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## Collegiate Grading Practices and the Gender Pay Gap

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### Abstract

Extending research findings by R. Sabot and J. Wakeman-Linn (1991), this article presents a theoretical analysis showing that relatively low grading quantitative fields and high grading verbal fields create a disincentive for college women to invest in quantitative study. Pressures on grading practices are modeled using higher education production functions.

The gender pay gap has narrowed in the United States since the 1970s, but is still of sufficient magnitude to warrant concern about the equal employment and status of women. The decrease in the size of the gap can be explained in part by the increasing numbers of college women who responded to expanded opportunities in the labor market and chose to enter technical and applied fields, particularly business (Eide, 1994; Loury, 1997). Women entering fields requiring quantitative skills can expect a greater return on their educational investments, because such skills are a relatively scarce human capital input (Paglin & Rufolo, 1990). Numerous studies have demonstrated that, all else equal, college graduates with quantitative skills will earn more than their counterparts without such skills (Berger, 1992; Eide, 1994; James & Alsalam, 1993; Rumberger &

Thomas, 1993; Sharp & Weidman, 1989). However, women continue to be disproportionately represented in the humanities and social sciences and underrepresented in mathematics and the applied and physical sciences (National Center for Education Statistics, 1997). The theoretical analysis presented in this article shows that one way to increase the participation of college women in quantitative fields, and potentially reduce the pay gap even further, is to institute uniform collegiate grading practices in quantitative and nonquantitative fields.

Previous research (Kuh & Hu, 1999; Sabot & Wakeman-Linn, 1991) has provided evidence that grade inflation and compression has occurred in collegiate disciplines at different rates, creating non-uniform (or divergent) grading practices. One factor contributing to the underenrollment of women in quantitative fields may be the use of relatively high grading practices in nonquantitative, or "verbal," fields and low grading practices in quantitative fields. This article has two purposes. The first is to show that grading disparities between academic disciplines have a significant impact on the curricular and career choices of female students. The second is to apply the analytical tool of the higher education production function to explain pressures on assessment practices from within and outside the academy that lead to divergent grading practices. This analysis also considers from which quarter pressure might come to change such practices. The discussion takes account of the public and private nature of institutions of higher education, noting that human capital formation is not their only, or necessarily even primary, function.

## **Theoretical Framework**

Students earn college credits and degrees by investing time, money, and effort. At the majority of institutions of higher education, student performance in classes is evaluated with grades, and students must receive passing grades to receive credit for coursework. Students must also earn a sufficient number of credits in prescribed areas to be granted a degree in any given field of study. Variation in the effort students must expend to successfully complete coursework in different fields creates variation also in the costs of earning credits in those fields. The full costs of that effort will be tempered by a student's motivation and interest.

A student might pay the same tuition to major in mathematics or in English, but if she has strong mathematical skills and weak writing skills, she will have to invest more time to earn passing grades in English than in mathematics. Thus, the cost of earning a degree in a given field depends on the effort a student must expend to complete courses with a passing grade, or, for students with higher standards, to be satisfied with his or her own performance. In addition, some fields have more numerous or rigorous requirements, which raises the cost of study in that field relative to other fields for any student. (Note 1) The grades students receive inform them of their area of comparative advantage in completing coursework in a subject, the probability of successful completion of a course of study, and the costs (in time and effort) of obtaining a degree (Altonji, 1993).

The analysis presented in this article is based on an economic approach (Becker, 1976) to understanding the curricular and career choices of college students. Educational choices are treated as investment decisions, influenced by pecuniary and non-pecuniary costs and benefits. By her curricular choices, a student determines the specific type of human capital she will acquire. She thereby influences potential future returns to the educational investment and her ability to maximize her "utility," or satisfaction. The economic approach to understanding human behavior makes a number of assumptions

about the way in which individuals conceive of their well being. Self-interest is conceived of broadly, beyond the pursuit of material concerns, to include a wide range of values and preferences. Individuals are considered to be forward-looking, to have consistent preferences over time, and to seek to maximize their welfare. There are a number of constraints on a person's capacity to pursue his or her self-interest and these include time, income, incomplete information, and lapses in judgment (Becker, 1996).

Altonji (1993) has highlighted the fact that individuals make educational choices under considerable uncertainty regarding their ability to complete a course of study in their selected field. His analysis (p. 51) models how "new information about preferences and academic performance, and new information about payoffs influence choice of major and the decision to stay in school." Within this human capital framework, as individuals gain new information, they make their curricular choices, transferring from one field to another or dropping out of college, based on an estimation of their ability to complete degree requirements. The probability of completion is influenced by their stock of knowledge, academic ability, and by degree requirements. The utility function indicated by Altonji's analysis also includes educational and occupational preferences and the present value of lifetime earnings.

## **Prior Research**

In a 1991 article published in the *Journal of Economic Perspectives*, Sabot and Wakeman-Linn examined the influence of collegiate grading practices on student course choice. They documented the existence of grade inflation and compression (low variation) and also observed grading patterns that characterized high and low grading departments. They concluded that students face a disincentive to study in low grading fields, which, in their study of a small but varied sample of U.S. colleges, were predominantly quantitative fields. They found that economics, chemistry, and mathematics are consistently low grading fields, while art, English, music, philosophy, psychology, and political science are consistently high grading fields. In a survey administered to a small sample of English majors at a research university (Dowd, 1998), I also found that responding students believed that the average grades in biological sciences, physics, computer science, and chemistry at their institution was a B-; in political science, philosophy, economics, and mathematics a B; and in foreign languages, English, sociology, and history a B+. Consistent with Sabot and Wakemann-Linn's study, the low grading fields included quantitative subjects and the high grading fields included verbal subjects.

Davis (1966) argued that college students assess their areas of comparative advantage (where their skills and aptitudes put them ahead of their peers) based on the local competition for grades at their institution. Students then shape their career plans based on the feedback grades provide. However, Sabot and Wakeman-Linn (1991) observed that due to varying rates of grade inflation and compression among academic departments, "grades as a signal of relative strengths and weaknesses {are} more difficult for students to interpret." They noted (p. 167) that students do not adequately adjust their perception of differentially-scaled grades in order to gain a sense of their relative strengths and weaknesses, because "the incentive effects of absolute grades on course choice are far more powerful" than the indicators of comparative advantage that are weakened by non-uniform grading. Sabot and Wakeman-Linn argued that arbitrary differences in grading policies should be eliminated, because they provide incentives for some students to move away from academic areas where they are comparatively strong. Conversely, the effect of more-uniform grading policies would be to encourage greater

numbers of students to take courses in the currently low grading departments, which are those that place emphasis on quantitative skills. While the labor market, through high earnings, provides an incentive to invest in quantitative study, under divergent grading—where quantitative fields are low grading relative to others—colleges create a disincentive to investment in quantitative study.

## **Divergent Grading and Labor Market Supply**

The following simple utility-maximizing model extends Sabot and Wakeman-Linn's (1991) analysis to highlight the influence of non-uniform grading practices, where they exist, on the supply of college graduates with quantitative skills. The model is intended to facilitate a policy analysis of the implications of divergent grading for gender equity in earnings.

Under divergent grading practices, when a student decides in which fields of study to invest her time, she faces greater costs to obtain the valuables associated with college study in a quantitative rather than a verbal field. To obtain a certain number of credits in a quantitative rather than a humanities class with a grade of B would on average require more effort, because quantitative classes have lower mean grades. The relative costs of the effort to earn a degree through study in quantitatively or verbally oriented fields may be represented by the ratio  $E_Q/E_V$ , where  $E_Q$  represents the costs, psychic and otherwise, associated with quantitative study, and  $E_V$  represents the costs associated with verbal study. I assume that this ratio is fixed for each individual (disregarding the fact that costs would vary as students make marginal investments in either field).

We can also represent the ratio of the different compensation packages offered by employers to individuals with strong quantitative and strong verbal skills as  $W_Q/W_V$ . Again, I assume that this ratio is fixed. A forward-looking student with complete information about her future wage potential could determine whether to invest in quantitative or verbal study by comparing  $W_Q/W_V$  and  $E_Q/E_V$ . If  $W_Q/W_V > E_Q/E_V$ , she would choose to invest in quantitative study. If  $W_Q/W_V < E_Q/E_V$ , she would choose to invest in verbal study, and if the two ratios are equal, she would be indifferent to these two options. For example, if the wage ratio is 2:1 (Q:V), then the student should invest her time pursuing quantitative study as long as earning credits in quantitative fields is less than twice as difficult (accounting for all costs, both psychic and material) as earning credits in verbal fields. The forward-looking student in this scenario would need to take into account lifelong earnings and career satisfaction, as well as the continuing education required to succeed at the occupations pursued.

The college's assessment systems and grading policies affect a student's decision to choose to study in a quantitative or verbal field by the fact that the differential between average grades in these two types of fields is one component (along with ability, motivation, and interest) establishing the ratio  $E_Q/E_V$ . As the differential increases, the value of  $E_Q/E_V$  also increases, and a greater number of students will determine it is not a wise investment to study in a quantitative field. In this way, the divergent grading system is a contributing factor determining the proportion of the population of college graduates who enter the labor market with quantitative skills. Student perceptions of the relative wages offered for quantitative and verbal skills also influence the proportion of students who enter different fields of study (as Freeman (1978) has illustrated with his cobweb model of curricular and career choice).

College graduates with different types of interests and abilities encounter different opportunities in the labor market. As strong quantitative skills are scarce relative to

strong verbal skills, quantitative skills are compensated at a higher rate in the labor market than are verbal skills. Recent studies indicate earnings advantages over comparison groups of humanities and education majors of 23% to 61% for engineers, up to 25% for business majors, 13% to 35% for students of mathematics and the physical sciences, and 8% to 24% for social scientists (Angle & Wissmann, 1981; Berger, 1992; Bishop, 1994; Daymont & Andrisani, 1984; Eide, 1994; Griffin & Alexander, 1978; James & Alsalam, 1993; Rumberger & Thomas, 1993; Sharp & Weidman, 1989). When students are influenced by divergent grading practices to invest in verbal skills rather than in quantitative skills, the supply of verbal skills provided by college graduates to the labor market increases over the supply of graduates who would have made this choice, given their aptitudes and interests, under uniform grading practices. Labor economic theory indicates that the impact of this supply shift would lead to a decrease in wages paid to graduates offering verbal skills to employers (Ehrenberg & Smith, 1993).

### **Influences on the Curricular Choices of Women**

Divergent grading leads to a greater quantitative- skills deficit among women than among men for several reasons. The first relates to the distribution of quantitative skills among men and women. In the population of college-bound high school graduates, women are less likely to be among those with the strongest quantitative skills. In addition, the measured quantitative and verbal skills of men show greater variance than that of women (Cole, 1997), and those students at the tails of the quantitative and verbal skills distribution are least affected by divergent grading. Students who have average skills in both quantitative and verbal fields are those who are most likely to receive misinformation about their comparative skills advantage as a result of low grading in quantitative fields and high grading in verbal fields. On the basis of their abilities, these students should be indifferent regarding choice of field. However, the degree of misinformation they receive is the full difference between average quantitative and verbal grades, and they are then motivated to choose verbal fields. Students with close to average quantitative and verbal skills are also likely to receive erroneous feedback. Students with a quantitative/verbal skills differential so large that the grading differential does not change the direction of the signal regarding their area of comparative advantage are not affected.

Second, women may be more affected by the quantitative/verbal grading differential because they may already face higher costs of study in quantitative than in verbal fields as a consequence of participating in a learning environment that is oriented toward men. Sandler, Silverberg, and Hall (1996) have described a "chilly classroom climate" for women, which is exacerbated in traditionally male fields. In such a climate, women would experience psychic costs as they find their intellects and class contributions devalued. In particular, the competitiveness of study in quantitative fields relative to verbal fields may create high costs for women who pursue quantitative study (Dowd, 1998; Strenta, Elliott, Adair, Matier, & Scott, 1994). Even when women have equal measured abilities and aptitudes as men in quantitative fields, they have been found to enjoy science courses less than their male counterparts and to choose at greater rates to exit the field (Ware, Steckler, & Leserman, 1985). Prior research has shown that women persist in quantitative fields at greater rates if they attend women's colleges (Jacobs, 1996; Solnick, 1995), which suggests that women find a more welcoming environment in all-female classes, experiencing lower costs than those imposed by a male-centered environment. However, the findings on the effect of women's colleges on female educational attainments are not conclusive (Riordan, 1994; Smith, Wolf, &

Morrison, 1995).

Finally, women may also give greater weight in making their curricular choices to their present or "local" status, to use Frank's term (1985), in the collegiate environment than to their future economic status. Loury (1997) found that women are less motivated than men by the college wage premium in making the decision to attend college. Frank (1996) and Daymont and Andrisani (1984) found that women place greater value than men on moral and personal dimensions of career satisfaction. These findings suggest that women are less concerned than men with future monetary returns to education. This disinterest may cause women to spend less time acquiring information about salaries and to underestimate the relative economic returns to quantitative and verbal fields of study. Disinterest may also be fostered by greater uncertainty concerning labor market participation, due to the fact that child-rearing responsibilities often interrupt women's careers. As Polachek (1981) observed, the prospect of discontinuous employment may provide an incentive for women to acquire human capital that does not depreciate quickly during their time outside the labor force and lead them to avoid rapidly changing technological fields. However, England (1982) countered that available data do not support this hypothesis.

## **The Higher Education Production Function**

The discussion above has shown that divergent grading creates a disincentive to study in quantitative fields. Further, it demonstrates that these disincentives are likely to have a greater influence on the curricular choices of women than of men. At this point, beginning with an overview of relevant aspects of several theories of the higher education production function, I evaluate the factors creating patterns of low and high grading in quantitative and verbal fields of study. The need for and purposes of grading can be understood as part of a higher education production function, and the existence of divergent grading practices suggests that quantitative and verbal fields experience a different kind or degree of pressure to produce grades.

Production functions consider the outcomes of schooling as educational "outputs" resulting from various inputs including faculty, quality of students, and physical and financial capital. The demand for these outputs, which include teaching, research, and public service, comes from students, private and public funding agencies, and donors (Garvin, 1980; Hopkins, 1990; Hopkins & Massy, 1981; James, 1990). Production functions typically are based on the assumption that the goal of a private firm is to maximize profits. It is further assumed that market forces create an imperative that firms produce at the most efficient technological boundary of production. These assumptions do not apply to higher education, however, and in modifying the production function model for the higher education context, researchers have proposed several other objectives, including the maximization of administrative scope, income, and prestige. The role played by grading in the production function varies depending on the outcome to be maximized.

Niskanen (1971) described universities as "mixed bureaus," non-profit organizations with public and private characteristics, due to the fact that they are funded through grants as well as through revenues generated by selling their output at a per-unit rate. He viewed universities as income-maximizers, whose administrators and faculty gain utility by increasing the size and scope of their bureaucracy. Breneman (1976) observed that faculty members seek to optimize departmental prestige, and Garvin (1980) elaborated on this and other research to develop a model of institutions as a whole as prestige maximizers. Faculty members gain utility from increasing levels of

prestige associated with their departments in the form of higher salaries, better quality graduate students who can be attracted at a lower price, higher caliber colleagues, and greater success rates in seeking internal or external funding.

Zemsky and his colleagues drew on elements of the prestige- and bureaucracy-maximizing utility models to argue that faculty members increasingly expend their energies toward individual goals, away from the goals of the institution (Pew Higher Education Research Program, 1990; Zemsky, Massy, & Oedel, 1993). They attribute this phenomena to misplaced incentive structures that motivate faculty to focus on their research at the expense of teaching and advising. Faculty members maximize prestige in their disciplinary labor market by publishing academic papers. Teaching, the quality and value of which is difficult to present to external observers, carries little reward, they argued.

## **The Demand for Grades**

The prestige- and bureaucracy-maximizing production models of higher education provide a theoretical basis for examining the characteristics of high and low grading departments. In this section, I extend these models to explain the pressures on departments at four-year research institutions to adopt high or low grading practices. I also use a utility maximization analysis to describe the interests students have in the prestige of their institutions and the demand they create for grades.

As Breneman (1976) and Garvin (1980) have illustrated theoretically and empirically, departments at research universities maximize prestige through research and scholarly output. They can increase their output by hiring very productive faculty members or by increasing the total number among the faculty. As increasing student enrollments provide a rationale for additional faculty hiring, there is a derived demand for a larger quantity of students. As faculty members prefer to work with talented students, there is also a demand for higher quality students. When departments attract external research funds from the government, foundations, or corporations, they can afford to lose a share of university resources allocated on the basis of student enrollment. The availability of external funding creates pressure to "weed out" less talented students and reduce enrollments. Departments that attract a lesser share of external research dollars will attempt to maximize enrollment, a goal that would relax pressures for competitive grading practices intended to dissuade the least capable students to leave the field.

Under certain conditions, students themselves create a demand for competitive grading, in a way that the other agents in the higher education output-demand system do not. Funding agencies, such as the government and foundations, are primarily interested in the outputs of research and teaching, as they make investments in higher education to develop public goods and promote social welfare. For students, higher education is both a consumption and an investment good (Schultz, 1961). The immediate value of their consumption is affected by the quality of teaching and learning, including modes of assessment. The value of their investment benefit is influenced by the status of their college (Heath, 1993).

Heath (1993) has illustrated theoretically that students value both local and global status, where local status is defined as a student's academic standing at her institution. As was discussed above, local status informs a student's understanding of the investment costs of completing a degree in any given field of study (Altonji, 1993). Local status also has psychic costs and benefits (Frank, 1985) and contributes to determining the consumption value of a student's education. In Heath's analysis, global status is

determined largely by a college's ability to place graduates in high paying occupations and in graduate and professional programs. Global status is influenced by an institution's academic rigor and the quality of enrolled students, with greater rigor attracting an academically talented student body. Students value the positive effects of higher standards on their global status, but fear the potentially negative effects on their local status and the increased costs of completing their work.

Student interest and influence on collegiate grading practices stem from their investment and consumption decisions. Students can be expected to endorse competitive grading practices, in which performance is graded on a curve and where average grades are low relative to other fields, if they perceive that such practices enhance their global status and ability to compete for high paying jobs. Students who are competing for scarce places in lucrative professions will have the greatest concern for global status. Under heavy interest, access to an occupation becomes limited and institutions have a prestige-maximizing incentive to certify only a portion of their students for entry into that field. The response to this incentive is the adoption of assessment practices that are designed to motivate or require those who are least capable to leave the field of study (Breneman, 1976).

Students who are not career oriented and who place a greater value on higher education as a consumption good can be expected to resist competitive grading and to avoid such practices when making their course choices, because it imposes immediate psychic costs and reduces the consumption value of their classes. If a field of study does not provide a closely articulated link to lucrative and competitive career paths, students will demonstrate a lack of interest in the credentialing function of grades. These students may value grades intrinsically as a reflection of their talents, but they do not create a demand for comparative rankings. In the absence of preprofessional student pressures, the field has an income- and resource- maximizing incentive to become high grading in order to attract enrollment.

In summary, the prestige-maximizing and bureaucracy-maximizing model of higher education production provides a theoretical basis for understanding the pressures on collegiate grading practices. External research dollars enable departments to maximize prestige and income while "weeding out" the least successful students from their programs. Student careerism also creates pressures for competitive grading, as students wish to enhance their global status. The model clearly predicts the behavior of departments experiencing a combination of low student careerism and low external funding (high grading practices) and high careerism and high external funding (low grading practices). As quantitative and applied fields are influenced much more greatly by research interests and strong links to employers than are arts and letters fields (Becher, 1989; Breneman, 1976), they are more likely to adopt low grading practices to maximize prestige. Verbal fields, with weak ties to employers and low levels of research funding, are more likely to adopt high grading practices to maximize administrative scope and enrollment.

## **Traditions of Scholarship**

The educational production function identifies the utility-maximizing goals of scholars in different disciplines and provides a model that predicts grading practices in response to different output-demand systems. Internal features of departments stemming from disciplinary traditions and epistemologies may also account for different assessment practices. In *Academic Tribes and Territories*, Becher (1989) characterizes modes of scholarship in academic disciplines. His four-part taxonomy of "hard pure,"



"hard applied," "soft applied," and "soft pure" fields bears resemblance to the simpler quantitative/verbal dichotomy I have used. Hard fields are quantitative and soft fields, which include the humanities, social sciences, and "social professions" (education, social work, law), may or may not employ quantitative analyses. The applied fields, whether hard or soft, are those whose research practices are influenced strongly by practitioners and a search for practical knowledge. Becher's applied fields are those I have described as having ties with employers. Whether these employment relationships influence grading practices depends on the level of competition among students for entry into related occupations and professions. These relationships can be influential in a hard applied field, such as engineering, as well as in a soft applied field, such as business.

As Becher (1989) indicates, the modes of scholarship in the applied fields follow from those of their pure counterparts, but are altered by the focus of applied fields on generating solutions to practical issues outside academe. For this reason, the epistemological distinctions that Becher observes between hard pure fields (natural sciences and mathematics) and soft pure fields (humanities and social sciences) describe the predominant disciplinary traditions and cultures that may influence grading practices. He offers a set of contrasts that, in sum, indicate that hard pure fields have a more clearly defined body of knowledge than the soft pure fields. First, Becher (1989, p. 13) observes, knowledge in hard pure fields is cumulative through the work of generations of researchers building on each others' findings relevant to clearly defined and bounded questions. In contrast, soft pure fields address issues that retain their currency over time. Researchers in soft pure fields make contributions, not by generating new knowledge, but by providing insights into familiar topics. Soft pure fields lack the clear boundaries that specify areas of investigation in hard pure fields. Second, while hard pure fields "break down complex ideas into smaller components," in soft pure fields "complexity is regarded as a legitimate aspect of knowledge, to be recognized and appreciated" (p. 14). Third, in hard pure fields, scientists make "strong" arguments based on mathematical models, measurement, and observed regularities. In soft pure fields, where explanation revolves around numerous concepts and the absence of clearly defined variables, scholars make apparently weak arguments and rely more heavily on "judgment and persuasion" (p. 14). Finally, soft pure knowledge recognizes and admits the "intentionality" of the scholar, while hard pure fields convey knowledge as "impersonal" and "value-free" (pp. 14-15).

Becher, himself, does not comment on differences in assessment practices between fields. This likely stems from the fact that participants in his case study at "elite departments" defined their membership in their academic professions "in terms of excellence in scholarship and originality in research, and not to any significant degree in terms of teaching capability" (p. 3). For this same reason, grading practices may be given peripheral attention, be little affected by disciplinary norms, and be easily modified by external influences. Or, they may follow closely from the research traditions. In the latter case, the openness of soft pure fields to divergent viewpoints combined with the acceptance of unresolved complexities in subject content would be consistent with assessment practices that allow numerous "correct" answers. In contrast, hard pure fields would be expected to rely on assessment practices that test students' abilities to convey their understanding of established subject content and to make greater distinctions between right and wrong answers. Low grading practices in hard pure (quantitative) fields and high grading practices in soft pure (verbal) fields may, therefore, have epistemological roots. This explanation is not completely persuasive, however, because the soft pure fields awarded lower grades on average in earlier times (Kuh & Hu, 1999; Sabot & Wakeman-Linn, 1991). Understanding of the relative influence of external

demands and internal traditions of scholarship on assessment practices would require a study of changes in external and internal departmental environments in relation to changes in grading over time. To my knowledge, such a study has not yet been conducted.

## **Empirical Tests**

Though little research has been conducted that tests the predictions of the production function model of grading practices, two recent studies present relevant findings. Freeman (1999) investigated the predicted relationship that departments with graduates entering lucrative professions have low average grades. He hypothesized (p. 344) that "given equal money prices per credit hour across disciplines, departments manage their enrollments by 'pricing' their courses with grading standards commensurate with the market benefits of their courses, as measured by expected incomes." Using data from the National Center for Education Statistics on 648 U.S. institutions of higher education, he confirmed that fields associated with higher starting salaries had lower GPAs than those associated with greater "income risk" (p. 350). His research provides evidence that departments manage student enrollment through their grading practices. Those experiencing higher student demand due to positive salary prospects for graduates are more likely to grade more rigorously. Freeman's work did not also estimate the influence of available research dollars on grading practices.

Kuh and Hu (1999) investigated the causes of grade inflation from the mid-1980s to the mid-1990s, providing evidence that average grades have increased during that time period. However, their models do not include variables representing changes in labor market returns to field of study or changes in availability of externally funded research dollars, so the work does not provide a test of the production function model of grading practices. Their results do provide some relevant empirical evidence to evaluate the model, however. Using a large national data base including students from approximately 600 four-year colleges and universities, they find (p. 306) that grades in the humanities increased at a faster rate than grades in science and mathematics, with the grade increase in the science and mathematics cluster observed to be minimal. This finding supports the idea that quantitative fields, which have greater opportunities to attract research support, are resistant to inflationary pressures on grading. Grades in the social sciences and preprofessional fields were on average lower than those in science and mathematics, which, if the included social sciences were applied fields, supports the aspect of the model that indicates that preprofessional students will create a demand for rigorous grading.

In addition, Kuh and Hu found (p. 304) that while "grades increased across the board the increases were greatest at [research universities]," which suggests that some fields at research universities felt the greatest pressure to increase grades. Under the production function model, these fields are expected to be those attracting few external research dollars, though they could only have had the observed impact on the average grades if they were, indeed, departments with high enrollments. However, disaggregating the broader results, Kuh and Hu find (p. 314) that grades in general liberal arts colleges and in the humanities and social sciences were actually deflated in private institutions during the period under study. These findings may provide evidence contradictory to the production function model. Alternatively, they may indicate that humanities and social science fields without a significant preprofessional student body do not assume inflationary practices unless they are in a competitive situation with low grading preprofessional and research- oriented fields, which are more likely to be found

at public and research universities. The latter interpretation of their results is appropriate if the sample included a significant number of private liberal arts colleges among the private institutions, but it is not possible to draw this conclusion from the article.

## Discussion

The existence of divergent grading indicates that high grading and low grading departments are subject to different output-demand systems for grades. Institutions themselves are not likely to insist on uniform grading practices across their departments without a change in that demand system. If we assume that departments are maximizing their utility under existing practices, from what quarter might change toward uniform grading come? As discussed above, students, with their sometimes conflicting interests in global and local status, and agencies such as corporations, foundations, and the state, with their interests in the outputs of research and teaching, are the primary consumers of higher education. In this section, I discuss the potential motivations of the state and of students to create a demand for change. Foundations with an interest in social justice and economic development may play a role analogous to that of the state discussed below. Corporate sponsors of research will be most interested in private returns to their investments, but corporations too have an interest in an adequate supply of college graduates who have quantitative training.

As a matter of social justice, the state has an interest in promoting equal employment opportunities for women. As a matter of economic development, it has an interest in encouraging women to develop human capital in quantitative fields if market mechanisms are not providing an adequate incentive. Through research grants and internship programs, in its role as an employer, and through direct funding of colleges and universities, the state creates a demand for research and teaching. Through specialized programs, it structures some of that demand to create opportunities for women. These opportunities do not attract as many women in the presence of divergent grading as they would under uniform grading (as some women continue to choose verbal fields despite the offer of an incentive, due to the higher cost of earning a degree in a quantitative field). The state could potentially increase the enrollment of women in quantitative fields by putting regulative pressure on colleges to adopt uniform grading practices.

However, as Strike (1997) has argued, when state regulatory processes require educational institutions to promote human capital formation as the goal of schooling, the resulting regulations promote a particular conception of what constitutes a good life. Such an intrusion as defining human capital formation as the goal of education, at the exclusion or expense of other legitimate schooling goals, is beyond the purview of the state. Colleges and universities do not have an obligation to motivate female students to plan their educational investments with an eye toward future economic success. The traditional liberal arts curriculum has been intended to produce people who are "virtuous, of good taste and liberated interests" (Strike), not people whose educational and life goal is to attain high earnings. Liberal arts colleges may very legitimately wish to structure the curriculum, including grading practices, to require or encourage students to take liberal arts courses. If liberal arts colleges choose to promote enrollment in liberal arts courses by intentionally lowering the psychic costs of study in those courses, that approach may well be consistent with institutional goals. Pressures for uniform grading might therefore come from the state, not in a regulatory mode but in its capacity as a consumer. The state addresses its human capital concerns by supporting educational programs that provide training in areas it deems valuable, thereby increasing the

attractiveness of those areas to prospective students (by reducing associated tuition costs or by providing enhanced instructional facilities, for example). To further increase enrollment of women in quantitative fields, the state could attempt to alter aspects of the learning environment in those fields that create greater costs for women than for men. As competitive learning environments appear to place a particularly onerous burden on women (Dowd, 1998; Sandler et al., 1996; Strenta et al., 1994), the creation of non-competitive workshops, internships, research projects, or other opportunities of this type may serve to attract women to the study of mathematics and science. Non-graded instructional programs in quantitative fields could rely on other types of assessment to provide students with an incentive to learn the material presented. Such programs would provide certification of the attainment of threshold levels of knowledge, but would not provide comparative rankings. The instructional program would be structured to allow students multiple opportunities, as needed, to acquire the skills and knowledge necessary to capitalize on their investment in the labor market. Such an approach may be less efficient than using competitive grading to identify the most able students, but may be more efficient in fostering occupational gender equity. Astin (1990) has advocated a "talent development approach" to assessment in higher education, arguing for noncompetitive assessments on the basis of both equity and efficiency.

Demand for competitive grading in verbal fields might be created by trends in student enrollment. As the human capital model indicates, both grades and the present value of lifetime earnings are part of the equation determining the best human capital investment for a particular student. If the earnings associated with verbal fields of study fell so low as to outweigh the benefits of high grading, enrollment in verbal fields would fall. In that case, colleges might seek to create better links with employers for liberal arts graduates in order to place graduates in higher paying positions and to bolster enrollments. One way to establish these links would be to take an active role in supplying the most talented students to those labor markets. Such an approach would lead to comparative grading practices that would bear more resemblance to grading practices in quantitative fields.

Alumni donors might support such developments, because the increased success of graduates in the labor market would enhance institutional prestige. As Heath (1993) observed, alumni benefit most from increases in an institution's prestige, experiencing positive benefits related to their alma mater's enhanced reputation, without having to pay the costs associated with the academic competition of a higher quality student body. Alternatively, alumni might decry the professionalism of liberal arts programs and oppose new practices. The effect of their influence would depend on whether alumni donations are of a sufficient amount to motivate income-maximizing behaviors.

Liberal arts colleges and departments do not have an ethical obligation to ensure access to employment information for their students, but they may benefit themselves by enabling their students to more efficiently estimate their future utility and to make investments in course choices that will maximize their financial return. If the college's graduates are able to maximize their utility in the labor market at a higher level after having had access to employment information while in college, the graduates would be able to achieve higher levels of both income and career satisfaction. Such an outcome would increase alumni donations, as well as the demand from prospective students for a liberal arts education.

## **Conclusion**

I have presented a theoretical model, based on various explications of a higher

education production function, to explain the demand for college grades. I have described student assessment as part of the process of producing educational outputs. The practice of high grading in verbal fields and low grading in quantitative fields was placed in the context of the different levels of demand placed on those fields for the outputs of teaching and research. Low grading fields are predicted to experience high demand by preprofessional students for entry into occupations with scarce positions and/or a high demand for research. The opposite demand system would affect high grading departments. Students who are concerned with entering a lucrative and competitive profession will create a demand for rigorous grading as it contributes to the prestige of the institution and to their own "global status," or value in the labor market. Students who are less career-oriented will place greater value on the consumption benefit of a college education and be concerned with the quality of teaching and learning and the value of their own "local status," or academic standing. Evidence from prior research was presented to show that women are more influenced than men in their choice of major by local status concerns, leading them to disproportionately choose high grading verbal fields. Thus, divergent grading creates an incentive for women to underinvest in quantitative fields of study, and, thereby, contributes to occupational sex segregation and the gender pay gap.

## Notes

1. See Hoenack and Weiler (1975) for a discussion of the potential impact on university administration of charging different tuition rates by field of study.
2. While this simple model refers to an either/or investment in two different kinds of study, the argument could be extended to evaluate marginal investments in quantitative and verbal subjects and to take account of the different returns to various subfields.
3. This article is based on the author's dissertation research.

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