.A. in economics. I use the same variables as presented in equation 4.3, but the student sample includes only students



who completed an intermediate microeconomics course and graduated with an economics major. I also estimate separate results for male and female students.

#### **4.4 Results**

Tables 4.6 and 4.7 present the marginal effects at the mean estimates for the effect of student, instructor, and structural characteristics on men and women's decisions to enroll in Introduction to Macroeconomics and an intermediate microeconomics course, respectively. In each table, Model 1 shows the effect of student characteristics for students who took all of their courses at UD. Model 2 incorporates students who received course equivalency through an AP exam, and Model 3 uses the same student sample as in model 1 with the addition of instructor and structural variables.

##### **4.4.1. Introduction to Macroeconomics Course Persistence**

The results from Table 4.6 indicate that female minority students are less likely to take Introduction to Macroeconomics after completing Introduction to Microeconomics. In terms of high school preparation, male students with higher math SAT scores are significantly less likely to enroll in macroeconomics, while neither the math nor verbal SAT scores are a significant predictor of persistence for women. Among students who received course equivalency for introductory microeconomics (Model 2), men who come from a state that requires students to complete a high school course in economics for graduation are more likely to persist in taking macroeconomics. In all three models, both male and female students have an increased probability of persistence if they are business majors upon matriculation, though the effect is slightly larger for women than men. This result is expected, given that all students who graduate with a business degree must complete both Introduction to Microeconomics and Introduction to Macroeconomics.

Table 4.6 Marginal Effects for Introduction to Macroeconomics Course Persistence

Variable	Model 1		Model 2		Model 3	
	Male	Female	Male	Female	Male	Female
Minority	0.009 (0.016)	-0.044* (0.018)	-0.004 (0.014)	-0.062*** (0.015)	0.009 (0.016)	-0.047** (0.018)
Age at Micro	0.032 (0.198)	0.091 (0.256)			0.042 (0.202)	0.105 (0.258)
Age at Micro <sup>2</sup>	-0.003 (0.005)	-0.005 (0.007)			-0.003 (0.005)	-0.006 (0.007)
SAT Math	-0.004** (0.001)	-0.002 (0.001)			-0.004*** (0.001)	-0.002 (0.001)
SAT Verbal	-0.001 (0.001)	-0.0001 (0.001)			-0.001 (0.001)	-0.0002 (0.001)
HS Econ Required	-0.002 (0.017)	-0.009 (0.018)	0.036* (0.016)	0.022 (0.016)	-0.002 (0.017)	-0.008 (0.018)
Economics Entry	0.028 (0.044)	0.095 (0.084)	0.015 (0.038)	0.061 (0.072)	0.031 (0.044)	0.097 (0.084)
Business Entry	0.166*** (0.015)	0.191*** (0.016)	0.203*** (0.011)	0.259*** (0.012)	0.167*** (0.015)	0.193*** (0.016)
Non-Fresh at Micro	-0.064*** (0.016)	-0.090*** (0.017)			-0.067*** (0.016)	-0.092*** (0.017)
Micro Grade	0.057*** (0.009)	0.021 (0.015)			0.056*** (0.009)	-0.021 (0.049)
Relative Micro Grade	-0.027 (0.016)	0.102* (0.050)			-0.025 (0.016)	0.102* (0.050)
Micro Repeater	0.152** (0.044)	0.229*** (0.049)			0.147** (0.045)	0.225*** (0.049)
AAP at Micro	-0.084** (0.027)	-0.176*** (0.032)			-0.168*** (0.042)	-0.267*** (0.042)
AP Micro Pass			0.250** (0.078)	0.124 (0.109)		
Fem Micro Prof					-0.112** (0.039)	-0.068 (0.040)
Fem Micro Adjunct					0.043 (0.040)	0.088 (0.046)
Male Micro Adjunct					-0.043 (0.042)	-0.067 (0.050)
Fem Micro Grad TA					-0.115*** (0.030)	-0.054 (0.031)
Male Micro Grad TA					-0.041 (0.026)	-0.025 (0.025)
Micro Class Size					-0.0004** (0.0001)	-0.0002* (0.0001)
Micro Percent Female					0.381*** (0.080)	0.145 (0.088)
Observations	6,270	6,095	7,951	6,988	6,270	6,095
% Correctly predicted	64.0%	65.5%	58.6%	58.9%	64.1%	65.7%
Log Likelihood	-4,268.03	-3,814.87	-5,293.07	-4,622.57	-4,246.38	-3,807.61

Notes: The marginal effects are evaluated at the means. Standard errors are in parenthesis.

\*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

A student's year in college is also a significant determinant of persistence for both men and women. Students who take Introduction to Microeconomics after their freshman year have a decreased probability of persistence to Introduction to Macroeconomics. Additionally, female students who repeat their introductory microeconomics course have a significantly higher likelihood of persistence, though this variable is not significant for male students. Both men and women who complete Introduction to Microeconomics through the Associate in Arts Program are significantly less likely to enroll in Introduction to Macroeconomics. The results from Model 2 also indicate that men who pass the AP Microeconomics exam with a score of 3 or higher have higher probabilities of persistence. Neither of these variables, however, is a significant determinant of course persistence for women.

Although both male and female students are significantly affected by their introductory microeconomics course grade, they are influenced much differently. For male students, a higher absolute grade in Introduction to Microeconomics is a significant, positive predictor of persistence. Specifically, men who earn a one-unit letter grade above the sample average (from a B- to an A-) are 6% more likely to take Introduction to Macroeconomics. On the other hand, male students' grades in Introduction to Microeconomics relative to their grades in other departments' courses completed during the term in which they take their introductory microeconomics course do not have significant effects. For women, the absolute microeconomics course grade is not a significant predictor of persistence; however, women who earn a relative microeconomics grade one unit above the sample average are 10% more likely to enroll in Introduction to Macroeconomics.

The results from Model 3 indicate that, apart from class size, instructor and structural characteristics are not significantly correlated with female macroeconomics course persistence. For both men and women, the number of students in their economics class is a significant, negative predictor of enrolling in macroeconomics, but the size of the marginal effect is very small. In addition, male students who take their Introduction to Microeconomics course with a female professor or a female graduate student instructor are approximately 11% less likely to take Introduction to Macroeconomics. In contrast with prior research, men who have a larger percentage of women in their introductory microeconomics course are more likely to enroll in Introduction to Macroeconomics.

#### **4.4.2. Intermediate Microeconomics Course Persistence**

Table 4.7 provides the marginal effect estimates for persistence to an intermediate microeconomics course, conditional upon students having completed or received equivalency for both introductory economics courses. Consistent with prior research, math SAT scores have a strong positive effect on both male and female enrollment in an intermediate microeconomics course. Additionally, a higher verbal SAT score decreases men's probability of persistence, but verbal SAT scores have no effect on female students' persistence. In Model 2, students who select economics as their major upon matriculation are significantly more likely to enroll in an intermediate microeconomics course, and the effect size for women is over twice the size of the effect for men. On the other hand, both male and female students whose initial major is business are significantly less likely to enroll in an intermediate microeconomics course.

Table 4.7 Marginal Effects for Intermediate Microeconomics Course Persistence

Variable	Model 1		Model 2		Model 3	
	Male	Female	Male	Female	Male	Female
Minority	0.023 (0.020)	0.022 (0.013)	0.024 (0.013)	0.012 (0.009)	0.025 (0.020)	0.021 (0.013)
Age at Macro	0.221 (0.260)	-0.040 (0.195)			0.242 (0.261)	-0.030 (0.192)
Age at Macro <sup>2</sup>	-0.007 (0.007)	0.001 (0.005)			-0.007 (0.007)	0.0004 (0.005)
SAT Math	0.008*** (0.001)	0.005*** (0.001)	0.010*** (0.001)	0.006*** (0.0005)	0.008*** (0.001)	0.005*** (0.001)
SAT Verbal	-0.004** (0.001)	0.00003 (0.001)	-0.0003 (0.001)	-0.0002 (0.0005)	-0.004** (0.001)	-0.0001 (0.001)
Economics Entry			0.276*** (0.041)	0.658*** (0.075)		
Business Entry			-0.031** (0.010)	-0.023*** (0.006)		
Econ Major at Macro	0.455*** (0.041)	0.650*** (0.071)			0.454*** (0.041)	0.644*** (0.072)
Bus Major at Macro	-0.149*** (0.016)	-0.058*** (0.009)			-0.154*** (0.017)	-0.058*** (0.009)
Non-Fresh at Macro	0.014 (0.030)	-0.004 (0.031)			0.015 (0.030)	-0.003 (0.030)
Macro Grade	0.053** (0.015)	0.010 (0.010)			0.052** (0.015)	0.009 (0.011)
Relative Macro Grade	0.127** (0.045)	0.182*** (0.034)			0.138*** (0.115)	0.183*** (0.034)
Macro Repeater	0.087 (0.092)	0.190 (0.135)			0.095 (0.093)	0.195 (0.135)
AAP at Macro	-0.189*** (0.028)	0.015 (0.037)			-0.159** (0.045)	-0.007 (0.038)
AP Micro Pass			0.218*** (0.046)	0.169*** (0.032)		
AP Micro/Macro Pass			0.289*** (0.038)	0.121*** (0.031)		
Fem Macro Prof					0.054 (0.043)	0.030 (0.027)
Fem Macro Adjunct					-0.025 (0.072)	0.050 (0.057)
Male Macro Adjunct					0.177* (0.089)	0.024 (0.042)
Fem Macro Grad TA					-0.021 (0.039)	-0.013 (0.020)
Male Macro Grad TA					0.040 (0.034)	0.007 (0.019)
Macro Class Size					0.0002 (0.0001)	0.00001 (0.0001)
Macro Percent Female					0.101 (0.087)	-0.001 (0.051)
Observations	3,878	3,333	7,926	6,968	3,878	3,333
% Correctly Predicted	72.9%	89.9%	76.6%	90.8%	73.1%	89.9%
Log Likelihood	-2,145.19	-983.714	-4,193.62	-2,004.84	-2,139.53	-980.786

Notes: The marginal effects are evaluated at the means. Standard errors are in parenthesis.

\*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

The results from Models 1 and 3 indicate that a student's choice of major by the time they complete Introduction to Macroeconomics is the largest predictor of persistence to an intermediate microeconomics course for both men and women. Relative to students who choose a major outside of Lerner College of Business and Economics, women who select an economics major are approximately 65% more likely to enroll in an intermediate microeconomics course, while male economics majors are 46% more likely to persist. Conversely, both male and female students who choose to major in business are less likely to enroll in an intermediate microeconomics course relative to their counterparts who major in an academic domain outside of Lerner College of Business and Economics. The magnitude of the effect for this variable is also much larger for men than for women.

A student's Introduction to Macroeconomics course grade is also a significant predictor of enrolling in an intermediate microeconomics course, but male and female students have differential responses to their course grades. Consistent with prior literature, women's relative Introduction to Macroeconomics course grades positively affects their persistence to an intermediate microeconomics course, though their absolute grades are not significantly correlated with persistence. For men, both their absolute and relative Introduction to Macroeconomics course grades are significant, positive predictors of enrolling in an intermediate microeconomics course. The strength of the effect for the relative grade is larger for women, however. In addition, both male and female students who pass Advanced Placement economics exams have a significantly positive likelihood of persistence, even when they pass only AP Microeconomics. The magnitudes of the effects for passing an AP exam differ by gender, however. The effect sizes are larger for

men. Also, male students who take microeconomics through the Associate in Arts Program are 19% less likely to persist although this variable is not significant for women.

The results from Model 3 suggest that, with the exception of men who take Introductory to Macroeconomics with a male adjunct instructor, introductory macroeconomics course instructors are not significant predictors of enrolling in an intermediate course. Men who take macroeconomics with a male adjunct instructor are nearly 18% more likely to persist to an intermediate microeconomics course. Additionally, neither the class size nor the percentage of women in a student's introductory macroeconomics course is correlated with male or female students' decision to enroll in an intermediate microeconomics course.

#### **4.4.3 Economics Degree Selection**

Table 4.8 provides the marginal effects at the mean estimates for a multinomial logit model of economics degree selection, conditional upon students having taken an intermediate microeconomics course. The results show the probability that male and female students will graduate with a B.S. in economics degree, a B.A. degree in economics, or a minor in economics. The reference group is students who earn no economics degree. Men's math ability is a significant predictor of the type of economics degree selected. Men with a higher math SAT score have a significantly higher probability of completing a B.S. in economics degree but a significantly lower likelihood of graduating with an economics minor. Women's math SAT scores are not a significant predictors of their economics degree selection; however, women who earn a higher verbal SAT score are significantly more likely to complete a minor in economics. Men's verbal SAT scores have no significant effect on their economics degree selection.

Table 4.8 Marginal Effects for Multinomial Logit of Economics Degree Selection

Variable	Male Students			Female Students		
	B.S. Econ	B.A. Econ	Econ Minor	B.S. Econ	B.A. Econ	Econ Minor
Minority	0.014 (0.044)	0.046 (0.035)	-0.049 (0.056)	0.006 (0.046)	-0.014 (0.017)	0.080 (0.096)
Age at Int Micro	-0.858 (0.511)	-0.086 (0.342)	1.904* (0.739)	0.965 (0.761)	0.039 (0.293)	0.976 (1.480)
Age at Int Micro <sup>2</sup>	0.021 (0.013)	0.003 (0.008)	-0.047* (0.018)	-0.025 (0.019)	-0.0002 (0.007)	-0.025 (0.037)
SAT Math	0.006* (0.003)	-0.001 (0.002)	-0.007* (0.003)	0.002 (0.003)	-0.002 (0.001)	-0.009 (0.006)
SAT Verbal	-0.0001 (0.002)	0.001 (0.002)	0.001 (0.003)	0.0003 (0.003)	0.003 (0.002)	0.013* (0.006)
Econ Major at Int Micro	0.634*** (0.030)	0.194*** (0.026)	-0.532*** (0.027)	0.529*** (0.074)	0.302*** (0.068)	-0.608*** (0.046)
Senior at Int Micro	-0.067 (0.040)	-0.097** (0.033)	0.149** (0.054)	-0.022 (0.042)	-0.083 (0.047)	0.420*** (0.086)
Int Micro Grade	-0.051 (0.041)	-0.080** (0.028)	0.233*** (0.056)	0.060 (0.050)	-0.008 (0.022)	0.071 (0.113)
Relative Int Micro Grade	0.194 (0.146)	0.404** (0.103)	-0.496* (0.202)	-0.087 (0.176)	0.129 (0.096)	-0.232 (0.412)
Calculus	0.089** (0.031)	-0.081** (0.031)	-0.071 (0.048)	0.044 (0.034)	-0.021 (0.021)	0.041 (0.078)
Observations	876			333		
Log Likelihood	-736.242			-237.057		

*Notes:* The marginal effects are evaluated at the means. Standard errors are in parentheses. The reference group is students who graduate with a non-economics degree.

\*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

Relative to students who choose a non-economics degree, the biggest determinant of graduating with a degree in economics is whether the student was an economics major at the time of completing an intermediate microeconomics course. This variable has differential effects for men and women. Compared to their non-economics major counterparts, men who have declared economics as a major at the time of taking an intermediate microeconomics course have a higher probability of completing a B.S. degree by 63%, compared to 53% for women. Female economics majors are 30% more likely than non-majors to complete a B.A. degree in economics relative to 19% of men.



Students of both genders who are economics majors are significantly less likely to earn a minor in economics though the magnitude of this effect is stronger for women.

Students' absolute and relative course grades in intermediate microeconomics are significant predictors of economics degree selection for men only. Men who earn a full letter grade above the sample average (from a B- to an A-) are 8% less likely to choose the B.A. in economics but 23% more likely to earn an economics minor. Male students' relative intermediate microeconomics grades are also correlated with the type of degree chosen. Men's relative course grades have positive effects on their selection of a B.A. degree but negative effects on the decision to earn an economics minor. In addition, male students who take calculus or pass an AP Calculus exam have a higher probability of selecting a B.S. degree in economics. The effect of taking calculus does not significantly predict female students' economics degree selection, however.

Among students who have chosen an economics major, gender differences exist in the type of economics degree earned. Marginal effect estimates for a binomial logit model comparing students' selection of either a Bachelor of Science or Bachelor of Arts in economics are presented in Table 4.9. Students who complete a B.S. in economics degree are the reference group. Women are more likely to choose the B.S. degree if they earn a math SAT score that is one unit above the sample mean. On the other hand, women who earn a verbal SAT score that is higher than the sample average have a higher probability of choosing the B.A. degree in economics. Comparatively, a male student's choice of economics degree is determined only by his math achievement. Men's verbal SAT scores are not a significant predictor of the type of economics degree they select, but male students with stronger math ability are less likely to choose the B.A. degree.

Table 4.9 Marginal Effects for Binomial Logit of Economics Major Choice

Variable	Male Students	Female Students
	B.A. Econ	B.A. Econ
Minority	0.075 (0.075)	-0.164 (0.165)
Age at Int Micro	1.194 (0.820)	-4.593 (3.493)
Age at Int Micro <sup>2</sup>	-0.029 (0.020)	0.124 (0.089)
SAT Math	-0.010* (0.005)	-0.024* (0.010)
SAT Verbal	0.002 (0.004)	0.025* (0.011)
Econ Major at Int Micro	-0.157 (0.113)	0.309 (0.186)
Senior at Int Micro	-0.115 (0.062)	-0.469** (0.131)
Int Micro Grade	-0.102 (0.062)	-0.422* (0.199)
Relative Int Micro Grade	0.685** (0.228)	2.036** (0.751)
Calculus	-0.326*** (0.060)	-0.331** (0.120)
Observations	327	93
Log Likelihood	-173.333	-45.107

*Notes:* The marginal effects are evaluated at the means. Standard errors are in parenthesis. The reference group is students who earn a B.S. degree.

\*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

Female students who take an intermediate economics course during their senior year have a significantly lower probability of graduating with a B.A. degree, but this variable has no significant effect on men's economics major selection. Additionally, female economics majors who earn a higher absolute grade in their intermediate microeconomics course are less likely to choose the B.A. in economics, while earning a higher relative intermediate course grade has a positive effect on the choice of a B.A. degree. For men, the relative intermediate microeconomics course grade is a significant, positive predictor of selecting the B.A. in economics, but men's absolute grades do not affect their degree selection. In addition, the magnitude of the effect for the relative

course grade is nearly three times larger for women than men. As expected, both male and female students who complete calculus have a lower probability of graduating with a B.A. degree.

#### **4.5 Discussion**

The findings presented in this chapter indicate that one of the greatest determinants of economics course persistence and the propensity to graduate with an economics degree is whether students choose to major in economics early in their college career. Although only a small percentage of students, both male and female, are economics majors upon matriculation, the number of majors increases among students who persist into higher-level courses. Women who choose to major in economics by the time they complete their second economics course have a higher probability of persistence than men, suggesting that women's experiences in their introductory economics courses may either encourage or dissuade women from entering the economics major. Additionally, prior research suggests that students who complete a high school economics course are more likely to select an economics major (Ashworth & Evans, 2001; Bansak & Starr, 2010; Lopus, 1997). For female students in particular, the choice of college major may be significantly influenced by taking a high school course in the subject (Malgwi et al., 2005). The results from this chapter also find support for prior research indicating that students who complete an AP Microeconomics or AP Macroeconomics course in high school may be more inclined to earn an economics degree, especially if they earn a score of 4 or 5 on the AP exam (Avery et al., 2016; Morgan & Klaric, 2007).

The results are consistent with prior research suggesting that among students who complete a first course in introductory microeconomics, fewer women persist to a second

economics course (Rask & Tiefenthaler, 2008; Emerson et al., 2012). Many students who do enroll in an introductory macroeconomics after completing an introductory microeconomics course may do so because of requirements for another degree program. For instance, anyone who chooses a business major within Lerner College of Business and Economics must pass both Introduction to Microeconomics and Introduction to Macroeconomics. Since the effect on macroeconomics persistence of being a business major at the time of matriculation is stronger for women than for men, it may be the case that many of the women who do enroll in a second economics course may do so only to fulfill the requirements for the business major. Furthermore, only economics majors and minors are required to take an intermediate microeconomics course, so it is not surprising that business students are less likely to enroll in an intermediate-level course.

In addition, students may consider economics and business degrees as substitutes (Brasfield et al., 1996; Salemi & Eubanks, 1996). Prior research suggests that universities and colleges that have business schools have fewer economics majors (Dean & Dolan, 2001; Siegfried & Bidani, 1992). Because Lerner College of Business and Economics offers both business and economics degrees, business students may display a lower likelihood of persistence to an intermediate-level course. Students who major in business may also be attracted to a minor in economics, and economics minors must complete one of the four intermediate microeconomics courses that the Department of Economics offers. More women than men earn an economics minor, and the probability of persistence to intermediate microeconomics is more negative for men who major in business than for women. In fact, male business majors are two times less likely to enroll

in intermediate microeconomics than their female counterparts. Thus, female business majors may be more inclined to select an economics minor.

Students' economics course grades are also a significant determinant of economics course persistence and degree selection (Butcher et al., 2014; Calkins & Welki, 2006; Chizmar, 2000; Ohland et al., 2004; Rask & Bailey, 2002; Riegle-Crumb et al., 2016). Prior research has indicated that women have a greater sensitivity than men to their economics course grades (Goldin, 2015a; Rask & Tiefenthaler, 2008; Sabot & Wakeman-Linn, 1991). The results of this study support that conclusion. Calkins and Welki (2006) found that women are more likely to perceive that their grades in introductory economics are too low and are thus less likely to select an economics major. Female students may need an A or A- in their initial economics course for them to continue to study economics (Goldin, 2015a; Owen, 2010). In this study, the mean grade for women who take Introduction to Microeconomics is equivalent to a B- letter grade. Although the mean economics course grades increase for women who take subsequent classes, women may base their decisions to take additional courses heavily on the grades they receive in their very first economics course. They may perceive that their microeconomics course grades are simply too low, and that a low grade in an introductory course suggests they will continue to earn low grades if they take additional economics courses (Beyer, 1999; Correll, 2001).

Grades are also linked to students' ability self-efficacy, and women may be more inclined to perceive performance feedback in the form of grades as an indication of their ability in a particular academic domain (Beyer & Langenfeld, 2000; Correll, 2004; Ost, 2010; Sabot & Wakeman-Linn, 1991). In addition, the grades a student receives in one

department's courses relative to the grades they earn in courses within other departments may be associated with students' perceptions of their economics ability. Findings from this chapter strengthen the results from prior research, which indicate that women's relative microeconomics and macroeconomics course grades, but not their absolute grades, are a significant predictor of persistence to a subsequent economics course (Emerson et al., 2012; Rask & Tiefenthaler, 2008). Female students' mean relative microeconomics and macroeconomics course grades are also significantly lower than men's mean relative grades in these economics courses. As a result, women may perceive that a low relative grade is an indication that economics is not an academic strength. They may believe that they will not do well in future economics courses and may decide not to take additional economics courses for that reason.

In addition, some evidence suggests that male students who major in economics have lower grades in their economics courses and lower grades overall. Students may view economics and business as close substitutes, and men may be more likely to earn an economics degree because they cannot satisfy the minimum grade requirements needed to complete a degree in business (Goldin, 2015a; Marangos, 2012; Salemi & Eubanks, 1996). At UD, the Department of Economics has a lower minimum GPA requirement than any of the other departments within Lerner College of Business and Economics (see Table 3.3). The results from this chapter, however, indicate that men who have higher grades in economics are more likely to persist, suggesting that men who continue to take economics courses may do so because they earn higher grades.

Another important factor in economics degree selection may be related to students' math and verbal abilities. Students' scores on standardized tests have only a

small effect on their economics degree selection, a finding that is consistent with prior research (Dynan & Rouse, 1997; Horvath et al., 1992; Keys & Turner, 2006). Even though students' SAT scores may not have a strong effect on the selection of an economics degree relative to a non-economics degree, the results from this chapter indicate that women may choose a particular type of economics degree based on their relative math and verbal abilities. Women who earn a verbal SAT score that is greater than their math SAT score may choose the B.A. in economics because the B.A. degree does not require students to take calculus. They may also perceive they have an advantage in the required foreign language component for that degree when they earn a higher verbal SAT score. On the other hand, women who have a comparative advantage in math over English may be more likely to choose the B.S. in economics degree. Fewer women take a college-level calculus course, and women who do take calculus may feel that they have strong enough math skills to satisfy the quantitative requirements of the B.S. degree. These results suggest that women with different academic skills may be attracted to the two different economics majors offered at the University of Delaware. Men are more likely to take calculus, and men tend to have a comparative advantage in math over English. Thus, they may primarily consider their math ability when determining which type of economics degree to select.

Additionally, the findings from this study are consistent with the mixed results related to instructor characteristics found in the literature. Taking a course with a female instructor is not a significant predictor of course persistence for women, which is consistent with some of the research on the gender role-model effect of instructors (Fournier & Sass, 2000; Robb & Robb, 1999). Although instructor gender does not

significantly affect women's decisions to take additional classes, a larger percentage of female students enroll in a macroeconomics course taught by a female graduate student, suggesting that there may still be some positive gender role model effect for women. Women may be self-selecting into classes taught by a female graduate student because they identify with young women who are pursuing an advanced academic degree (Griffith, 2010). For male students, taking microeconomics with a full-time female professor or a female graduate student, relative to a full-time male professor, results in a lower probability of enrolling in macroeconomics. Male professors may increase their male students' interest in taking a subsequent economics class because they perceive the instructor to be similar to themselves (Carrell et al., 2010; Jensen & Owen, 2001; Rask & Bailey, 2002). Another way in which instructors may influence student persistence is indirectly through course grades. Griffith (2014) found that students receive higher grades from instructors who are the same gender. Since male students are significantly more likely to enroll in macroeconomics when they earn a higher grade in their microeconomics course, they may be deterred from doing so if they receive a low grade from a female instructor.

In terms of the structural characteristics, the finding that students who take microeconomics in a larger class are less likely to persist is supported indirectly through research about the effect of class size on introductory economics course grades. Students tend to perform better if they take their introductory courses in a smaller class (Arias & Walker, 2004; Kokkelenberg et al., 2008). On the other hand, the results indicating that men are more likely to enroll in macroeconomics if they have a greater proportion of women in their microeconomics class are the opposite of what prior studies have found.



In fact, some prior research has suggested that female students' persistence is positively influenced by having more women in their economics courses, while male students' persistence is negatively affected by more women in the class (Dynan & Rouse, 1997; Emerson et al., 2012; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008). One possible explanation for the finding from this study is that some research suggests that college students who are exposed to academic environments with greater gender diversity have more positive performance outcomes (Fenwick & Neal, 2001; Umans et al., 2008). Since men's absolute economics course grades are positive predictors of their economics course persistence, men who take their introductory classes with a larger percentage of females may earn higher grades and be more likely to enroll in subsequent economics courses. Also, over half of men take microeconomics as a freshman. The mean cumulative GPA for men at the time of taking Introduction to Microeconomics is significantly lower than the mean female cumulative GPA, so male students may actually experience better course performance when they are around higher ability peers (Ost, 2010). The research on peer effects, however, is very limited, and more research is needed on how peer attributes and interactions affect outcomes in economics courses.

In summary, the results from this chapter are consistent with prior research indicating that female students are less likely to persist in economics courses beyond a first course, especially when an introductory microeconomics course is required for their major. Furthermore, women are less likely than men to earn an economics degree. An important finding is that female students who declare an economics major by the time they take their second course have a higher likelihood than their male counterparts of

enrolling in an intermediate microeconomics course and graduating with an economics degree. Students' absolute and relative economics course grades are also significant predictors of economics course persistence for both men and women. In particular, women who earn higher grades in their introductory economics courses relative to the grades received in other departments' courses are significantly more likely to take subsequent economics course. Furthermore, women's economics degree selections are affected by both their math and verbal aptitudes, while men's decisions to earn economics degrees are significantly correlated with their math abilities. Additional research may explore gender differences in students' perceptions of their economics course grades and self-efficacy beliefs related to the study of economics. Furthermore, more research is needed into how male and female students' math and verbal abilities affect the type of economics degree they select.

## **Chapter 5**

### **THE GENDER GAP IN UNDERGRADUATE ECONOMICS DEGREE ATTAINMENT BASED ON INITIAL MAJOR SELECTION**

This chapter assesses the gender gap in undergraduate students' economics degree completion based on their major at matriculation. In addition, this study analyzes the effect of male and female students' grades in Introduction to Microeconomics on their propensity to complete an economics degree. The research is guided by the following question identified in Section 1.2: How do a student's initial major selection and introductory microeconomics course grade differentially affect male and female students' propensities to earn economics degrees?

#### **5.1 Introduction**

For many students, the college degree selection process is a dynamic one. Although some students choose an initial major and remain in it through graduation, many students change majors at some point. In fact, research suggests that as many as 40% of students switch majors at least once (Astorne-Figari & Speer, 2017; Dickson, 2010; Kugler et al., 2017). Nationwide less than two percent of undergraduate students earn a bachelor's degree in economics (Siegfried, 2016; Stock, 2017). An even smaller proportion of students enter university as economics majors, suggesting that many of the students who earn an economics degree switch into it from another major (Mumford & Ohland, 2011). Students may also graduate with more than one major, and economics may be a popular choice for a second major (Stock, 2017). Among those who select economics as a major,

female students are underrepresented. Women earn only about one-third of all undergraduate economics degrees (Ball, 2012; Bayer & Rouse, 2016; Ceci et al., 2014; Goldin, 2013; Kim et al., 2002; McElroy, 2014; National Center for Education Statistics, 2017; Rask & Tiefenthaler, 2008; Siegfried, 2016).

With an emphasis on gender, this chapter uses a series of multinomial logistic regressions to assess how differences in students' initial major selections affect their likelihood of graduating with economics degrees. I also analyze how male and female students' performances in their first economics courses affects their propensity to select economics degrees. Findings indicate that both male and female students who initially choose to major in economics have a strong probability of completing an economics major and are less likely to earn an economics minor. Students who complete an economics degree also come from a large selection of initial majors, including undeclared students. In addition, the results suggest that male and female students who complete economics degrees may be drawn in from different initial majors. For example, male students who earn an economics major are more likely to matriculate as engineering majors, while female economics majors are more likely to be pulled in from an initial major in math, computer science, or applied economics. Among students who matriculate into the Alfred Lerner College of Business and Economics, male undeclared business students have a higher probability of completing an economics major than their female counterparts. In addition, male and female students display differential responses to their absolute and relative Introduction to Microeconomics course grades.

## 5.2 Data

The data used to conduct this study come from administrative records for 1,470 male and 667 female undergraduate students. All students in the sample completed Introduction to Microeconomics (ECON 101) between Fall 2006 and Spring 2014 and graduated by Winter 2016.<sup>11</sup> Each student record contains demographic characteristics, measurements of ability, and college coursework. The student records also contain information about each student's initial major selection and degrees earned, including both majors and minors.<sup>12</sup> Table 5.1 describes the variables used in this chapter.

Table 5.1 Summary of Student Variables

Variable	Description
Female	1 if student is female
Minority	1 if student is non-white
Age at Micro	Student's age in years at introduction to microeconomics
SAT Math	Student's Math SAT score
SAT Verbal	Student's Verbal SAT score
Non-Fresh at Micro	1 if student has greater than 27 cumulative credits at microeconomics
Economics Entry	1 if student's initial major was in economics
Business Entry	1 if student's initial major was in business
Bus Undeclared Entry	1 if student's initial major was in business undeclared
Engineering Entry	1 if student's initial major was in engineering
Hum/Health/Educ Entry	1 if student's initial major was in the humanities, health sciences, or education
Math/CSsci/Ap Econ Entry	1 if student's initial major was in math, comp. science, or applied econ
Natural Sciences Entry	1 if student's initial major was in the natural sciences
Social Sciences Entry	1 if student's initial major was in the social sciences
Undeclared Entry	1 if student's initial major was undeclared
Micro Grade	Student's microeconomics course grade
Relative Micro Grade	Student's micro grade/cum GPA from micro term without micro grade
Multiple Majors	1 if student graduated with more than one major degree
Econ Major	1 if student graduated with a B.S. or B.A. degree in economics
Econ Minor	1 if student graduated with a minor in economics

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<sup>11</sup> The University of Delaware awards degrees four times a year: February, May, August, and December.

<sup>12</sup> Students may complete multiple major degrees and/or multiple minor degrees.

Figure 5.1 shows the initial major selection for 297 male students who graduated with an economics major. Students who matriculated as business majors represent the largest share of men who completed an economics major, while the second largest share entered the University as undeclared majors. Nearly 11% of the male economics majors were initially engineering majors, and 9% of them entered into a social science field. Only 7% of the male economics majors matriculated as economics majors. Less than 5% of the men who graduated with an economics major initially selected a major in math, computer science, applied economics, the humanities, the health sciences, or education.

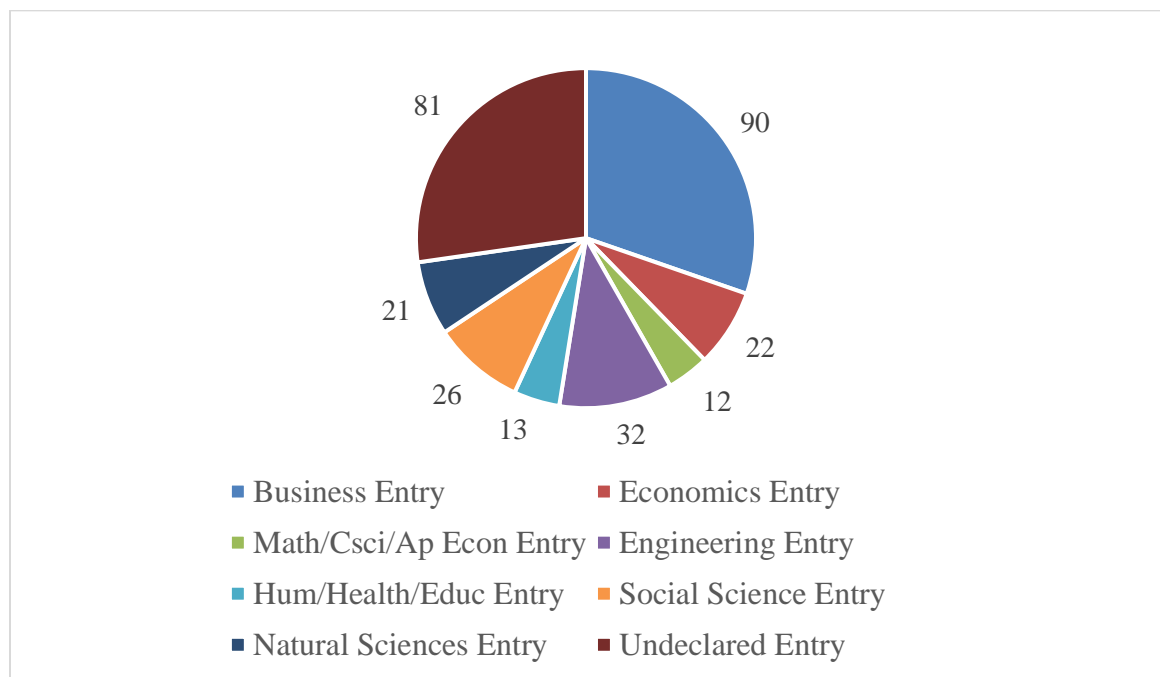


Figure 5.1 Number of Male Students Who Earned an Economics Major, Based on Initial Major Selection (N=297)

Figure 5.2 shows the initial major selection for 81 female students completed an economics major. Nearly 25% of the women initially entered as undeclared majors,

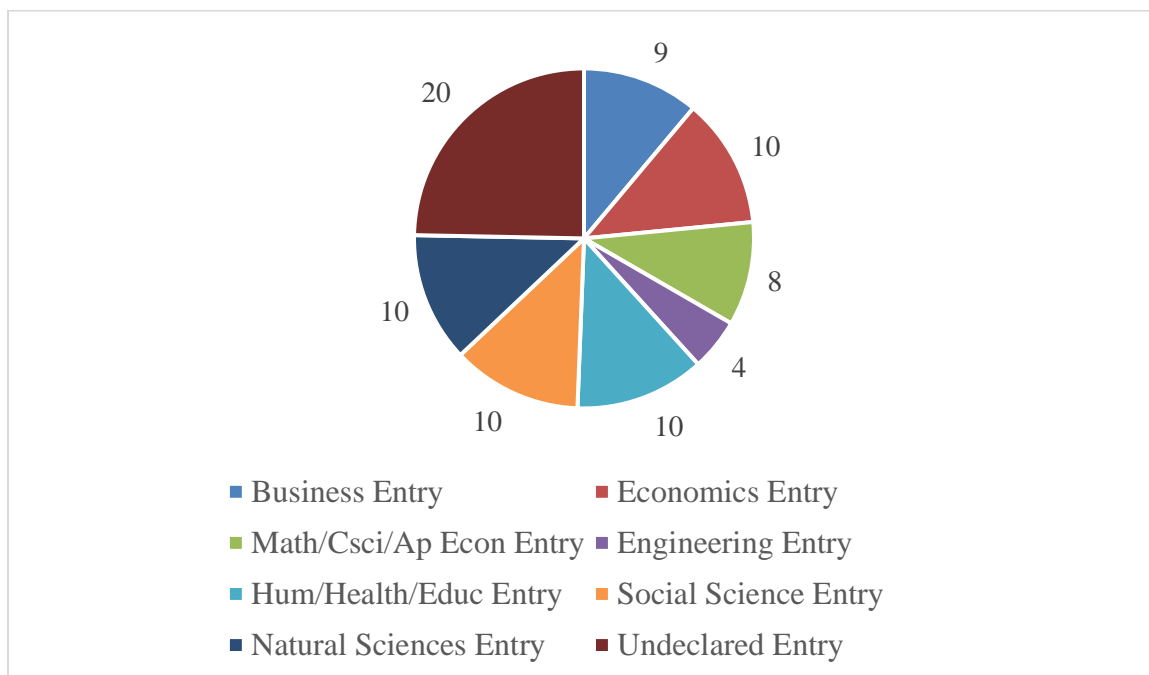


Figure 5.2 Number of Female Students Who Earned an Economics Major, Based on Initial Major Selection (N=81)

which represents the largest share of the economics majors. Women who matriculated as business majors represent 11% of the economics majors, while 10% initially selected economics as their major. The smallest share of women who graduated with an economics major were initially engineering majors.

Figure 5.3 shows the initial major selection for 351 male students who graduated with an economics minor. Initial business majors represent the largest share (approximately 44%) of male students who earn an economics minor. Approximately 24% of the economics minors were initially engineering majors, while 9% matriculated

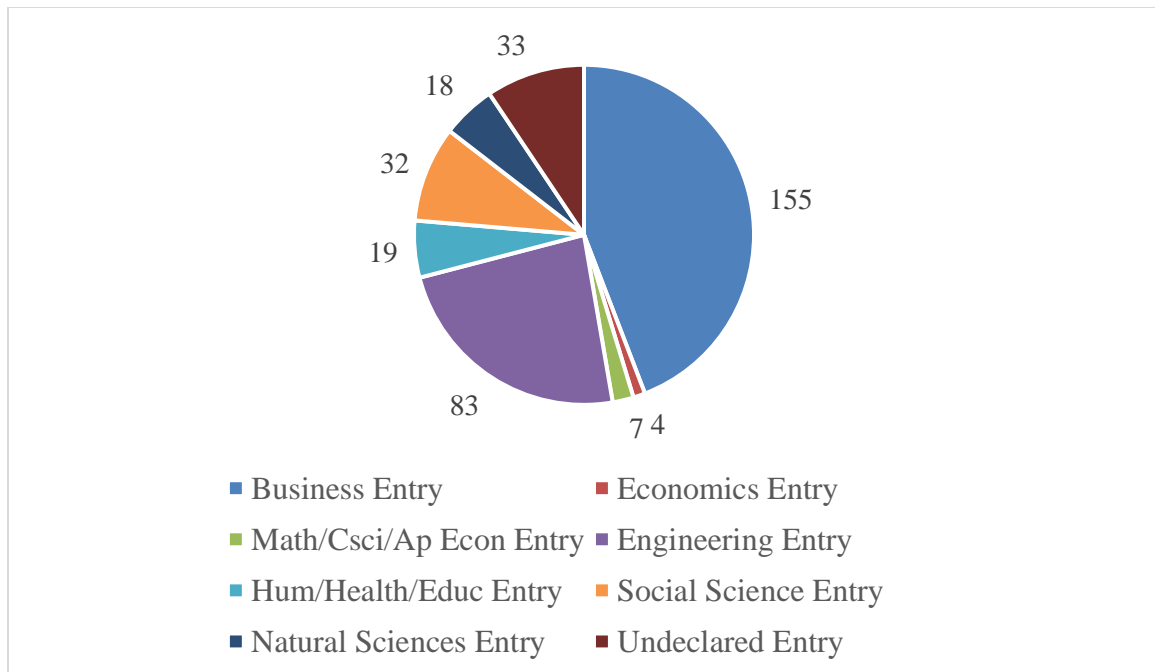


Figure 5.3 Number of Male Students Who Earned an Economics Minor, Based on Initial Major Selection (N=351)

as either a social science major or an undeclared student. Less than 2% of the male economics minors initially selected math, computer science, or applied economics. Only 4 of the students were initially economics majors.

Figure 5.4 shows the initial major selection for 160 female students who earned an economics minor. One-third of the female economics minors matriculated into the University as business majors, and 16% of them entered as undeclared students. Approximately 15% of the women who graduated with an economics minor entered the University as engineering or social sciences majors. Only 1 initial economics major graduated with an economics minor.



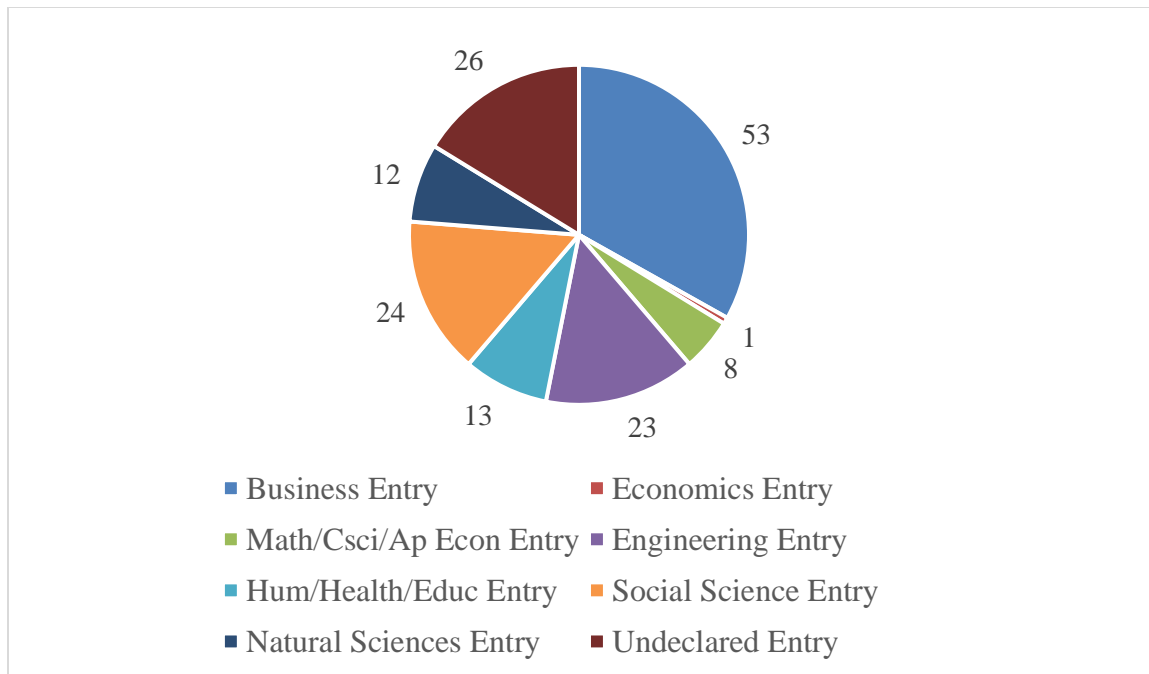


Figure 5.4 Number of Female Students Who Earned an Economics Minor, Based on Initial Major Selection (N=160)

### 5.2.1 Descriptive Statistics

Table 5.2 provides the descriptive statistics by gender for the full sample of students who completed Introduction to Microeconomics. Male students comprise about 69% of the students in the sample (n=1,470). There is no significant gender difference in the percentage of minority students in the sample, but the male students are slightly older on average. The mean math SAT score is significantly higher for men than for women, but female students have a significantly higher mean verbal SAT score. A significantly larger proportion of women took Introduction to Microeconomics (ECON 101) after their freshman year.

Table 5.2 Summary Statistics for Full Sample of Students

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.189	0.389	0.177	0.382	
Age at Micro	18.218	0.689	18.100	0.687	***
SAT Math	644.395	67.564	630.900	65.763	***
SAT Verbal	593.469	70.782	602.489	74.284	**
Non-Fresh at Micro	0.386	0.487	0.459	0.499	***
Economics Entry	0.027	0.161	0.019	0.138	
Business Entry	0.507	0.500	0.435	0.096	**
Bus Undeclared Entry	0.197	0.398	0.168	0.374	
Engineering Entry	0.127	0.333	0.067	0.251	***
Hum/Health/Educ Entry	0.039	0.193	0.076	0.266	***
Math/CSci/Ap Econ Entry	0.041	0.200	0.075	0.264	**
Natural Sciences Entry	0.045	0.207	0.060	0.238	
Social Sciences Entry	0.061	0.239	0.076	0.266	
Undeclared Entry	0.154	0.361	0.190	0.393	*
Micro Grade	3.024	0.707	3.023	0.688	
Relative Micro Grade	1.027	0.307	0.951	0.201	***
Multiple Majors	0.305	0.460	0.364	0.482	**
Econ Major	0.202	0.402	0.121	0.327	***
Econ Minor	0.239	0.426	0.240	0.427	
N	1,470		667		

Note: Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

All students in the sample chose only one major at matriculation.<sup>13</sup> No significant gender difference exists in the share of students in the sample who matriculated as economics majors. Over half of the men in the sample initially declared business as their major, which is a significantly larger proportion than the 44% of the female business majors. On the other hand, there is no significant gender difference in the share of male

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<sup>13</sup> Students who matriculated with more than one major are not included in the sample.

and female students who entered as undeclared business majors. Nearly twice the number of male students matriculated as engineering majors, while women significantly outnumbered men in the humanities, health sciences, and education fields by almost two to one. Additionally, significantly more women matriculated into the fields of math, computer science, and applied economics and as undeclared students. In contrast, no significant gender difference exists among students whose initial major was in the natural sciences or in a non-economics social science domain.

The mean Introduction to Microeconomics grade for both men and women is a 3.02, which is equivalent to a B letter grade. Although there is no significant gender difference in students' absolute grades in introductory microeconomics, male students' mean relative microeconomics grades are significantly higher than the mean relative microeconomics grade for women. Students' relative microeconomics grades are calculated by dividing their absolute grades in Introduction to Microeconomics by the grades they receive in other departments' courses that are taken during the same term. For female students, the average relative economics grade is less than one, indicating that the women in the sample performed slightly worse in Introduction to Microeconomics than in the other courses they completed that semester. Men's mean relative microeconomics grade is slightly above one, indicating that male students performed as well as, if not somewhat better, in Introduction to Microeconomics than in their other courses.

A significantly larger percentage of women graduated with multiple major degrees, though the percentage of female students who graduated with an economics major is significantly lower. Twenty percent of the male students completed an

economics major, compared to only 12% of the female students. In contrast, no significant gender difference exists among students who earn minors in economics. Approximately 24% of the male and female students completed economics minors.

The descriptive statistics by gender for the 1,049 students who matriculated into a major outside of Lerner College of Business and Economics are shown in Table 5.3. Male students are 65% of the sample ( $n=685$ ). While no significant gender difference exists in the proportion of minority students, the male students are significantly older on average. Consistent with the results for the full sample, the mean math SAT score is significantly higher for men. In contrast with the full sample, however, no significant gender difference exists in students' verbal SAT scores. Furthermore, 66% of the female students and 62% of the male students completed Introduction to Microeconomics after their freshman years, but the difference is not significant.

A significantly larger percentage of male students initially selected engineering as their major, while a significantly greater proportion of the female students matriculated into the humanities, health sciences, and education as well as math, computer science, and applied economics. No significant gender disparity exists in the share of students who initially chose majors in the natural or social sciences or who were initially undeclared majors. The mean grade in Introduction to Microeconomics for both male and female students is a 3.11, which is slightly above the mean grade for the full sample of students. Consistent with the full student sample, the mean relative Introduction to Microeconomics grade is significantly larger for men. There is no significant gender difference in the percentage of students who completed more than one major, but

Table 5.3 Summary Statistics for Non-Lerner College Students

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.171	0.377	0.165	0.372	
Age at Micro	18.496	0.775	18.338	0.722	**
SAT Math	645.036	73.384	631.429	70.266	**
SAT Verbal	599.314	76.048	605.220	78.612	
Non-Fresh at Micro	0.622	0.485	0.662	0.474	
Engineering Entry	0.272	0.445	0.124	0.330	***
Hum/Health/Educ Entry	0.083	0.276	0.140	0.348	**
Math/CSsci/Ap Econ Entry	0.089	0.285	0.137	0.345	*
Natural Sciences Entry	0.096	0.295	0.110	0.313	
Social Sciences Entry	0.130	0.336	0.140	0.348	
Undeclared Entry	0.330	0.471	0.349	0.477	
Micro Grade	3.105	0.717	3.114	0.718	
Relative Micro Grade	1.068	0.365	0.987	0.218	***
Multiple Majors	0.226	0.419	0.272	0.446	
Econ Major	0.270	0.444	0.170	0.376	***
Econ Minor	0.280	0.449	0.291	0.455	
N	685		364		

Note: Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

significantly fewer women earned a major in economics. As in the full sample, the percentage of men and women who received a minor in economics is about equal.

Table 5.4 presents the summary statistics by gender for the 1,088 students who matriculated into the Lerner College of Business and Economics. Male students represent 72% of the students in the sample ( $n=785$ ). Consistent with the results for the other two samples, there is no significant gender difference in the proportion of minority students in the sample, but the male students are significantly older on average. The mean math SAT score is significantly higher for males than females, while the mean verbal SAT score is

Table 5.4 Summary Statistics for Lerner College Students

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.199	0.399	0.191	0.394	
Age at Micro	17.976	0.488	17.815	0.514	***
SAT Math	643.834	62.083	630.264	60.016	**
SAT Verbal	588.369	65.468	599.208	68.711	*
Non-Fresh at Micro	0.181	0.385	0.238	0.426	*
Economics Entry	0.050	0.217	0.043	0.203	
Business Entry	0.950	0.217	0.957	0.203	
Bus Undeclared Entry	0.368	0.483	0.370	0.484	
Micro Grade	2.953	0.690	2.914	0.635	
Relative Micro Grade	0.991	0.239	0.908	0.169	***
Multiple Majors	0.373	0.484	0.475	0.500	**
Econ Major	0.143	0.350	0.063	0.243	***
Econ Minor	0.203	0.402	0.178	0.383	
N	785		303		

*Note:* Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

significantly higher for women. A significantly smaller share of the male students completed Introduction to Microeconomics after their freshman year.

In contrast with the results for the two previous student samples, no significant gender difference exists between students based on their initial major selection. Although there is no significant gender difference in the mean Introduction to Microeconomics course grades, male students' mean relative Introduction to Microeconomics grade is significantly higher than the mean relative grade for women. Furthermore, the absolute and relative grades for students of both genders are lower than the grades received by students who initially selected majors outside of Lerner College. A significantly larger percentage of the female students completed more than one major degree, but significantly fewer women graduated with economics majors. Over 14% of male business

students earned economics majors, compared to only 6% of the female students. Consistent with the prior samples, there is no significant gender difference in the percentage of men and women who earned a minor in economics.

### **5.3 Methodology**

A series of multinomial logistic regressions are used in this chapter to analyze students' economics degree selections. Students may select from three types of economics degrees: an economics major (either the B.A. or B.S. degree in economics), an economics minor, and a non-economics degree. I first estimate the probability that a student will graduate with an economics degree for the full sample of students, using students who select business as their initial major as the reference group. Next, I run two additional regressions: one for students who matriculated into Lerner College and one for students whose initial major was outside of Lerner College. In the regression for Lerner College students, the reference group is students who declared a specific business major, such as accounting or marketing, upon admission. This model also includes a dummy variable for students who initially entered as business undeclared students. In the model for students who matriculated into a major outside of Lerner College, I use students whose initial major was math, computer science, or applied economics as the reference group. The initial major groupings were selected based on prior studies that analyzed the likelihood that students would earn economics majors based on their major at matriculation (Fournier & Sass, 2000; Salemi & Eubanks, 1996; Ashworth & Evans, 2001; Asarta & Butters, 2012).

Recognizing that male and female students may have different propensities to earn economics degrees, I run separate regressions for men and women using equation

5.1. Student demographics characteristics, including their minority status and age at the time of taking Introduction to Microeconomics, are incorporated into the model. In addition, I control for student ability by including students' math and verbal SAT scores. Since SAT scores are reported in units of 10 (e.g. 550 and 560), students' math and verbal SAT scores were divided by 10. The model also includes students' initial majors at the time of matriculation as well as dummy variables to control for students' class years during the terms in which they completed Introduction to Microeconomics and if they graduated with more than one major. In addition, I include students' absolute and relative Introduction to Microeconomics grades.

$$\begin{aligned} \Pr^{M,F}(Econ\ Major/Econ\ Minor/Non_i = 1) = & \beta_0 + \beta_1 Minority + \beta_2 Age\ at\ Micro + \\ & \beta_3 Age\ at\ Micro^2 + \beta_4 SAT\ Math + \beta_5 SAT\ Verbal + \\ & \beta_6 Non-Fresh\ at\ Micro + \beta_7 Economics\ Entry + \\ & \beta_8 Engineering\ Entry + \beta_9 Hum/Health/Educ\ Entry + \beta_{10} Math/CSci/ \\ & Ap\ Econ\ Entry + \beta_{11} Natural\ Sciences\ Entry + \\ & \beta_{12} Social\ Sciences\ Entry + \beta_{13} Undelcared\ Entry + \beta_{14} Micro\ Grade + \\ & \beta_{15} Relative\ Micro\ Grade + \beta_{16} Multiple\ Majors \end{aligned} \quad (5.1)$$

## 5.4 Results

### 5.4.1 Economics Degree Selection for Full Sample of Students

Table 5.5 presents the marginal effects at the mean estimates by gender for the multinomial logistic regression of economics degree selection for the full sample of students. For both men and women, neither a student's minority status nor age at the time of completing Introduction to Microeconomics are significantly correlated with economics degree selection. Student's math and verbal SAT scores are also not



Table 5.5 Marginal Effects for Economics Degree Selection for Full Sample of Students

Variable	Male Students		Female Students	
	Econ Major	Econ Minor	Econ Major	Econ Minor
Minority	0.004 (0.027)	0.009 (0.030)	0.012 (0.029)	0.024 (0.048)
Age at Micro	-0.350 (0.422)	-0.379 (0.472)	-0.395 (0.308)	0.601 (0.798)
Age at Micro <sup>2</sup>	0.010 (0.011)	0.010 (0.013)	0.010 (0.008)	-0.017 (0.022)
SAT Math	-0.001 (0.002)	-0.001 (0.002)	-0.003 (0.002)	0.006 (0.003)
SAT Verbal	0.002 (0.002)	-0.0004 (0.002)	0.003 (0.002)	0.003 (0.003)
Non-Fresh at Micro	0.009 (0.025)	0.004 (0.028)	-0.016 (0.023)	-0.015 (0.042)
Economics Entry	0.576*** (0.071)	-0.173*** (0.027)	0.824*** (0.069)	-0.189*** (0.039)
Engineering Entry	0.119* (0.051)	0.139** (0.047)	0.172 (0.115)	0.204* (0.100)
Hum/Health/Educ Entry	0.201* (0.085)	0.052 (0.065)	0.381** (0.116)	-0.009 (0.072)
Math/CSci/Ap Econ Entry	0.120 (0.075)	-0.129** (0.038)	0.347** (0.117)	-0.132** (0.045)
Natural Sciences Entry	0.253** (0.077)	0.018 (0.058)	0.387** (0.128)	0.046 (0.094)
Social Sciences Entry	0.168** (0.065)	0.130* (0.062)	0.328** (0.113)	0.159 (0.091)
Undeclared Entry	0.319*** (0.044)	-0.110*** (0.026)	0.246** (0.071)	-0.034 (0.048)
Micro Grade	-0.058** (0.019)	0.132*** (0.022)	-0.009 (0.020)	0.054 (0.038)
Relative Micro Grade	0.208*** (0.048)	-0.199** (0.066)	0.172** (0.063)	-0.104 (0.133)
Multiple Majors	0.264*** (0.029)	-0.216*** (0.019)	0.072** (0.026)	-0.213*** (0.032)
Observations	1,470		667	
Log Likelihood	1,267.689		493.532	

Notes: The marginal effects are evaluated at the means. Standard errors are in parentheses. The reference group is students who selected business as their initial major.

\*p<0.05 \*\*p<0.01 \*\*\*p<0.001

significant predictors of choosing economics degrees for either gender. Both male and female students who select economics as their initial major are more likely to graduate with an economics major but are less likely to complete a minor in economics. The magnitude of the coefficients is larger for female economics majors at entry for both economics major and minor degree selection. Women whose initial major is economics are 82% more likely than female initial business majors (the reference group) to earn an economics major relative to a non-economics degree, whereas male initial economics majors are only 58% more likely to earn an economics major than their initial business major peers.

Gender differences in economics major selection also exist among students who matriculate into a major outside of Lerner College relative to initial business majors. Men whose initial major is engineering are 12% more likely than male business majors to complete an economics major, but the results are not significant for female initial engineering majors. Students of both genders whose initial majors are in the natural sciences, social sciences, and the humanities, health sciences, or education are significantly more likely to complete economics majors compared to initial business majors. Additionally, women who enter as math, computer science, or applied economics majors are 35% more likely to complete economics majors than female business majors. Male math, computer science, and applied economics majors, however, are not significantly more likely to earn economics majors than their initial business major peers. Both male and female students who are admitted as undeclared majors have significantly higher probabilities of earning economics majors than non-economics degrees, but the coefficient is larger for the men.

Some significant gender differences in economics minor selection are also apparent. Both male and female initial engineering majors are significantly more likely to earn economics minors when compared to their initial business major peers, though the size of the coefficient is stronger for women. Female initial engineering majors are 20% more likely to complete minors in economics, whereas their male counterparts are only 14% more likely than initial business majors to earn an economics minor. Among men, matriculating as a social science major is a significant positive predictor of graduating with an economics minor, but male students who enter as undeclared majors are significantly less likely to earn a minor in economics. In contrast, there is no significant effect on earning an economics minor among women who enter as social science or undeclared majors. In addition, both male and female initial math, computer science, and applied economics majors are about 13% less likely to earn an economics minor than their initial business major counterparts.

Consistent with prior research, male and female students exhibit different responsiveness to their grades (Emerson et al., 2012; Goldin, 2015a; Horvath et al., 1992; Rask & Tiefenthaler, 2008). Male students' absolute microeconomics grades are negatively correlated with earning an economics major but positively correlated with completing a minor in economics. A full letter grade increase from the mean Introduction to Microeconomics grade (e.g., a difference of a B and an A letter grade) results in a 6% decrease in the likelihood that a male student will earn an economics major but a 13% increase in the probability of earning a minor in economics. There is no significant effect of female students' absolute microeconomics grade for either type of economics degree. Both male and female students' relative microeconomics course grades, however, are

positively correlated with earning an economics major. In contrast with previous research, however, the effect is slightly stronger for men. For instance, a one-unit increase from the mean in a male student's relative microeconomics grade increases the probability of completing an economics major by 20%, compared to 17% for women. Additionally, male students' relative microeconomics grades are negatively correlated with economics minor selection, while women's relative microeconomics grades do not significantly affect completion of an economics minor. Also, men who earn more than one major degree are 26% more likely to earn an economics major, compared to females who have a 7% higher probability of earning an economics major if they graduated with more than one degree. Conversely, students of both genders who graduate with multiple major degrees are significantly less likely to complete an economics minor.

#### **5.4.2 Economics Degree Selection for Initial Lerner College Majors**

Table 5.6 presents the marginal effects at the mean estimates by gender for the regression on economics degree selection among students who matriculated into the Lerner College of Business and Economics. As with the findings from the full sample, students' math SAT scores are not significant predictors of economics major completion for either gender. In contrast to the findings from the full sample of students, however, women's math SAT scores are positively correlated with earning an economics minor. Male students' verbal SAT scores are positively associated with earning an economics major but negatively correlated with economics minor completion. The sizes of the coefficients for the significant SAT scores are small. For women, a ten-point increase from the mean score on the math SAT increases the probability of completing an economics minor by

Table 5.6 Marginal Effects for Economics Degree Selection for Lerner College Students

Variable	Male Students		Female Students	
	Econ Major	Econ Minor	Econ Major	Econ Minor
Minority	0.027 (0.030)	-0.004 (0.035)	0.001 (0.018)	-0.055 (0.053)
SAT Math	-0.002 (0.002)	0.002 (0.002)	-0.002 (0.001)	0.010* (0.004)
SAT Verbal	0.003* (0.002)	-0.005* (0.002)	0.001 (0.001)	-0.002 (0.004)
Non-Fresh at Micro	-0.036 (0.027)	0.021 (0.039)	-0.014 (0.011)	-0.035 (0.052)
Economics Entry	0.578*** (0.086)	-0.143*** (0.027)	0.722*** (0.160)	-0.090 (0.089)
Business Undeclared Entry	0.066** (0.025)	-0.061* (0.027)	0.004 (0.014)	-0.018 (0.046)
Micro Grade	0.012 (0.018)	0.099*** (0.026)	0.049* (0.019)	0.004 (0.053)
Relative Micro Grade	0.074 (0.041)	-0.104 (0.081)	-0.164* (0.078)	0.068 (0.190)
Multiple Majors	0.199*** (0.030)	-0.219*** (0.025)	0.014 (0.014)	-0.108* (0.046)
Observations	785		303	
-2 Log L	602.514		172.535	

*Notes:* The marginal effects are evaluated at the means. Standard errors are in parentheses. The reference group is students whose initial major was in declared business field. \*p<0.05 \*\*p<0.01 \*\*\*p<0.001

1%, whereas a similar increase in the mean verbal SAT score decreases male students' likelihood of earning an economics minor by 0.5%.

The results also indicate that there are significant gender differences in students' economics degree selections based on their initial major selection. The reference group is students who initially matriculated with a declared business major. Both male and female students who matriculate as economics majors are significantly more likely to earn

economics majors than their declared business major peers. The size of the coefficient is larger for women, who are 72% more likely than female initial business majors to earn an economics major rather than a non-economics degree. Male economics majors are 58% more likely to complete economics majors than their declared business major counterparts. Additionally, men who enter as economics majors are significantly less likely to complete minors in economics rather than non-economics degrees, but this variable is not a significant predictor of women's economics minor selection. There is also a significant gender difference in economics degree selection among male and female students who were initially business undeclared majors. Male initial business undeclared students are 7% more likely to complete economics majors and 6% less likely to complete a minor in economics than their declared business major peers. On the other hand, women who enter as business undeclared students are no more or less likely to earn economics degrees of any type relative to female declared business majors.

The findings also indicate that male and female students have differential responses to their grades in Introduction to Microeconomics. Women's absolute and relative microeconomics course grades are significant predictors of earning an economics major but not for completing an economics minor. A full letter grade increase from the mean in a female student's absolute microeconomics grade increases her probability of earning an economics major by 5%. Contrary to expectations, women whose relative microeconomics grades are one unit higher than the mean are 16% less likely to complete a major in economics. Thus, female students who matriculate into Lerner College are less likely to graduate with an economics major when they perform better in Introduction to Microeconomics relative to the grades they receive in other departments' courses. For

male students, the absolute microeconomics grade is only a significant predictor for earning a minor in economics. Men have a 10% higher likelihood of completing an economics minor if they earn a grade in Introduction to Microeconomics that is a full letter grade above the mean. Male students' relative microeconomics grades are not significantly correlated with either economics major or minor selection. Additionally, men who complete more than one major degree have a 20% higher probability of earning economics majors, although this variable is not a significant predictor of economics major selection for women. In contrast, both male and female students who earn multiple major degrees have a lower likelihood of completing minors in economics, but the effect of this variable for men is twice the magnitude of the effect for women.

#### **5.4.3 Economics Degree Selection for Initial Non-Lerner College Majors**

Table 5.7 shows the results of economics degree selection by gender among students who initially matriculate into majors outside of Lerner College. Similar to the findings from the full sample, neither a students' minority status nor their verbal or math SAT scores have significant effects on economics degree selection relative to non-economics degree selection for both men and women. In contrast to the regression results presented in Tables 5.5 and 5.6, men who take Introduction to Microeconomics after their freshman year are significantly more likely to earn economics majors rather than non-economics degrees. For female students, the effect of taking economics after their freshman year is not a significant predictor of either economics major or minor selection.

Men who initially matriculate into engineering, the natural or social sciences, and the humanities, health sciences, or education are no more or less likely than male math, computer science, and applied economics majors (the reference group) to earn economics

Table 5.7 Marginal Effects for Economics Degree Selection for Non-Lerner Students

Variable	Male Students		Female Students	
	Econ Major	Econ Minor	Econ Major	Econ Minor
Minority	-0.010 (0.047)	0.019 (0.048)	0.044 (0.060)	0.109 (0.078)
SAT Math	0.001 (0.003)	-0.006 (0.003)	-0.004 (0.004)	0.002 (0.004)
SAT Verbal	0.001 (0.003)	0.005 (0.003)	0.004 (0.003)	0.006 (0.004)
Non-Fresh at Micro	0.082* (0.037)	-0.040 (0.039)	-0.031 (0.048)	-0.021 (0.057)
Engineering Entry	-0.060 (0.074)	0.363*** (0.097)	-0.119* (0.048)	0.464** (0.114)
Hum/Health/Educ Entry	0.001 (0.101)	0.265* (0.128)	-0.001 (0.079)	0.225 (0.130)
Natural Science Entry	0.061 (0.105)	0.212 (0.125)	-0.020 (0.078)	0.330* (0.142)
Social Science Entry	0.018 (0.095)	0.296* (0.119)	-0.040** (0.068)	0.440*** (0.118)
Undeclared Entry	0.183* (0.084)	0.018 (0.086)	-0.041 (0.064)	0.140 (0.096)
Micro Grade	-0.167*** (0.035)	0.167*** (0.034)	-0.051 (0.041)	0.095 (0.053)
Relative Micro Grade	0.451*** (0.086)	-0.340*** (0.097)	0.396** (0.126)	-0.224 (0.181)
Multiple Majors	0.321*** (0.049)	-0.208*** (0.031)	-0.139** (0.052)	-0.319*** (0.039)
Observations	685		364	
-2 Log L	644.171		309.842	

*Notes:* The marginal effects are evaluated at the means. Standard errors are in parentheses. The reference group is students whose initial major was in math, computer science, or applied economics. \*p<0.05 \*\*p<0.01 \*\*\*p<0.001

majors rather than non-economics degrees. Women whose initial majors are in engineering and the social sciences have a significantly lower probability of completing a



major in economics than women who enter as math, computer science, or applied economics majors. Although male students who matriculate as undeclared majors are 18% more likely to complete a major in economics, women whose initial major is undeclared are not significantly more or less likely to complete economics majors relative to non-economics degrees.

Gender differences also exist in students earning a minor in economics. Both male and female initial engineering majors are significantly more likely to earn an economics minor relative to their initial math, computer science, and applied economics major counterparts. Similarly, students of both genders who matriculate into a social science field have a higher probability of earning an economics minor when compared to the reference group students. Moreover, the magnitude of the coefficients is stronger for female initial engineering and social science majors. Men whose initial majors are in the humanities, health sciences, or education are significantly more likely to complete economics minors, but there is no significant effect on economics minor selection for female initial humanities, health science, or education majors. In addition, female students who matriculate into natural science majors are significantly more likely than their math, computer science, and applied economics peers to complete minors in economics. Matriculating as an undeclared major is not a significant predictor of economics minor selection for students of either gender.

Male and female students who matriculate into majors outside of Lerner College also have differential responses to their absolute and relative Introduction to Microeconomics course grades. For male students, the absolute and relative microeconomics grades are significant predictors of completing both types of economics

degrees. Men who earn an absolute microeconomics grades that are a full letter grade above the mean are less likely to earn economics majors but more likely to earn economics minors. On the other hand, male students who earn relative microeconomics grades one unit above the mean are 45% more likely to complete economics majors. This result indicates that male students who perform better in Introduction to Microeconomics than in the other departments' courses completed during the same term have a higher probability of graduating with an economics major. Conversely, men who earn a relative microeconomics grades that are one unit above the mean are significantly less likely to complete economics minors. Among women, only the relative microeconomics grade is a significant indicator of economics degree selection. Female students who earn relative microeconomics grades that are one unit above the mean have a 40% higher probability of earning economics majors relative to completing non-economics degrees. Female students' absolute and relative grades in Introduction to Microeconomics do not significantly affect their propensity to earn a minor in economics.

Among students who graduate with more than one major degree, men have a 32% higher probability of economics being one of those majors. In contrast, female students who complete more than one major degree are significantly less likely to earn an economics major as one of those degrees. In addition, both male and female students who complete multiple majors are significantly less likely to earn economics minors relative to non-economics degrees. The magnitude of the coefficient is stronger for women, suggesting that completing more than one major degree has a differential effect by gender.

## 5.5 Discussion

The findings from this chapter are consistent with prior research that indicates women are less likely to earn an economics degree than men (Bayer & Rouse, 2016; Dynan & Rouse, 1997; Emerson et al., 2018; Emerson et al., 2012; Rask & Tiefenthaler, 2008). More importantly, however, the results also suggest that gender differences in economics degree attainment may exist based on male and female student's initial major selection. Additionally, the results provide further support for evidence that male and female students' economics degree selections are affected by differential responses to their absolute and relative grades (Emerson et al., 2012; Horvath et al., 1992; Rask & Tiefenthaler, 2008).

Both male and female students who matriculate as economics majors are likely to earn economics majors, a finding that is consistent with prior research (Chizmar, 2000; Fournier & Sass, 2000; Mumford & Ohland, 2011). Even though only a small percentage of students enter the University as economics majors, they have the highest probability of earning an economics major. Not surprisingly, students whose initial major is economics are less likely to earn an economics minor rather than a non-economics degree. Additionally, women who initially select economics as their major may be even more likely than their male peers to graduate with a bachelor's degree in economics. These findings suggest that students who choose economics as their majors prior to entering college may have developed an interest in the subject during their adolescent years, possibly as a result of completing an economics course prior to college.

Research indicates that taking a high school economics course is a significant predictor of economics major selection (Ashworth & Evans, 2001). Students who

complete an Advanced Placement (AP) Microeconomics or Macroeconomics course may also be more likely to select an economics major, particularly if they earn a score of 4 or 5 on the AP Microeconomics or Macroeconomics exam (Avery et al., 2016; Morgan & Klaric, 2007). Female students may be particularly influenced by access to economic education at the K-12 level. Evidence suggests that completing a high school course in a subject is a more significant factor in a female student's college major selection than it is for male students (Malgwi et al., 2005). In addition, students who complete a high school economics course may perform better in college-level economics courses, though the findings are mixed (Ashworth & Evans, 2001; Ballard & Johnson, 2005; Brasfield et al., 1993; Lopus, 1997; Melican, Debebe, & Morgan, 1997). The majority of states, however, do not require students to complete a high school economics course for graduation (Council for Economic Education, 2018), though an increase in state economics mandates since the late-1990s have increased the percentage of students who do complete a high school economics course (Walstad & Rebeck, 2012).

The content and quality of K-12 economics courses also varies significantly (Lopus, 1997; Walstad, 2001). Teacher training in economics is a particular issue. Research indicates that there is a positive correlation between teachers' economic knowledge and students' economics achievement (Butters, Asarta, and Thompson, 2013; Butters, Asarta, and Fischer, 2011; Swinton, Scafidi, and Woodward, 2011). Economics is often taught by social studies teachers, many of whom take fewer than 2 college-level economics courses (Walstad 2001; Bosshardt and Watts 1994; Bosshardt & Watts, 2005; Walstad & Watts, 2015). Moreover, nearly one-third of high school social studies teachers and more than half of the elementary teachers who are certified in social studies

never complete an economics course in college (Bosshardt & Watts, 2005; Walstad & Watts, 2015). For teachers who have already received their degrees, attendance at workshops, in-service programs, and post-graduate coursework aimed at improving teachers' economics content knowledge and instructional pedagogy may improve student achievement in economics (Swinton et al. 2010; Cargill et al. 2008; Butters et al., 2011). Students may view their high school grades and achievement as evidence of their relative academic strengths and weaknesses, choosing a major in which they believe they have a comparative advantage (Riegle-Crumb et al., 2012; Correll, 2001). Thus, improving teacher training in economics may yield more students who enter college as economics majors.

Although students whose initial major is in business comprise a large percentage of the students who graduate with an economics major, particularly among men, the results indicate that students with a declared business major have a lower probability of completing an economics major than students who initially select majors outside of Lerner College. For example, one-quarter of the female students whose initial major was in the social sciences (n=50), and 20% of women who matriculated into a natural science major (n=51) switched into an economics major, relative to only 3% of female initial business majors (n=290). Among male students, 32% of those who entered as natural science majors (n=66) and 29% of initial social science majors (n=89) graduated with economics majors, compared to 12% of the male initial business majors (n=746). Many students may consider business and economics to be substitutes, but these results indicate that female initial business majors are much less likely than male initial business majors to complete a major in economics, suggesting that women may be less inclined to view

the two degrees as substitutes. Some prior research also suggests that students who choose an economics major do not do so because they view it as close substitute to business (Jones et al., 2008).

Gender differences are apparent, however, in which students switch into economics based on their major at matriculation. Men who enter as engineers are significantly more likely to earn an economics major, while female engineering majors are no more or less likely to earn an economics major than a non-economics degree when compared with female business students. When engineering students are compared to students who enter as math, computer science, and applied economics majors, however, female engineers are significantly more inclined to earn an economics major, but there is no significant effect for male engineers. On the other hand, female math, computer science, and applied economics majors have a much higher probability of earning an economics major than female business students. These findings are somewhat consistent with prior research that indicates a large proportion of students who graduate with an economics major originally select a math-intensive field for their major (Mumford & Ohland, 2011). Many of these students may select the math-oriented B.S. degree in economics.

In addition, both male and female students whose initial majors are in the natural or social sciences as well as the humanities, health sciences, or education are also more likely to earn economics majors when compared with their business major counterparts, although the magnitudes of the coefficients are stronger among women. Since the University of Delaware offers a more humanities-oriented B.A. degree in economics, many of these students may switch into the B.A. in economics major or add it as a second

degree. Studies have found that men who enter into female-dominated majors, such as education or psychology, may be more likely to change majors than women who enter male-dominated majors, such as economics (Kugler et al., 2017; Riegle-Crumb et al., 2016). The results from this study may offer some support for these conclusions.

One possible explanation for these findings is the timing of completing Introduction to Microeconomics. Relative to the three-quarters of Lerner College students who complete Introduction to Microeconomics during their freshman year, over 60% of students who matriculate into a major outside of the business school take economics after their freshman year. Students who complete introductory microeconomics during the freshman year tend to earn lower course grades compared to students who take microeconomics later in their college career (Elzinga & Melaugh, 2009). Students may have a positive experience in their introductory microeconomics course and switch into economics from another major or add it as a second or third major (Stock, 2017).

The findings from this study also provide support for research showing that male and female students have differential responsiveness to their absolute and relative economics grades (Emerson et al., 2012; Goldin, 2015a; Rask & Tiefenthaler, 2008; Sabot & Wakeman-Linn, 1991). For men who matriculate into Lerner College, neither their absolute nor relative Introduction to Microeconomics course grades significantly affect their propensity to earn an economics major. This finding may not be that surprising, given that students who complete a degree in business must pass Introduction to Microeconomics with a C- letter grade or better. In addition, business majors may be more likely to pass their introductory economics courses than students of other majors; however, they are significantly less likely to pass intermediate microeconomics than

economics majors (Bosshardt & Watts, 2008). Students who major or minor in economics at UD must complete an intermediate microeconomics course. Thus, it is possible that the grades male students receive in intermediate microeconomics courses may be more important predictors of their propensity to earn an economics degree than the grade they earn in Introduction to Microeconomics.

On the other hand, for male students in the full sample and among those who matriculate into a major outside of Lerner College, the absolute and relative Introduction to Microeconomics grades are significant predictors of graduating with an economics major. Their absolute Introduction to Microeconomics grade is a negative predictor of earning an economics major, but their relative microeconomics grade is positive and significant. Moreover, the magnitude of the relative microeconomics grade parameter for men who enter outside of Lerner College is larger than in the full sample.

This result suggests that male students who initially select a major outside of a business field may “pulled into” economics not simply by earning a strong grade in Introduction to Microeconomics, but by earning a higher grade in in their introductory microeconomics course than in courses completed in other subjects. Prior research also suggests that students who matriculate as engineering and natural science majors are more likely to transfer out of their initial major when their non-major GPA improves (Mumford & Ohland, 2009; Ohland et al., 2004; Dickson, 2010; Ost, 2010). Students who perform poorly in their initial major may become discouraged and “pushed out” of their initial majors due to low grades. As a result, lower-ability students may enter into economics, a finding supported by Mumford and Ohland (2009). The results in this chapter, however, indicate that students who matriculate into a major outside of Lerner



College earn higher absolute and relative mean Introduction to Microeconomics grades when compared to both the full sample of students and to students who matriculate into Lerner College.<sup>14</sup> Non-Lerner College majors who transfer into the economics major, may be pulled into economics by strong performance in their Introduction to Microeconomics course. Thus, they may be considered “Encouraged-Economics-Majors.”

In contrast, for women in the full sample and for female students who enter into a major outside of Lerner College, the absolute Introduction to Microeconomics grade is not a significant predictor of completing an economics major. On the other hand, the relative microeconomics grade for the female students in these two samples is positively associated with earning an economics major, which suggests that female students may be more responsive to their relative economics grades than their actual economics grades. This finding is consistent with prior research comparing the effect of female students’ absolute and relative economics grades (Emerson et al., 2012; Rask & Tiefenthaler, 2008). Female business students may represent an exception, however. Among women who matriculate into Lerner College, earning a higher absolute grade in Introduction to Microeconomics increases their likelihood of earning an economics major, while a higher relative microeconomics grade significantly decreases their probability of completing a major in economics.

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<sup>14</sup> An independent-samples T-test comparing the absolute and relative microeconomics grades for men who matriculated into Lerner College and their non-business peers yields a significant difference. Conversely, a T-test comparing male students’ cumulative GPA at the time of taking Introduction to Microeconomics yields no significant difference.

This finding suggests that female business majors may respond differently to their introductory microeconomics course grades than women who initially select other majors. One possible explanation for this difference is based on research into the reasons behind college major selection for business students. Easterling and Smith (2008) found that business students were less concerned about whether or not their major was a good fit with their aptitude than students who selected other majors. Another possible explanation is that female business majors may have more negative views of economics compared to women who initially select other majors. Students who matriculate into Lerner College must complete Introduction to Microeconomics as part of their required business core courses. Thus, women who matriculate as business majors may take Introduction to Microeconomics solely because it is a requirement for a business degree. Conversely, students who select an initial major outside of economics may choose to take economics as an elective. Because female students are less likely to take economics courses in general, women who take Introduction to Microeconomics as an elective course may have more interest in and positive attitudes towards economics.

In summary, this chapter uses a series of multinomial logistic regressions to assess how male and female students' majors at the time of matriculation and grades in their introductory microeconomics course affect their propensities to graduate with economics degrees. The results suggest that students of both genders who initially select an economics major have a high probability of graduating with an economics major. In addition, a large proportion of male and female students who graduate with economics degrees initially matriculate into non-economics majors. The findings support prior research that indicates male and female students' differential responsiveness to their

absolute and relative microeconomics grades affects their economics degree selections. Moreover, the results suggest that students may respond differently to their absolute and relative microeconomics grades based on their major at matriculation. Further research may attempt to compare how initial business students of both genders perceive their introductory microeconomics grades relative to male and female students who initially select other majors. Additional research may also explore if students who select majors have varying interest in and opinions of the economics major.

## **Chapter 6**

### **THE GENDER GAP IN UNDERGRADUATE FINANCE COURSE PERSISTENCE AND DEGREE SELECTION**

This chapter assesses the gender gap in undergraduate students' finance course persistence, defined as taking an additional finance course after completing an initial course, as well as gender disparities in students' finance degree selection. The research is guided by the following question identified in Section 1.2: How do student, instructor, and structural (class) characteristics differentially affect gender persistence in taking finance courses and the propensity to earn a finance degree?

#### **6.1 Introduction**

Women represent about half of all undergraduate business students (Ball, 2012; Ceci et al., 2014; Bayer & Rouse, 2016). The percentage of female students choosing to earn business degrees rose throughout the 1990s and peaked in the mid-2000s. Since that time, the share of female business majors has declined (Ball, 2012; Bayer & Rouse, 2016). Ball (2012) found that female undergraduate students are about 39% less likely than their male peers to earn a degree in business. Women who do select a business degree are more likely to choose subfields, such as accounting and marketing. Moreover, certain sub-disciplines, including management, international business, and hospitality, have become increasingly more female-dominated (Ball, 2016). Among finance majors, however, female students are underrepresented. Additionally, the share of female finance graduates has been decreasing. In 2003, women comprised 36% of finance degree

recipients. By 2016, that percentage fell to 29% (Ball, 2012; NCES, 2016). Despite the significant gender gap in finance degree completion, there has been no research on male and female students' finance course persistence, and only one prior study analyzes gender differences in finance degree selection (Worthington & Higgs, 2003).

Using a binary logit model, this chapter considers how student, instructor, and structural (class) characteristics differentially affect the likelihood of taking an additional finance course beyond the first course, Principles of Finance (FINC 311). The data includes students who took all finance courses through the University of Delaware. Additionally, I use a binary logit model to assess how student characteristics and college coursework influence students' propensities to complete Bachelor of Science (B.S.) degrees in Finance.

Findings are consistent with evidence that indicates women are underrepresented in the field of finance. Both male and female students who select finance as their initial major are significantly more likely to persist in taking an intermediate finance course after completing Principles of Finance, though the effect is stronger for women. Math aptitude is a significant, albeit small, positive predictor of male and female students' likelihood of enrolling in an intermediate finance course, but male students who earn a higher score on the verbal SAT are less likely to enroll in a subsequent finance course. Consistent with research on gender differences in students' responsiveness to their absolute and relative economics grades (Emerson et al., 2012; Rask & Tiefenthaler, 2008), female students' grades in their Principles of Finance course relative to their grades in other departments' courses are strong, positive predictors of finance course persistence. In addition, the results suggest that for students of both genders, the grade

received in Introduction to Microeconomics (ECON 101) significantly affects their finance course persistence. Moreover, female students who earn a higher grade in Introduction to Macroeconomics (ECON 103) are more likely to take an intermediate finance course. The results also suggest that students of both genders may be influenced by the gender and type of instructor for their Principles of Finance course. In addition, selecting a finance major by the time of taking Principles of Finance is the strongest indicator of finance degree completion.

## **6.2 Data**

The data used in this chapter are from institutional records for 1,746 male and 1,308 female undergraduate students who completed Principles of Finance at the University of Delaware (UD) between Fall 2007 and Fall 2015. The full student sample includes students who took the introductory finance courses, Principles of Finance (FINC 311), at UD. The student records are supplemented with data on instructor and structural (class) characteristics. Table 6.1 defines the student, instructor, and structural (class) variables used in this chapter.

### **6.2.1 Descriptive Statistics**

Table 6.2 provides the descriptive statistics by gender for students who completed Principles of Finance at UD. With the exception of economics majors, all students who complete a degree within Lerner College of Business and Economics must take Principles of Finance as part of the core business curriculum. Women represent approximately 43% of students who completed Principles of Finance. A significantly larger share of the male students are of minority background, and the male students are significantly older than the female students. Consistent with prior research, male students' mean math SAT score

Table 6.1 Summary of Variables

Variable	Description
Minority	1 if student is non-white
Age at Finance	Student's age in years at principles of finance (finance)
SAT Math	Student's SAT Math score
SAT Verbal	Student's SAT Verbal score
Junior at Finance	1 if student is a junior at finance
Finance Entry	1 if student matriculated as a finance major
Economics Entry	1 if student matriculated as an economics major
Finance at Finance	1 if student is a finance major at finance
Finance Grade	Student's finance course grade
Relative Finance Grade	Student's finance grade/cum GPA from finance term but without finance grade
Micro Grade	Student's introduction to microeconomics course grade
Macro Grade	Student's introduction to macroeconomics course grade
Int Fin Grade	Student's intermediate (int.) finance course grade
Relative Int Fin Grade	Student's int. finance grade/cum GPA from int. finance term but without int. finance grade
Fem Finance Prof	1 if finance instructor was a female professor
Fem Finance Adjunct	1 if finance instructor was a female adjunct
Male Finance Adjunct	1 if finance instructor was a male adjunct
Finance Class Size	Number of students in finance class
Finance Per. Female	Percentage of female students in finance class
B.S. Finance	1 if student graduated with a Bachelor of Science in finance

is significantly larger than the mean female math SAT score; however, the mean verbal SAT score is significantly higher for women. Students may complete Principles of Finance as early as the second semester of their sophomore year, but over 75% of male and female students complete Principles of Finance during their junior year. A significantly larger proportion of the male students who completed Principles of Finance were finance majors at the time of matriculation into the University. Approximately 14% of the male students entered UD as finance majors, compared to only 5% of the female students. Although economics majors are not required to complete Principles of Finance, approximately 2% of the male students matriculated as economics majors, whereas less than 1% of the female students were initially economics majors.

Table 6.2 Summary Statistics for Students Who Completed Principles of Finance

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.188	0.391	0.159	0.366	*
Age at Finance	19.750	0.738	19.684	0.680	*
SAT Math	629.926	66.908	614.541	68.370	***
SAT Verbal	584.141	69.892	592.661	76.943	**
Junior at Finance	0.762	0.426	0.750	0.433	
Finance Entry	0.139	0.346	0.054	0.225	***
Economics Entry	0.019	0.136	0.009	0.095	*
Finance Grade	3.125	0.720	3.086	0.761	
Finance Relative Grade	1.035	0.215	0.953	0.213	***
Micro Grade	2.814	0.710	2.839	0.707	
Macro Grade	2.989	0.678	3.035	0.682	
Fem Finance Prof	0.112	0.316	0.119	0.324	
Fem Finance Adjunct	0.007	0.086	0.006	0.078	
Male Finance Adjunct	0.047	0.212	0.064	0.245	*
Finance Class Size	151.181	85.199	143.080	87.905	*
Finance Per. Female	0.408	0.086	0.439	0.083	***
N	1,746		1,308		

*Note:* Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

The mean Principles of Finance grade for both male and female students is slightly above a 3.0, which is equivalent to a B on a 4.0 scale. There is no significant gender difference in students' absolute Principles of Finance grades; however, male students have significantly higher relative finance grades. The relative finance grade is a measure of students' Principles of Finance grades compared to the grades received in other departments' courses taken during the same semester. The mean male relative finance course grade is greater than 1, suggesting that men earn a slightly higher grade in Principles of Finance than in other departments' courses, while the mean relative finance



grade for women is less than one. There are no significant gender differences in students' absolute grades in Introduction to Microeconomics or Introduction to Macroeconomics.

Approximately the same proportion of male and female students complete Principles of Finance with a female professor or female adjunct instructor. On the other hand, a significantly larger share of female students take introductory finance with a male adjunct instructor. Male students have a larger average class size than female students. Compared to male students, female students' Principles of Finance class sizes are significantly smaller. Women may self-select into smaller classes, which are often taught by adjunct faculty members, most of whom are male.<sup>15</sup> Women also have a significantly higher percentage of female students in their Principles of Finance class.

Table 6.3 provides the summary statistics for the 784 students who completed an intermediate finance course and graduated with a degree from UD. Students may select from among three intermediate finance courses: Intermediate Financial Management (FINC 312), Fixed Income Securities (FINC 313), and Investments (FINC 314). Students must complete Principles of Finance (FINC 311) with a C- letter grade or better as a prerequisite. All intermediate-level finance courses may be taken only during a student's junior or senior year. In addition, enrollment in Intermediate Financial Management (FINC 312) and Investments (FINC 314) is only open to students who are majoring in finance or management information systems majors who are concentrating in finance. Fixed Income Securities (FINC 313) is open to finance and accounting majors only.

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<sup>15</sup> Certain sections of Principles of Finance are also restricted to non-finance majors.

Table 6.3 Summary Statistics for Students Who Completed Intermediate Finance and Graduated

Variable	Male Students		Female Students		Mean Diff.
	Mean	SD	Mean	SD	
Minority	0.180	0.384	0.156	0.364	
SAT Math	643.665	62.767	630.900	57.716	**
SAT Verbal	587.504	65.927	599.242	73.247	*
Finance at Finance	0.630	0.483	0.526	0.500	*
Int Finance Grade	3.229	0.685	3.278	0.622	
Relative Int Fin Grade	1.042	0.218	1.005	0.184	*
Micro Grade	2.968	0.681	2.986	0.632	
Macro Grade	3.121	0.624	3.150	0.643	
B.S. Finance	0.937	0.243	0.934	0.249	
N	573		211		

*Note:* Gender mean differences significant at \* $<0.05$  \*\* $<0.01$  \*\*\* $<0.001$

Women represent approximately 27% of the students who complete an intermediate-level finance course. In contrast with the summary statistics for the Principles of Finance course, there is no significant difference in the share of minority students who complete an intermediate finance course. The mean math SAT score is significantly higher for male students, but female students have a significantly higher average verbal SAT score. Over 60% of the male students are finance majors at the time of completing an intermediate finance course, which is significantly larger than the 53% of the female students. The mean intermediate finance course grade is not significantly different for men and women; however, male students' mean relative intermediate finance grade is significantly higher than the mean female relative intermediate finance grade. Among students who complete an intermediate finance course, over 93% of them complete a B.S. degree in finance. There is no significant gender difference in the share of intermediate finance course students who earn a finance degree.

### 6.3 Methodology

Following research on students' economics course persistence and degree selection, I use a binary logistic regression to assess students' propensity to take an intermediate finance course (Emerson et al., 2012; Rask & Tiefenthaler, 2008), conditional upon completion of Principles of Finance. Principles of Finance is a prerequisite for all three of the intermediate finance courses modeled in this chapter. Students' finance degree selections are then modeled using a binary logit regression, conditional upon students having completed an intermediate finance course. Figure 6.1 shows the progression of finance courses and degree selection modeled in this chapter.

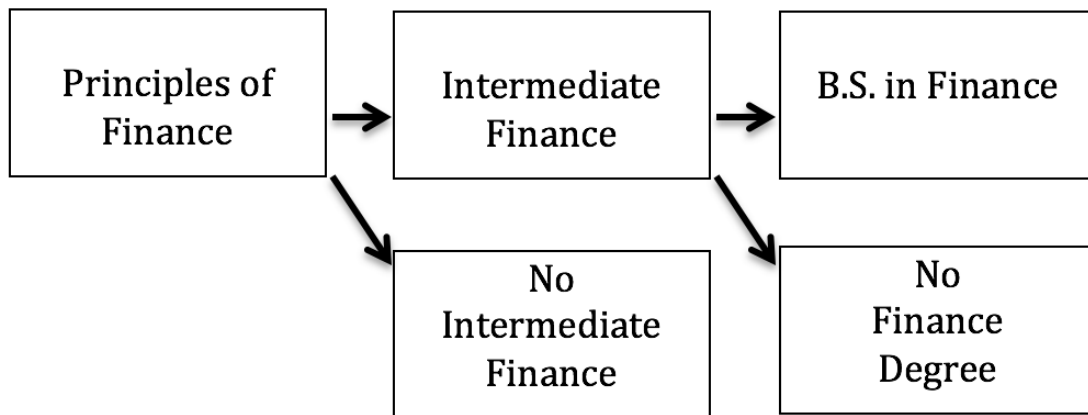


Figure 6.1 Finance Course Persistence and Degree Selection

#### 6.3.1 Intermediate Finance Course Persistence

The binary logit for students' persistence to an intermediate finance course is presented in equation 6.1. The model controls for student's minority status as well as their math and verbal SAT scores. Students' SAT scores were divided by ten because SAT scores are reported in units of ten (e.g. 620 and 0). The estimation also includes a

dummy variable to measure the effect of taking Principles of Finance during the junior year. To control for student's prior interest in finance, I include a dummy variable for whether a student was a finance major at the time of matriculation into the University. In addition, I control for students' selection of an economics major at entry since finance may be considered to be a subfield of economics (Summers, 1985).

Because Principles of Finance is a prerequisite for all intermediate finance courses, students' introductory finance course grades (both absolute and relative) are included in the analysis. Also included in the estimation is a measure for a student's relative Principles of Finance course grade. Additionally, all students who complete a degree within the Lerner College of Business and Economics must complete Introduction to Microeconomics and Introduction to Macroeconomics; therefore, I control for students' grades in these two courses. The highest letter grade a student may earn in any course at UD is an A, which represents a 4.0. Students may also earn plus and minus letter grades, such as an A- or a B+. Recognizing that male and female students may have different propensities to persist in taking an intermediate finance course, I estimate separate models for males and females.

$$\begin{aligned} \Pr^{M,F}(Int\ Finance_i = 1) = & \beta_0 + \beta_1 Minority + \beta_2 SAT\ Math + \\ & \beta_3 SAT\ Verbal + \beta_4 Junior\ at\ Finance + \beta_5 Finance\ Entry + \\ & \beta_6 Economics\ Entry + \beta_7 Finance\ Grade + \beta_8 Relative\ Finance\ Grade + \\ & \beta_9 Micro\ Grade + \beta_{10} Macro\ Grade \end{aligned} \quad (6.1)$$

To measure the effect of additional variables, I estimate a second model of students' intermediate finance course persistence. Model 2 controls for a student's age at the time of completing Principles of Finance. It also incorporates the Principles of

Finance instructor gender and type (professor or adjunct instructor) as well as structural characteristics, including the class size and the percentage female in the student's Principles of Finance class.

### 6.3.2 Finance Degree Selection

Next, I use a binary logistic regression to model students' choice of degree, conditional upon them having completed an intermediate finance course. To determine students' probability of graduating with a B.S. degree in finance, I use equation 6.2. I control for a student's minority status and math and verbal aptitudes using his or her SAT scores. This model also includes a dummy variable to control for a student's selection of a finance major at the time of completing Principles of Finance. In addition, this estimation incorporates students' absolute and relative intermediate finance course grades as well as their grades in Introduction to Microeconomics and Introduction to Macroeconomics. I run separate estimations for male and female students.

$$\begin{aligned} \Pr^{M,F}(B.S. Finance = 1) = & \beta_0 + \beta_1 Minority + \beta_2 SAT Math + \\ & \beta_3 SAT Verbal + \beta_4 Finance at Finance + \beta_5 Int Finance Grade + \\ & \beta_6 Relative Int Finance Grade + \beta_7 Micro Grade + \beta_8 MacroGrade \quad (6.2) \end{aligned}$$

## 6.4 Results

### 6.4.1 Intermediate Finance Course Persistence

Table 6.4 presents the marginal effects at the mean estimates by gender for the impact of student, instructor, and structural characteristics on students' decision to enroll in an intermediate finance course. Model 1 shows the effect of student characteristics for students who took all of their courses at UD, while model 2 incorporates students' age at

Table 6.4 Marginal Effects for Intermediate Finance Course Persistence

Variable	Model 1		Model 2	
	Male	Female	Male	Female
Minority	0.015 (0.034)	0.033 (0.039)	0.024 (0.028)	0.044 (0.040)
Age at Finance			-0.452 (0.433)	-1.500* (0.676)
Age at Finance <sup>2</sup>			0.009 (0.011)	0.035* (0.017)
SAT Math	0.010*** (0.002)	0.007** (0.002)	0.006** (0.002)	0.004 (0.002)
SAT Verbal	-0.005* (0.002)	-0.004 (0.002)	-0.004* (0.002)	-0.002 (0.002)
Junior at Finance	0.187*** (0.030)	0.184*** (0.027)	0.110*** (0.026)	0.144*** (0.031)
Finance Entry	0.341*** (0.029)	0.450*** (0.059)	0.264*** (0.031)	0.424*** (0.068)
Economics Entry	-0.066 (0.093)	0.381** (0.139)	0.019 (0.078)	0.380* (0.151)
Finance Grade	0.024 (0.042)	-0.070 (0.050)	0.025 (0.034)	-0.113* (0.051)
Relative Finance Grade	0.211 (0.126)	0.459** (0.161)	0.250* (0.104)	0.756*** (0.170)
Micro Grade	0.109*** (0.025)	0.083** (0.026)	0.081*** (0.020)	0.093*** (0.026)
Macro Grade	0.015 (0.025)	0.062* (0.027)	0.013 (0.021)	0.059* (0.027)
Fem Finance Prof			-0.234*** (0.037)	-0.212*** (0.033)
Fem Finance Adjunct			0.348** (0.124)	0.262 (0.225)
Male Finance Adjunct			0.178** (0.055)	0.129 (0.017)
Finance Class Size			0.001*** (0.0002)	0.001*** (0.0002)
Finance Per. Female			-0.553*** (0.129)	-0.111 (0.183)
Observations	1,746	1,308	1,746	1,308
% Correctly predicted	65.1%	70.1%	71.9%	72.5%
Log Likelihood	-1,079.29	-745.13	-973.26	-695.90

Notes: The marginal effects are evaluated at the means. Standard errors are in parenthesis. \*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

Principles of Finance and the instructor and structural (class) characteristics. The results from both models indicate that minority students are no more or less likely to enroll in an intermediate finance course. Male and female students' math SAT score are positive, significant predictors of intermediate finance course persistence in Model 1, though the magnitude of the effect is small. For instance, a ten-point increase from the mean math SAT score increases a student's likelihood of taking an intermediate finance course by 1% for men and by 0.7% for women. Moreover, when the additional variables are included in Model 2, the size of the effect for the math SAT score decreases for men and becomes insignificant for women. A student's verbal SAT score is a significant indicator of finance course persistence for male students only. Men who earn a higher verbal SAT score are significantly less likely to enroll in an intermediate finance course. The results in both models indicate that students of both genders have a higher probability of persisting to an intermediate finance course when they take Principles of Finance during their junior year.

A strong predictor of students' enrollment in an intermediate finance course is their major at matriculation. As expected, both male and female students who initially select finance as their major have a higher probability of enrolling in an intermediate finance course. Men who initially major in finance are 26-34% more likely to take an intermediate finance class than their non-finance, non-economics major peers, while female initial finance majors are 42-45% more likely to enroll in an intermediate finance course relative to their non-finance, non-economics major counterparts. An interesting finding is that being an economics major at matriculation is a significant positive predictor of finance course persistence for women. They have a 38% higher probability

of taking an intermediate finance course than female non-finance and non-economics majors at entry. On the other hand, men who are initial economics majors are not significantly more or less likely to take a subsequent finance course.

For male students, the absolute grade they receive in Principles of Finance is not a significant indicator of intermediate finance course persistence. For female students, earning a higher absolute Principles of Finance grade has a significant negative effect on their likelihood of enrolling in an intermediate finance course, but this variable is only significant in Model 2. Conversely, women who earn a higher relative Principles of Finance grade are significantly more likely to enroll in an additional finance course in both models. The magnitude of this variable is large and is the strongest predictor of female students' finance course persistence. Model 1 indicates that women who earn a relative finance grade that is one unit above the mean have a 46% higher probability of taking an intermediate finance course. The size of this effect increases to 76% when additional variables are added into Model 2. Male students' relative grades in Principles of Finance are significant indicators of finance course persistence in Model 2 only, and the effect is three times smaller than the effect for female students. Both male and female students' grades in Introduction to Microeconomics are significant, positive predictors of intermediate finance course persistence. In contrast, students' Introduction to Macroeconomics grades have significant effects solely on women's intermediate finance course persistence. Female students' who earn one-full letter grade above the mean (the difference between a B and an A) are 6% more likely to take an intermediate finance course.



The findings in Model 2 indicate that female students' age at the time of completing Principles at Finance has a significant, quadratic effect on their intermediate finance course persistence. Additionally, the results for instructor characteristics indicate that the finance course persistence for students of both genders may be affected by the instructor type and gender. Both male and female students who complete introductory finance with a full-time female professor are significantly less likely to persist in taking an additional course, relative to students who take Principles of Finance with a male professor. The magnitude of the effect is also slightly larger for male students. Male students who take their Principles of Finance course with a male or female adjunct instructor have a significantly higher probability of intermediate finance course persistence. In particular, men who take their first finance course with a female adjunct have a 35% higher probability of finance course persistence than their male peers. The effect of taking Principles of Finance with an adjunct instructor of either gender is not a significant predictor of women's finance course persistence, however.

The results for the structural characteristics in Model 2 suggest that students' Principles of Finance class sizes may affect their finance course persistence. Both male and female students who take Principles of Finance in a larger class are significantly more likely to enroll in an additional finance course, but the size of this effect is quite small. Additionally, a one-unit increase in the percentage of female students in introductory finance leads to a 55% decrease in male students' probability of finance course persistence, but this variable has no effect on women's finance course persistence.

#### **6.4.2 Finance Degree Selection**

Table 6.5 presents the marginal effects at the mean estimates by gender for the effect of student characteristics on men's and women's decisions to earn a B.S. degree in finance. Male and female minority students are no more or less likely to earn a finance degree. Student's math SAT scores have no significant effect on the probability of completing a finance degree for either male or female students, though men who earn a higher verbal SAT are significantly less likely to earn a finance degree. Both male and female students who select finance as their major by the time of completing Principles of Finance are significantly more likely to complete a degree in finance. The magnitude of the effect is larger for women, who have an 8% higher probability of earning a finance degree, relative to women who were not finance majors when they took Principles of Finance. Male finance majors are 6% more likely to complete a finance degree than their non-finance major counterparts. Neither students' absolute nor relative intermediate finance course grades have a significant effect on their propensity to earn a finance degree. In addition, students' grades in Introduction to Microeconomics are not significant predictors of finance degree selection for either gender. On the other hand, female students who earn a higher grade in Introduction to Macroeconomics are significantly more likely to complete a finance degree.

#### **6.5 Discussion**

The findings in this chapter indicate that female students are less likely to enroll in an intermediate finance course after completing Principles of Finance. In addition, female students are less likely to earn a B.S. degree in finance. These results are consistent with the nationwide trends in undergraduate finance degree completion. There

Table 6.5 Marginal Effects for Logistic Regression of Finance Degree Selection

Variable	<b>Male</b> B.S. Finance	<b>Female</b> B.S. Finance
Minority	-0.018 (0.026)	-0.022 (0.030)
SAT Math	0.001 (0.002)	0.001 (0.002)
SAT Verbal	-0.003 (0.002)	-0.001 (0.001)
Finance at Finance	0.060* (0.025)	0.086* (0.036)
Int Finance Grade	0.028 (0.027)	-0.016 (0.034)
Relative Int Finance Grade	-0.090 (0.070)	0.080 (0.136)
Micro Grade	-0.022 (0.019)	-0.035 (0.022)
Macro Grade	0.006 (0.021)	0.044* (0.018)
Observations	573	211
% Correctly predicted	93.7%	93.4%
Log Likelihood	-126.552	-42.845

*Notes:* The marginal effects are evaluated at the means. Standard errors are in parenthesis. The reference group is students who were non-finance business majors at intermediate finance. \*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

has been no comparable research, however, on the gender gap in students' finance course persistence and degree selections even though prior studies have analyzed the gender gap in course persistence and degree selections in economics, in which there is a similar underrepresentation of women (Emerson et al, 2012; Rask & Tiefenthaler, 2008; Horvath et al., 1992; Jensen & Owen, 2001). The findings from this chapter on the importance of initial college major selection and the effect of students' relative introductory finance course grades on finance course persistence and degree selection are somewhat consistent with the economics literature.

Survey research of undergraduate business students has analyzed the differences in the selection of a business sub-discipline. Students who choose to major in finance rather than another subfield may be more likely to choose their major based on high expected earnings and the respect and prestige associated with working in a finance-related career (Kim et al., 2002; Roach et al., 2012; Worthington & Higgs, 2003). The pecuniary aspects of employment in the finance sector, including potential for a high salary and opportunities for career advancement, are stronger factors for men than women in determining their college major (Montmarquette et al., 2002; Zafar, 2013). Finance majors may also be less concerned as to whether their major is a “good fit” for their abilities; however, female students who select finance as their major rather than another subfield of business may be particularly attracted to the intellectual challenge provided by the finance coursework (Kim et al., 2002; Lowe & Simmons, 1997).

Additionally, female students may be discouraged from selecting a finance major based on their perceptions of working in the finance sector. Traditionally masculine character traits, such as aggressiveness and dominance, have historically been valued in the financial industry (Oliver Wyman, 2014). Female students may view individuals who work in the financial sector as less concerned with helping people or as lacking in ethics (Barber & Odean, 2001; Graafland & van de Ven, Bert W., 2011; Oliver Wyman, 2016; von Hippel et al., 2015). Some evidence suggests that a negative correlation may exist between a person’s degree of business ethics and selecting a financial career, such as stockbroker or financial advisor (Berings & Adriaenssens, 2012). In addition, individuals who major in finance may be less empathetic and display more narcissistic personality traits (Brown et al., 2010). The culture of working in the finance industry may also be

more competitive, rather than cooperative, which may turn away female students who tend to favor working in cooperative environments (Gneezy et al., 2003; Niederle & Vesterlund, 2007; Berings & Adriaenssens, 2012). Women who work in the finance sector may also experience stronger stereotype threat or a feeling that they must separate themselves from their feminine identity in order to be successful (von Hippel et al., 2016). As a result, they may be less likely to recommend younger women to go into the field of finance. Women who work in finance also tend to have lower salaries than their male peers (Roth, 2003; Bertrand et al, 2010), and this gender pay gap may discourage women from entering the field.

The results indicate that one of the strongest predictors of a student's propensity to enroll in an intermediate finance course is selecting finance as their initial major at the time of matriculating into the University of Delaware. This result is consistent for students of both genders, but the effect is strongest upon female students. Prior research indicates that taking a high school course in a subject is an important factor in college major selection, particularly for women (Malgwi et al., 2005). Students who have prior education in finance or who have taken a high school business course that includes a finance component may be influenced to select finance as their major. There has been an increase in the number of states mandating a personal finance course for high school graduation since the early 2000s, though only one-third of the states currently require a personal finance course (Council for Economic Education, 2016). As of 2018, twenty-two states require a high school personal finance course to be offered (Council for Economic Education, 2018). The increase in the number of states providing access to and requiring students to take a personal finance course may influence more women to select

a finance major in the future. On the other hand, the content provided in a high school personal finance course is different from the content taught in an undergraduate finance curriculum. Thus, an increase in high school personal finance education may not necessarily increase the share of women obtaining undergraduate finance degrees.

Students may also be influenced to major in finance if they complete a high school economics course. Studies have found that students who take an economics course in high school are more likely to major in economics (Ashworth & Evans, 2001; Bansak & Starr, 2010; Lopus, 1997). The results from this study indicate that female students who are economics majors at matriculation are more likely to enroll in an intermediate finance course after completion of Principles of Finance. Students may view economics and finance as substitute fields (Summers, 1985). It is possible that females may be more inclined to view economics and finance courses as similar, both in content and in methodology. Moreover, women who develop an interest in economics prior to entering college may be more interested in finance-related topics, such as global capital markets, than women who select other business degrees.

One of the biggest factors in a student's college major selection is interest in the subject (Beggs et al., 2008; Easterling & Smith, 2008; Malgwi et al., 2005; Zafar, 2013). Female students may also be less interested in finance course content (Jensen & Owen, 2001; Bansak & Starr, 2010). They may also have particularly negative perceptions of finance, believing it to be more repetitive and dull than their male peers (Worthington & Higgs, 2003). However, evidence suggests that students of both genders may view their introductory finance course as challenging, highly quantitative and theoretical, and one of the most difficult courses ever taken (Krishnan et al., 1999). Students may also perceive

their introductory finance course to be less useful than they anticipated (Krishnan et al., 1999). In fact, the results from one pre- and post-finance course survey revealed that over half of the students would not take a finance course if it were not required, which represented an increase from the 36% who agreed with this statement in the pre-course survey (Krishnan et al., 1999).

Women's experiences in the field of finance may be particularly negative (Krishnan et al., 1999; Worthington & Higgs, 2003). For instance, female students may experience gender bias in their introductory finance courses (Bauer & Dalquist, 1999). Finance textbooks may incorporate more examples of men making financial decisions, and men are more likely to be presented as investors and wealthy stock purchasers, relative to women who are presented as beauty salon owners or as needing more help with financial investment decisions (Bauer & Dalquist, 1999). Thus, the average introductory finance textbook may reinforce the belief that finance is a male-dominated field (Bauer & Dalquist, 1999). Women may also be deterred by the competitive nature of the field of finance (Niederle & Vesterlund, 2007; Gneezy, Niederle, & Rustichini, 2003). Additionally, women who work in the financial industry may experience a strong stereotype threat as well and may be less likely to recommend a finance career to younger women (von Hippel et al., 2015).

A student's grade in their introductory finance course may be a significant predictor of their likelihood to take an additional finance course, a finding that is consistent with research in economics course persistence (Rask & Tiefenthaler, 2008; Emerson, McGoldrick, & Mumford, 2012). Some evidence suggests that women perform worse than men in their introductory finance courses, although the findings are mixed

(Borde et al., 1998; Chan et al., 2005; Terry, 2002; Didia & Hasnat, 1998; Seiver et al., 2014). The results from this study indicate that female students, on average, earn grades in Principles of Finance that are on par with the grades male students receive.

Additionally, students with stronger quantitative skills perform better in their introductory finance courses (Ely & Hittle, 1990; Chan et al., 2005; Didia & Hasnat, 1998; Alcock et al., 2008), which supports the finding that students who earn a higher math SAT score may be more likely to enroll in an intermediate-level course than their peers with lower math aptitude. Given that women tend to earn lower math SAT scores than men (Turner & Bowen, 1999; Davison, Jew, & Davenport, 2014), women with stronger math ability may be more inclined to persist in taking additional finance classes.

Female students' intermediate finance course persistence is strongly affected by their relative Principles of Finance grades. This result is consistent with the literature that suggests women may be more sensitive to their relative course grades (Rask & Tiefenthaler, 2008; Sabot & Wakeman-Linn, 1991; Emerson et al., 2012). The findings indicate that there is no significant gender gap in students' intermediate finance course grades, and they are not significant predictors of the likelihood of selecting a finance degree for either gender. Thus, men's and women's grades in their first finance course may be a particularly important determinant of the finance degree selection. Students' grades in their introductory microeconomics and macroeconomics courses are also a significant predictor of their finance course persistence. Prior research has found that students who take an introductory economics course may earn a higher grade in introductory finance courses (Didia & Hasnat, 1998; Alcock et al., 2008). Terry (2002) found a significant gender gap in students' grades in a corporate finance class; female



students who took an economics course performed significantly better than their male peers. If students perceive economics and finance to be similar or view success in their introductory economics as an indicator of their future performance in Principles of Finance, they may be more likely to choose finance as their major. Since females' students grades in Introduction to Macroeconomics are significant, positive predictors of their persistence to an intermediate finance course and of earning a finance degree, women may be particularly inclined to view success in their economics courses as a predictor of success in finance courses.

Female students may also suffer from a lack of gender role models in finance. Only a small proportion of finance instructors are female (Dyl & Hasselback, 1998; Keys & Turner, 2006). Findings indicate that both men and women who take their first finance course with a full-time female professor are less likely to persist in taking an intermediate-level course. Female finance instructors may receive lower student evaluations of teaching (Constand & Clarke, 2015), resulting in students' being less inclined to enroll in additional finance courses. On the hand, male students' finance course persistence is positively correlated with taking a course with a male or female adjunct instructor. Prior research suggests that adjunct instructors who are working in professional fields may bring important industry knowledge into the classroom, resulting in greater course persistence (Bettinger & Long, 2010).

This chapter represents an initial analysis of the factors that determine students' finance course persistence and degree selections. The strongest determinant of both male and female persistence in the field of finance is choosing finance as their initial major. Although women are less likely to select finance as their major, those who do may be

more likely than male finance majors to graduate with a finance degree. The results also show that female students are more responsive to their relative Principles of Finance course grade. Women who are economics majors at matriculation are also significantly more likely to enroll in subsequent finance courses. Female students are also more encouraged to choose a finance degree based on a high grade in Introduction to Macroeconomics. In order to reduce the gender gap among undergraduate finance majors, finance departments may need to find ways to make the Principles of Finance course more appealing to women. In addition, the results indicate a need for more access to economics and finance education at the high school level. Further research may analyze students' associations between the fields of finance and economics as well as female students' perceptions of their finance course grades. Additional research may also attempt to replicate the methodology of finance course persistence using data from another college or university to see if there are similar results.

## **Chapter 7**

### **DISCUSSION AND CONCLUSIONS**

#### **7.1 Introduction**

Since the 1980s, the majority of undergraduate students have been female, and women currently represent 57% of all undergraduate degree recipients (Ball, 2012; Ceci et al., 2014; Goldin, Katz, & Kuziemko, 2006, National Center for Education Statistics, 2017). Despite this fact, women are significantly underrepresented in the fields of economics and finance. Female students earn approximately one-third of all economics and finance degrees (Ball, 2012; Ceci et al., 2014; Goldin, 2013; Kim et al., 2002; McElroy, 2014; National Center for Education Statistics, 2017; Siegfried, 2016). In contrast to the recent increases in the percentage of women who are choosing to complete a bachelor's degree in highly quantitative STEM areas, the share of female economics and finance degree earners has remained fairly constant for nearly twenty years (Bayer & Rouse, 2016; Siegfried, 2016). Female students are also less likely to take introductory economics and finance courses and to enroll in subsequent economics and finance courses course (Dynan & Rouse, 1997; Emerson et al., 2012; Fournier & Sass, 2000; Horvath et al., 1992; Rask & Tiefenthaler, 2008).

Prior research has analyzed the gender gap in economics degree selection through a variety of factors, including student demographic characteristics, ability, and economics

course grades (Chizmar, 2000; Dynan & Rouse, 1997; Emerson et al., 2012; Goldin, 2015a; Horvath et al., 1992; Jensen & Owen, 2001; Rask & Tiefenthaler, 2008; Robb & Robb, 1999). Other studies have estimated the degree to which economics instructors serve as gender role models (Ashworth & Evans, 2001; Bettinger & Long, 2005; Griffith, 2013; Hoffmann & Oreopoulos, 2009a; Jensen & Owen, 2001). Additional research has analyzed the effect of structural characteristics, including class size and peer influences (Emerson et al., 2012; Fournier & Sass, 2000; Rask & Bailey, 2002). Most of these studies focus on a student's choice between an economics major and a non-economics one, rather than the choice among different types of economics degrees, such as a Bachelor of Science (B.S.), a Bachelor of Arts (B.A.), and an economics minor. On the other hand, studies of finance major selection have mainly been limited to surveys of students' reasons for choosing their major, comparing students who choose finance with students who select other business subfields (Kim et al., 2002; Lowe & Simons, 1997; Malgwi et al., 2005; Pritchard, Robert E., Potter, Gregory C., Saccucci, Michael S., 2004). Some studies of finance students have also assessed differences in male and female students' perceptions of their introductory finance courses (Krishnan et al., 1999; Worthington & Higgs, 2003).

Building upon prior research, this study uses a series of binary and multinomial logistic regressions to analyze gender differences in students' economics and finance course persistence and their likelihoods of completing economics or finance degrees. The results for students' economics course persistence and degree completion are presented in chapters 4 and 5. Chapter 6 provides the results for gender differences in students' finance course persistence and degree completion. Since there has been no previous

research on students' finance course completion and degree attainment, this study is the first of its kind to assess the gender disparities in finance course persistence and finance degree completion.

Chapter 4 analyzes male and female students' economics course persistence and degree selection. The findings indicate that female students are less likely to enroll in Introduction to Macroeconomics after completing Introduction to Microeconomics; however, women who persist and select an economics major by the time they complete their introductory macroeconomics course are significantly more likely to take an intermediate microeconomics course. The findings in this chapter also reveal that female students' economics degree selections are significantly correlated with both their math and verbal aptitudes. In particular, women who earn higher scores on their verbal SAT are significantly more likely to choose a B.A. degree in economics, while those who earn a higher score on the math SAT are significantly more likely to choose the B.S. degree in economics. In contrast, male students' economics degree selections are correlated solely with their math SAT score. In addition, female students display strong responsiveness to their relative economics course grades, suggesting that women who earn higher grades in their economics courses relative to the grades they receive in other departments' courses may perceive that they have a comparative advantage in economics. As a result, they may be more likely to complete an economics degree.

Chapter 5 analyzes male and female students' selections of economics degrees based on their initial major selections and the grades they receive in Introduction to Microeconomics. The results show that students of both genders who initially select economics as a major have a strong propensity to graduate with an economics degree.

Moreover, a significant proportion of the students who complete economics degrees initially matriculate as non-economics majors. Consistent with the results in Chapter 4, female students are more sensitive than male students to their relative course grade in Introduction to Microeconomics. In addition, among students who graduate with more than one bachelor's degree, male students have a higher probability of selecting economics as one of those degrees.

Chapter 6 presents the results for an estimation of male and female students' finance course persistence and finance degree selections. The findings show that students who select finance as their major at matriculation into the University of Delaware are significantly more likely to take an intermediate finance course after completing Principles of Finance. In addition, women who select economics as their initial major are significantly more likely to take an intermediate finance course. Consistent with the results in chapters 4 and 5 regarding students' responsiveness to their course grades, female students who earn higher relative course grade in Principles of Finance have a strong probability of intermediate finance course persistence. Additionally, a student's grade in Introduction to Microeconomics is a predictor of intermediate finance course persistence for both male and female students. Furthermore, female students are significantly more likely to take an intermediate finance course and earn a B.S. degree in finance when they earn a higher grade in Introduction to Macroeconomics.

## **7.2 Initial College Major Selection**

### **7.2.1 Initial College Major Selection Results**

The findings from chapters 4, 5, and 6 indicate that a very small percentage of male and female students matriculated into the University of Delaware as economics

majors. Significantly fewer female students chose economics as their initial major. The results from Chapter 4 suggest that both male and students who initially select economics as their major are significantly more likely to enroll in an intermediate microeconomics course. The size of the marginal effect is over two times larger for female students, however, suggesting that a woman who matriculates into the University as an economics major has a high probability of economics course persistence. These findings are supported by the results of Chapter 5, which show that students of both genders who initially select an economics major are significantly more likely to graduate with an economics major degree. Consistent with the results from Chapter 4, the magnitude of the effect of being an initial economics major is stronger for women than men.

In Chapter 6, the findings for intermediate finance course persistence indicate that both male and female students who initially select finance as their majors are significantly more likely to take an intermediate finance course than their non-finance major peers. The size of the marginal effect is also stronger for female than male students, which is consistent with the findings from chapters 4 and 5. In addition, women whose initial major selection is economics are also significantly more likely to enroll in an intermediate finance course. On the other hand, matriculating as an economics major has no significant effect on male students' intermediate finance course persistence. Since students who major in economics are not required to take any finance courses, those who do may view economics and finance as complements. The B.S. in economics, B.S. in finance is one of the most popular double majors at the University of Delaware (Institutional Research and Effectiveness, 2018), and the results from this study suggest that female students who initially select an economics major may be more likely than

their male peers to perceive economics and finance as complementary fields. Moreover, women who matriculate as economics majors may have a strong interest in financial topics within the field of economics. In addition, students who have developed an interest in economics or finance prior to entering college may have a higher likelihood of finance course persistence and a stronger propensity to graduate with a finance degree. Female students may be particularly influenced to pursue a degree in finance due to prior exposure to economics and finance coursework.

### **7.2.2 Initial College Major Selection Policy Recommendations**

The results presented in chapters 4, 5, and 6 indicate that matriculating as an economics or finance major is a significantly positive predictor of a student's economics and finance degree selection. In fact, the findings suggest that students' initial selections of an economics or finance major may be the most important determinant of economics and finance degree completion. Furthermore, the results indicate that women who initially select a major in economics or finance are significantly more likely than their male peers to graduate with an economics or finance degree. Given these results, one way to reduce the gender gap in undergraduate economics and finance degree attainment may be through increased access to K-12 education in economics and finance. Students who complete pre-college coursework in economics and finance may be more likely to select economics or finance as their initial major, and female students' initial college major selections may be a particularly strong determinant of their degree completion.

Prior research suggests that students' sense of identity, interests, and ability self-efficacy perceptions influence students' college degree selections (Cheryan & Plaut, 2010; Good, Rattan, & Dweck, 2012; Murphy, Steele, & Gross, 2007; C. M. Steele,



1997; von Hippel, Sekaquaptewa, & McFarlane, 2015; Wang & Degol, 2013; Wang et al., 2013). In addition, studies show that students' identity-beliefs, academic interests, and ability expectations may be formed by early adolescence (Eccles, 2009; Konrad et al., 2000). Exposure to economics and personal finance instruction in elementary school may encourage students to develop positive attitudes towards economics and finance. At the same time, high-stakes testing has emphasized instruction in mathematics and English, leading to a marginalization of economics and financial instruction, especially in elementary schools.

Students' access to K-12 economic and finance education may be highly dependent upon state mandates. Since the early-2000s, there has been an increase in the number of states that have developed K-12 economic education standards and required implementation of those standards. There has also be an increase in the number of states that mandate economics as a high school graduation requirement. However, as of 2018, only half of the states require high schools to offer an economics course, and only 22 states require students to take a high school economics course (Council for Economic Education, 2018). Students who take a high school economics course may be more likely to select economics as their initial college major, which is important because the findings from this study indicate that students who choose economics as their initial major have a strong likelihood of economics course persistence and degree completion. In particular, exposure to economic education in high school may strongly influence female students to pursue economics as a college major since research suggests that women are more likely to choose their college major if they completed a high school course in the subject

(Malgwi et al., 2005). These findings suggest a need for more K-12 economics instruction, particularly at the high school level.

Simply completing a high school economics course may not draw more women into the field, however. The content taught in high school economics courses may be very different from what is taught in college-level economics. Moreover, completing a high school economics course may deter students from choosing to major in economics if the course is taught poorly. Prior research suggests that the quality of high school economic education varies significantly (Lopus, 1997; Walstad, 2001). Most high school economics teachers have very little college coursework in economics (Walstad 2001; Bosshardt and Watts 1994; Bosshardt & Watts, 2005; Walstad & Watts, 2015). As a result, they may struggle with the economics content and may have little understanding of effective economics pedagogy. Research on professional development opportunities, including workshops, in-service programs, and post-graduate courses have all been found to increase high school teachers' understanding and knowledge of economics as well as their economics pedagogical content knowledge (Swinton et al. 2010; Cargill et al. 2008; Butters et al., 2011). Post-graduate coursework may be an especially effective way to train economics teachers (Butters, Asarta, & Thompkins, 2013). These findings suggest a need for more training and support for K-12 teachers of economics. Improved economics instruction may increase students' interest in pursuing an economics major and may result in more women choosing economics as their initial major. University departments of economics may consider implementing a post-graduate program in economic education, such as the University of Delaware's Master of Arts in Economics and

Entrepreneurship for Educators, as a way to train high school teachers both in economics content knowledge and pedagogical practices that are effective in economics instruction.

Similar issues exist in students' access to K-12 finance education. As with K-12 economic education, more states mandate personal finance education today than in the early-2000s. Only about one-third of them, however, require students to take a personal finance course for graduation (Council for Economic Education, 2018). The quality of personal finance education, due to inadequate teacher training, may also be a problem. In some schools, teachers who are certified to teach math or social studies, rather than business, teach personal finance courses (Hite, Slocombe, Railsback, & Miller, 2011). The course content in college-level finance courses may also be quite different from what is typically taught in a high school personal finance course. High school courses may emphasize topics, such as spending and saving, credit, banking services, and consumer rights (Hite et al., 2011), while college courses may focus on derivatives, capital and money markets, corporate finance, and risk management (Root, Rozycki, Senteza, & Suh, 2007). On the other hand, there may be some overlapping areas of instruction, including insurance, investments, and real estate (Root et al., 2007; Hite et al., 2011). Students who take a personal finance course in high school receive exposure to finance-related topics, which may lead them to develop an interest in finance. As a result, improving access to and instruction of high school personal finance courses may increase the number of students who choose finance as their initial major. As with economics, female students who take a high school course covering finance topics may be particularly influenced to matriculate with a finance major, which may reduce the gender gap in finance degree attainment.

## **7.3 Economics and Finance Program Offerings**

### **7.3.1 Economics and Finance Program Offerings Results**

The Department of Economics at UD offers three different economics degrees. Students may select from two economics majors, including a B.S. degree and a B.A. degree. They may also choose to complete a minor in economics. All three degrees require students to complete Introduction to Microeconomics, Introduction to Macroeconomics, and an intermediate microeconomics course, but these courses are not restricted to economics majors or minors. The B.S. degree includes a calculus requirement, while the B.A. degree requires proficiency in an ancient or modern foreign language at the intermediate-level or better. Economics minors are not required to take calculus or demonstrate foreign-language proficiency. In contrast, the Department of Finance offers only one degree- a B.S. degree in finance. The introductory course in finance, Principles of Finance, is a core business requirement for all students who select a major within Lerner College of Business and Economics except for economics majors. The intermediate finance course offerings are primarily restricted to students who are finance majors or who are majoring in another business subfield with a finance concentration.

The results from chapter 4 suggest that a male student's choice of an economics degree is correlated with their math ability, and that female students who have strong math aptitude are more likely to select a B.S. degree in economics. Conversely, women with stronger verbal abilities have a significantly higher probability of selecting a B.A. degree in economics. The findings in chapter 4 also suggest that both male and female students who select economics as their major by the time they complete Introduction to

Macroeconomics are significantly more likely to persist in taking an intermediate microeconomics course, though the size of the marginal effect at the mean is stronger for female students. These results indicate that students' experiences in their introductory economics courses may have a significant effect on their propensity to complete an economics major, especially for female students.

The findings from chapter 5 indicate that students who graduate with an economics degree may be drawn from a variety of initial majors. Male students who begin as engineering majors or as undeclared majors are particularly likely to earn an economics major. Female students who matriculate as math, computer science, or applied economics majors are more likely to complete an economics major than students who matriculate as social science or engineering majors. In terms of selecting an economics minor, females who are initially engineering, natural science, or social science majors have a higher likelihood of earning a minor in economics, as are men who enter as declared business majors.

The findings from chapters 4, 5, and 6 also indicate that the timing of economics course completion may be an important factor in students' college major selection. Both male and female students who complete Introduction to Microeconomics after their freshman year are significantly less likely to enroll in Introduction to Macroeconomics. Furthermore, female students who complete an intermediate microeconomics course before their senior year have a significantly higher likelihood of earning a B.S. degree in economics rather than a B.A. degree. On the other hand, students of both genders who complete an intermediate microeconomics course during their senior year may be more likely to complete a minor in economics, and the magnitude of this result is stronger for

women. The results in chapter 6 indicate that completing Principles of Finance during their junior year is a significantly positive predictor of enrolling in an intermediate finance course for students of both genders.

### **7.3.2 Economics Program Policy Recommendations**

The results from this study suggest that students of both genders may be highly influenced by their economics course experiences, particularly in Introduction to Microeconomics and Introduction to Macroeconomics. Female students who have positive experiences in their introductory economics courses may be more likely to complete an economics degree. Yet prior research suggests that female students have particularly negative views of introductory economics courses (Bansak & Starr, 2010; Bollinger et al., 2009; Calkins & Welki, 2006). Efforts to make introductory level economics courses more appealing to female students may improve their opinions about economics. These efforts may include providing course content of interest to women, such as women's labor market issues, the role of women in the household and informal economies, and social issues (Ferber, 1995; Bartlett et al., 2005; Jensen & Owen, 2001; Bayer & Rouse, 2016; Emerson, McGoldrick, & Siegfried, 2018) as well as reducing the amount of graph instruction (Cohn et al, 2004; Jensen & Owen, 2001). Making curricular changes in introductory economics courses may also increase women's confidence in their economics ability, leading more women into economics (Jensen & Owen, 2001).

In addition, the findings from this study indicate that women who have strong verbal ability may be more likely to choose a B.A. degree in economics, while women with high math aptitude may be more inclined to select the B.S. degree in economics. Women with strong verbal ability may view a humanities-oriented B.A. degree as an

alternative to a more traditional B.S. degree in economics that is math-intensive. The results from this study are also consistent with prior literature indicating that women have a comparative advantage in English over math (Davison, Jew, & Davenport, 2014; Turner & Bowen, 1999). Thus, by offering a B.A. degree that includes a language requirement, more women may be drawn into an economics major.

Research also suggests that universities that house their economics departments within a business school, as is the case at the University of Delaware, tend to have less variety in their economics electives (Dean & Dolan, 2001). For instance, these departments are less likely to offer elective courses, such as development economics, gender economics, health economics, or Marxian economics (Dean & Dolan, 2001). It is possible that female students may be more inclined to select economics as their major when a wider range of elective courses are available. One survey of male and female economics majors found that female majors wanted to see their programs change by offering more breadth in their courses as well as more coursework that promotes diversity and living in a global society (Jones et al., 2008). The results from chapter 5 indicate that women who choose an initial major in the social or natural sciences, and in the humanities, education, or health sciences have a higher likelihood of completing an economics major than female business students, therefore, increasing the variety of economics electives related to social issues may reduce the gender gap in undergraduate economics degree attainment. Thus, economics departments may want to offer more elective courses related to social issues, such as the economics of gender, the economics of discrimination, and inequality, which may make pursuing an economics major more appealing to female students (Bansak & Starr, 2010; Jones et al., 2008).

## **7.4 Economics and Finance Course Grades**

### **7.4.1 Economics and Finance Course Grades Results**

The findings from this study indicate that students' grades in their economics and finance courses have a significant effect on their economics and finance course persistence and degree selections. Chapter 4 shows that female students' economics course persistence is strongly influenced by their relative course grades in Introduction to Microeconomics and Introduction to Macroeconomics. Similarly, the findings in Chapter 6 indicate that female students' intermediate finance course persistence is significantly affected by earning a high relative course grade in Principles of Finance. Furthermore, both male and female students have higher rates of persistence to intermediate finance when they earn a higher grade in Introduction to Microeconomics. In addition, female students who earn a higher grade in Introduction to Macroeconomics are more likely to take an intermediate finance course and earn a B.S. degree in finance. Introduction to Macroeconomics includes course topics related to money and banking, and women who perform well in their introductory macroeconomics course may perceive that they will have more success in finance courses.

### **7.4.2 Economics and Finance Course Grades Policy Recommendations**

The implications of these findings may be significant, particularly when considering issues of grade inflation and departmental grading disparities. Economics departments may consider examining grading patterns in their economics courses and whether departmental grading disparities exist. Grading disparities between economics and business departments may be particularly important because at many institutions,



business students are required to complete both introductory microeconomics and macroeconomics. At UD, students who complete courses within the Department of Economics have lower grades on average than the average grades of students who complete courses from the four other departments within Lerner College of Business and Economics (Office of Institutional Research and Effectiveness, “University of Delaware Undergraduate Standard Grade Distribution”). The results from chapter 6 indicate that the average grade in Introduction to Microeconomics is a B- compared to the average grade in Principles of Finance, which is a B. These results are consistent for both genders. Additionally, while women are underrepresented in economics and finance degree attainment relative to the percentages of women in other business fields, the findings show that more women graduated with a degree in finance than economics. The results in chapters 4 and 6 show that approximately 27% of the students at UD who complete a B.S. in finance are women, while female students represent 22% of the students who graduate with a B.S. degree or B.A. degree in economics. The difference in average grades in students’ introductory economics and finance courses may be one potential explanation for more women selecting finance degrees, particularly since the results indicate that women are more responsive to their relative economics and finance course grades.

Departmental grading disparities also distort the information that course grades provide to students. Women may perceive a low relative grade in an introductory economics or finance course is an indication that these subjects are not an academic strength (Beyer, 1999; S. Correll, 2001). They may believe that they will not do well in future economics courses and may decide not to take additional economics courses for

that reason. Departmental grading differentials may reinforce women's perceptions of low economics and finance self-efficacy but may have a smaller effect on male students, who may be less sensitive to their relative economics and finance course grades.

Research on grade inflation and departmental grading differentials provides some support for this conclusion (Butcher et al., 2014; Kostal et al., 2016; Bar et al., 2009). One study at an all-women's college found that a college-wide policy designed to reduce departmental grading disparities significantly increased the percentage of women who selected an economics degree, which was initially one of the low-grading departments on campus (Butcher et al., 2014). Efforts to assess and reduce grading differentials between economics and other departments may positively affect women's economics course persistence and degree selection. Furthermore, given that the results from this study indicate that women's introductory microeconomics and macroeconomics course grades significantly affect their propensity to persist in taking intermediate finance courses, efforts to reduce grading disparities between economics and other departments may also increase the percentage of women who complete a finance degree.

Some support for this recommendation is provided by the preliminary findings from the *Undergraduate Women in Economics Challenge* (UWE), which has focused on ways to reduce the gender gap among undergraduate economics majors (Avilova & Goldin, 2018). Although the UWE initiative is still in progress, at one university an intervention aimed at providing women with greater information about their economics course grades was associated with an increase in female students' subjective probability of selecting economics as a major (Li, 2017). The intervention provided female students who were taking an introductory economics course with information about the grade

distribution at mid-term, and women whose grades were at or above the median-grade received a letter of praise and encouragement. Furthermore, this treatment was more effective than interventions that presented female students with a video about careers in economics or encouraged women to participate in peer mentoring activities (Li, 2017). Such findings suggest that providing better information about grades to female students may change their perceptions of lower relative economics course grades.

## **7.5 Instructor and Structural Effects**

### **7.5.1 Instructor and Structural Effects Results**

The results from this study present mixed findings for the effect of instructor and structural characteristics on students' economics and finance course persistence. In chapter 4, instructor and structural characteristics were added into the estimations of economics course persistence and degree selection. The findings indicate that male students may be significantly less likely to take Introduction to Macroeconomics if they complete Introduction to Microeconomics with a female professor or a female graduate student instructor. Male students' persistence to an intermediate microeconomics course has a significant, positive correlation with taking Introduction to Macroeconomics with a male adjunct instructor. On the other hand, the results suggest that instructor gender and type have no significant effect on female students' economics course persistence. The findings from chapter 4 also suggest that students of both genders who take Introduction to Microeconomics in a larger class are less likely to enroll in Introduction to Macroeconomics. In contrast to prior studies of economics course persistence, male students who take Introduction to Microeconomics in a class that has a larger share of female students are significantly more likely to take Introduction to Macroeconomics.

The results from chapter 6 indicate that both male and female students who take Principles of Finance with a female professor are significantly less likely to take an intermediate microeconomics course. In addition, male students who complete their introductory finance course with an adjunct instructor of either gender have a significant, positive probability of enrolling in an intermediate finance course. The results also suggest that students of both genders who take Principles of Finance with a larger class are significantly more likely to persist to an intermediate finance course. On the other hand, for male students, having a larger percentage of women in their Principles of Finance course is a significant, negative predictor of their likelihood of taking an intermediate finance course.

### **7.5.2 Instructor and Structural Effects Policy Recommendations**

Prior studies have analyzed the effect of instructor role models, though the findings have been mixed (Bettinger & Long, 2005; Rask & Bailey, 2002; Saunders & Saunders, 1999; Canes & Rosen, 1995; Emerson et al., 2018; Robb & Robb, 1999). The results from this study indicate that male students who take introductory economics courses with a male instructor may be more likely to enroll in subsequent economics courses. Men who take their introductory microeconomics courses with a male professor may view the instructor as similar to themselves, increasing male students' expectations that they can be successful in the field of economics (Bettinger & Long, 2005; Carrell et al., 2010; Rask & Bailey, 2002; Bettinger et al., 2016; Fournier & Sass, 2000). In addition, male students' may also view graduate student instructors as role models (Bettinger & Long, 2016), especially if they are considering pursuing graduate studies. This study suggests that male students' persistence to an intermediate microeconomics

course may be positively affected by adjunct instructors, both in economics and in finance. Some evidence suggests that adjunct instructors in professional fields, such as economics and finance, have a positive effect on students' course persistence because they can bring important industry knowledge and experience into their teaching (Bettinger & Long, 2010). Instructors may also indirectly influence students' economics and finance course persistence through the grades they assign. Some prior evidence suggests that students may perform better in classes with graduate student or adjunct instructors (Bettinger & Long, 2010; Bettinger et al., 2016; Fournier & Sass, 2000).

Some studies find no significant same-gender role model effects for female economics students (Canes & Rosen, 1995; Robb & Robb, 1999; Saunders & Saunders, 1999), suggesting that female students economics course persistence is driven by factors other than instructor gender and type. On the other hand, the results from this study show that both men and women who take their introductory finance course with a female instructor are less likely to enroll in an intermediate finance course. One potential explanation for this result is that female instructors receive more negative student evaluations of teaching (Boring, 2017; Boring, Ottoboni, & Stark, 2016; Kogan, Schoenfeld-Tacher, & Hellyer, 2010). Students may perceive the fields of economics and finance as traditionally male, and female students may experience fear of stereotype threat that discourages them from pursuing a finance degree (von Hippel et al., 2015). Students may also evaluate professors in challenging subjects, such as finance, more negatively, and it is possible that female professors are viewed as being more difficult (Constand & Pace, 2014).

The results from this study suggest a need for quality economics and finance instruction at the college level. Research shows that lecture is still the predominant instructional method used in introductory college economics courses (Watts & Schaur, 2011; Watts & Becker, 2008; Allgood, Walstad, & Siegfried, 2015; Harter, Schaur, & Watts, 2015). Conversely, prior studies suggests that students benefit from more active learning instructional strategies, such as use of cooperative learning and class experiments that may particularly benefit women and younger students (Emerson & Taylor, 2004; Ball, Eckel, and Rojas, 2006). Another issue is related to lack of preparation in teaching for economics graduate student instructors since many economics departments do not require graduate students to complete any training or coursework on college instruction (Allgood et al., 2015; Walstad & Becker, 2010). Requiring graduate student instructors to take a credit course on teaching may improve the quality of instruction in introductory economics courses and improve students' attitudes and interest in taking additional economics class and selecting economics as their major.

## **7.6 Limitations**

### **7.6.1 Threats to Internal Validity**

The methodology used in this study may result in several internal validity threats. One limitation is related to attrition. In an attempt to analyze students' economics and finance course persistence, some students may fail to take additional economics or finance courses because they have dropped out of the University due to low performance, or they may have transferred to another institution. As a result, some students in the full sample may be lost due to attrition. A second limitation is that, in the attempt to control for the instructor and structural (class) effects, the issue of selection arises. Since students

are able to select their course sections, they may self-select into classes of a particular size or with a particular instructor. For instance, some students may prefer to take their introductory economics course with a graduate student or their first finance course with an adjunct instructor. In addition, students may prefer a large or small class size. Courses taught by graduate and adjunct instructors tend to be smaller than those taught by full-time faculty, which may represent a confounding interaction between class size and instructor type. Students may also self-select into courses with professors who are deemed “easy” graders (Bar et al., 2009).

A third limitation is that the study does not control for instructor fixed effects. Instructors differ highly in terms of experience, pedagogy, and personality, all of which may impact students’ perceptions of their course experiences. Evidence suggests that female instructors in economics and finance receive lower student evaluations of teaching (Boring, 2017; Kogan et al., 2010). Students may also be more likely to negatively evaluate instructors who are perceived as difficult (Constand & Pace, 2014). In addition, the findings in this study suggest that fewer students take economics and finance course with female professors and female adjunct instructors. Also, there may be no female instructors for certain courses, such as Quantitative Microeconomic Theory, or female instructors may only teach Honors-level course sections. As a result, the findings for the effects of instructor type and gender may be biased because they may be limited to only female instructor of that type. For example, if there is only one female adjunct instructor who teaches Principles of Finance, students’ experiences with that instructor may affect their finance course persistence, but the results may not be a good predictor of how students will respond to other female adjunct finance instructors.

A final limitation is related to the internal validity threat of history. The data used in this study represents students who completed economics and finance courses between 2006 and 2015. The financial crisis and Great Recession of 2008-2009 was a major global event, which may have significantly affected the number and percentage of students who completed economics and finance courses or graduated with a degree in economics or finance. For instance, the crisis may have discouraged some students from pursuing degrees in finance or economics fields. This study does not include any fixed effects to control for students' year of college entry or graduation, which may affect the findings.

#### **7.6.2 Threats to External Validity**

The data used in this study are from a single institution, which may hinder the external validity of the results. As such, the findings may not be generally applicable to other universities or colleges. In particular, prior research suggests that institutional characteristics may differentially affect students' economics course persistence and their likelihood of graduating with an economics degree (Griffith, 2010; Kinzie et al., 2007; Solnick, 1995; Goldin, 2015; Siegfried, 2016). Public universities, such as the University of Delaware, graduate fewer female economics majors compared to private ones (Goldin, 2015; Siegfried, 2016). Additionally, the type of university or the location of the economics department in the business school may affect the economics program requirements and curricula, including the course offerings (Walstad, 2014; Petkus et al., 2014; Dean & Dolan, 2001). There is also a wide range of differences in university finance programs. Most institutions offer a separate finance degree, though a limited number of colleges only offer a joint degree in finance combined with economics,



accounting, or marketing (Root et al., 2007). Differences may also exist in in finance curricular offerings depending on whether the institution has received accreditation from the Association to Advance Collegiate Schools of Business (AACSB) (Root et al., 2007). Additionally, not all institutions require introductory microeconomics and/or macroeconomics as a requirement for a finance degree (Root et al., 2007).

## **7.7 Implications for Future Research**

Because female students may be particularly sensitive to the grades they receive in their economics and finance courses, additional research may analyze students' perceptions of their economics course grades. For instance, male and female students may have disparate perspectives on the meaning behind a particular grade (e.g. a B+, a B, or a B-). In addition, students may view their grades in economics or finance courses differently depending on their initial major selection or if they had prior exposure to economics or finance. A qualitative study using student interviews would be useful in getting students' opinions and perspectives on their grades. In addition, a mixed-methods study combining a survey with student interviews might be helpful.

Students' grades in economics and finance course may be tied to biases, stereotypes, and self-efficacy beliefs. Students of both genders may believe that the fields of economics and finance are traditionally male. Female students may experience stereotype threat or develop implicit biases about working in a financial field. In addition, students' biases and perceptions of their economics or finance ability self-efficacy may affect their economics and finance degree selection. Additional research may examine how these factors affect male and female students' propensities to complete economics and finance courses and pursue degrees in economics and finance. Research related to

students' biases, stereotypes, and self-efficacy beliefs may be modeled after experimental studies that have assessed these issues among STEM students (Correll, 2004; Kiefer & Sekaquaptewa, 2007; Nosek et al., 2009; Spencer et al., 1999; Beyer, 1999; Beyer, 1998; Niederle & Vesterlund, 2007; Murphy et al., 2007).

More research is also needed into how male and female students' math and verbal abilities affect the type of economics degree they select. Further research may also analyze students' associations between their economics and finance coursework. A follow-up study using data from another college or university that offers both a B.S. degree in economics and a B.A. degree in economics may add support to the findings in this study. Finally, much more research is needed on the determinants of finance major selection, both generally and in relation to the gender gap among undergraduate finance majors.

## **7.8 Conclusions**

The purpose of this study was to assess how student, instructor, and structural characteristics differentially affect male and female undergraduate students' economics and finance course persistence and degree selection. The goal was to examine the reasons for the gender gap in degree attainment in these fields and to determine ways to increase the representation of women in undergraduate economics and finance degree programs. Ultimately, I hope that the findings from this study will provide information for university economics and finance departments as well as economic educators about the causes for women's underrepresentation in these fields. In addition, I offer policy recommendations that may be implemented to encourage more women to graduate with a bachelor's degree in economics or finance.

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## **Appendix A**

### **INITIAL COLLEGE MAJOR CATEGORIES**

#### **Economics Entry**

Economics (B.A.)

Economics (B.S.)

#### **Business Entry**

Accounting (B.S.)

Business Administration (B.S.)

Business Undeclared

Entrepreneurship and Technology Innovation (B.S.)

Finance (B.S.)

Hospitality Industry Studies (B.S.)

Hotel, Restaurant, and Institutional Management (B.S.)

Hospitality Industry Management (B.S.)

International Business Studies (B.S.)

Management (B.S.)

Management Information Systems (B.S.)

Marketing (B.S.)

Operations Management (B.S.)

Sport Management (B.S.)

Sport Management Interest

#### **Engineering Entry**

Biomedical Engineering (B.B.E.)

Civil Engineering (B.C.E.)

Chemical Engineering (B.Ch.E.)

Computer Engineering (B.Cp.E.)

Electrical Engineering (B.E.E.)

Engineering- Undeclared

Environmental Engineering (B.En.E.)

Engineering Technology (B.S.)

Liberal Arts- Engineering (B.A.)

Mechanical Engineering (B.M.E.)

#### **Hum/Health/Educ Entry**

Agricultural Education (B.S.)

Applied Nutrition (B.S.)

Applied Music- Voice (B.M.)

Apparel Design (B.S.)

Art History (B.A.)  
 Art Conservation (B.A.)  
 Art (B.A.)  
 Athletic Training (B.S.)  
 Athletic Training Interest\*  
 Asian Studies (B.A.)  
 Black American Studies (B.A.)  
 Biological Science Education (B.A.)  
 Chemistry Education (B.A.)  
 Communication (B.A.)  
 Communication Interest\*  
 Dietetics (B.S.)  
 East Asian Studies (B.A.)  
 Early Childhood Development and Education (B.S.)  
 Early Childhood Education (B.S.)  
 Earth Science Education (B.A.)  
 Economics Education (B.A.)  
 Elementary Teacher Education (A.A.)  
 Elementary Teacher Education (B.S.Ed.)  
 English (B.A.)  
 English Education (B.A.)  
 Exercise Science (B.S.)  
 Exercise Science Interest\*  
 European Studies (B.A.)  
 Family and Community Services (B.S.)  
 Fine Arts (B.F.A.)  
 Fine Art Interest\*  
 Foreign Languages and Literatures (B.A.)  
 French/Political Science (B.A.)  
 Geography Education (B.A.)  
 Health and Physical Education  
 Health and Physical Education Interest\*  
 Health Behavior Management Interest\*  
 Health Behavior Science (B.S.)  
 Health Behavior Science Interest\*  
 Health Sciences (B.S.)  
 Health Studies (B.S.)  
 History and Foreign Language (B.A.)  
 History Education (B.A.)  
 Human Services, Education, and Public Policy (B.S.)  
 Human Services (B.S.)  
 Latin American and Iberian Studies (B.A.)  
 Liberal Studies (B.A.)  
 Linguistics (B.A.)  
 Mathematics Education (B.A.)  
 Material Culture Preservation (B.A.)

Medical Laboratory and Diagnostics Interest\*

Medical Laboratory Science (B.S.)

Medical Technology (B.S.)

Medical Technology Interest\*

Music (B.A.)

Music Education- Instrumental (B.M.)

Neuroscience (B.S.)

Nutritional Sciences (B.S.)

Nursing (B.S.N.)

Pharmacy Interest\*

Philosophy (B.A.)

Sociology Education (B.A.)

Spanish Education (B.A.)

Spanish/Political Science (B.A.)

Theatre Production (B.A.)

Visual Communication (B.F.A.)

Visual Communication Interest\*

Women and Gender Studies (B.A.)

### **Math/CSci/Ap Econ Entry**

Actuarial Sciences (B.S.)

Applied Mathematics (B.S.)

Computer Science (B.A.)

Computer Science (B.S.)

Environmental and Resource Economics (B.S.)

Food and Agribusiness Marketing and Management (B.S.)

Information Systems (B.S.)

Leadership and Consumer Economics (B.S.)

Mathematics (B.A.)

Mathematics (B.S.)

Mathematics and Economics (B.S.)

Natural Resource Management (B.S.)

Statistics (B.A.)

### **Natural Sciences Entry**

Animal and Food Sciences (B.S.)

Agriculture and Natural Resources (B.S.)

Animal Science (B.S.)

Biochemistry (B.S.)

Biological Sciences (B.A.)

Biological Sciences (B.S.)

Chemistry (B.A.)

Chemistry (B.S.)

Ecology (B.S.)

Energy and Environmental Policy (B.S.)

Entomology (B.S.)

Environmental Science (B.S.)  
Environmental Soil Science (B.S.)  
Environmental Studies (B.A.)  
Food Science (B.S.)  
Food Science and Technology (B.S.)  
Geological Sciences (B.A.)  
Geological Sciences (B.S.)  
General Agriculture (B.S.)  
Insect Ecology and Conservation (B.S.)  
Landscape Horticulture (B.S.)  
Landscape Horticulture and Design (B.S.)  
Marine Science (B.S.)  
Meteorology and Climatology (B.S.)  
Quantitative Biology (B.S.)  
Plant Science (B.S.)  
Physics (B.A.)  
Physics (B.S.)  
Pre-Veterinary Medicine and Animal Biosciences (B.S.)  
Wildlife Ecology Conservation (B.S.)

**Social Sciences Entry**

Anthropology (B.A.)  
Criminal Justice (B.A.)  
Cognitive Science (B.S.)  
Cognitive Science Interest\*  
Geography (B.A.)  
History (B.A.)  
International Relations (B.A.)  
Leadership (B.S.)  
Organizational and Community Leadership (B.S.)  
Public Policy (B.A.)  
Political Science (B.A.)  
Psychology (B.A.)  
Psychology (B.S.)

**Undeclared Entry**

University Studies

\*These majors are very popular and highly competitive at the University of Delaware; therefore, all incoming students who intend to major in these programs enter as “Interest” majors. They must meet certain academic requirements to be allowed to continue in the major.

## Appendix B

### HUMAN SUBJECTS/IRB APPROVAL



DATE: April 18, 2016

TO: Laura Ahlstrom  
FROM: University of Delaware IRB

STUDY TITLE: [894006-1] Where are the Women? The Gender Gap Among Undergraduate Economics and Finance Majors

SUBMISSION TYPE: New Project

ACTION: APPROVED

APPROVAL DATE: April 18, 2016

EXPIRATION DATE: April 17, 2017

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # (5)

Request for Waiver of Consent satisfied under 45 CFR 46.116 c(2)

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.