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4. Teaching and education commentaries (e.g. notes on pedagogy, evaluations of teaching effectiveness, evaluation and review of applied economics textbooks, and educational methodology).

Research Article

An Authentic Learning Approach to Group Assignments: An Analysis of Student Attitudes

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Abstract
Using a difference-in-difference estimator adapted to include student fixed effects, we examine whether exposure to an authentic, business-oriented approach to group assignments improves student attitudes about working in groups. Our results show that, compared with a traditional approach, students exposed to the business-oriented approach had significantly improved attitudes about group assignments in general. Specifically, students indicate that forming groups was more authentic and likable, individual grading processes were fairer, and scheduling group meetings was easier. We also identify the marginal effects for these improved attitudes and show that the relevant factors are, in descending order of importance, improvements to group scheduling, group formation, and individual grading.

1 Introduction

The National Association of Colleges and Employers (NACE) reports that, beyond a strong grade point average, the resume attributes that employers desire most are problem-solving skills and an ability to work in teams (NACE 2017). Other highly valued attributes include verbal and written communication skills, leadership skills, analytical skills, and a strong work ethic. To help their students acquire these skills, instructors often require their students to complete group assignments. Existing research shows that these assignments can improve students' abilities to write, speak, solve problems, negotiate, and coordinate plans (Oakley et al. 2004; Hansen 2006; Chapman et al. 2006).

We assess empirically how exposure to the "project manager/private contractor" (PM/PC) approach to group assignments that authentically parallels a common business structure affects student attitudes about working in groups (Brown et al. 2019). Our difference-in-difference (DID) regression results show that students exposed to this business-oriented approach had significantly improved attitudes about group assignments compared with a traditional group assignment approach. Specifically, students report that forming groups was more authentic and likable, individual grading processes were fairer, and scheduling group meetings was easier. Our analysis of the marginal effects indicate that student attitudes improved, in decreasing order of importance, due to difference in group scheduling, group formation, and individual grading.

2 The PM/PC Approach

The PM/PC approach to group assignments requires instructors to adopt the role of corporate executive (CEO) and requires students to adopt the role of either a project manager or a private contractor. Under the approach, a student's choices, responsibilities, and incentives in class mirror realities in actual business settings and vary based on the role he or she plays. The instructor facilitates the group formation process by gathering, collating, and redistributing one-page resumes for all students and arranging for all students to give one-minute speeches to their peers about why they want to or should be a manager or contractor. Project managers (PMs) are chosen by a class vote. Students acting as managers recruit their classmates who act as contractors and support completion of work assignments. Just as managers supervise contractors in business settings, student managers provide oversight of student contractors. Further, student managers become a critical component of the grading mechanism by providing grade recommendations to the instructor in exchange for a lump sum of bonus points that managers may either keep or distribute to their contractors.

This simulated business approach is a specific example of a more general technique called "authentic learning" (Herrington, Reeves, and Oliver 2010). The general technique calls for instructors to create immersive classroom learning environments that go beyond mere reliance on an instructor's personal set of ad hoc stories and examples (Herrington and Oliver 2000). Authentic learning is similar to experiential learning in that both highlight the value of real-world learning environments (e.g., McCarthy and McCarthy 2006). However, authentic learning generally accepts the physical or online classroom as a given, while experiential learning typically envisions students leaving the classroom, for example, to do an internship. While actual encounters afforded by experiential learning are valuable, the quality of such experiences varies in practice. Experiential learning opportunities often lack uniform levels of mentorship across students, particularly guided critical reflection (King and Sweitzer 2014). Likewise, experiential learning does not always target professional development such as real-time management and communication with employees or upward feedback to managers. Simulated encounters, such as the one proposed here, seem to offer structured learning environments that allow for more thoughtfully guided critical reflection and soft-skill development, while still maintaining the appearance and associated benefits of an authentic business environment.

The authors of the PM/PC approach speculate that the model might improve student attitudes about group assignments. Students often, but not always, oppose group assignments (Felder and Brent 2001; Phipps et al. 2001). For example, Gottschall and Garcia-Bayonas (2008) find that over half of business students have negative attitudes toward group work. Buckenmyer (2000) and others identify many reasons why students have negative attitudes about group assignments: unclear instructor expectations, mismatched grade expectations among group members, free riders, and students' lack of knowledge about how to form teams, choose team leaders, and divide work effectively (Caspersz, Wu, and Skene 2003). Pfaff and Huddleston (2003) generalize student objections and identify three basic problems. Students do not like (i) how instructors form teams, (ii) how instructors assign individual grades, and (iii) how challenging it is to schedule group meetings. Building on the descriptive foundation laid by the authors of the PM/PC approach, we evaluate empirically how exposure to that approach affects student attitudes about group projects. Evidence suggests that when students have positive attitudes about the method of their instruction, they are more receptive to course content and are more successful students (Caspersz, Wu, and Skene 2003).

3 Treatment and Comparison Courses

We use a DID approach adapted to include student fixed effects to assess how exposure to the PM/PC model affects student attitudes about group assignments. The DID approach is an example of a quasi-experimental research design in which there is a treatment group and a nonrandomly assigned comparison group with the latter serving as a natural, though imperfect control. For our quasi-experimental research design, we identified two similar undergraduate courses at different universities, implemented the PM/PC approach in one (the treatment course), and used traditional group assignment approaches in the other (the comparison group). We taught the treatment course in the Fall 2017 term and the comparison course in the Spring 2018 term.

The treatment and comparison courses were similar, but not identical. Both courses were advanced undergraduate agricultural finance courses offered at large, public, research-oriented, land-grant universities. The two courses shared the same four learning outcomes, including the same wording.[1] Both instructors pursued these four learning outcomes in similar ways using lectures on financial principles, Microsoft Excel applications, and group work solving business problems.

The treatment course included three group projects. Each project emphasized financial management decision making by agricultural producers. The target number of students per group was four. To form groups, the instructor solicited resumes from and then created resume packets for each student. Students each made one-minute speeches in class about their qualifications. Students then ranked which students they thought should be PMs. The instructor compiled the rankings and announced who the PMs were, and each PM recruited three private contractors (PCs) from among the remaining students. To grade individual students, the instructor assigned a grade to each project that, by default, was also the PM's grade and awarded to each PM additional bonus points equal to 10 percent of the maximum points possible for the assignment. If they desired, the PMs distributed any portion of their bonus points to their PCs. The PMs also recommended grades for each of their PCs with the constraint that the average PC grade in their group must equal the project grade assigned by the instructor. The three group projects varied in points possible, but together the projects counted for 95 percent of students' final course grades. To facilitate scheduling of meetings, the instructor allocated two 75-minute class periods for each of the three group projects (7.5 hours total) for groups to work together in the computer lab with Microsoft Excel applications. To accommodate this additional in-class meeting time, the instructor distributed lecture content (PowerPoint sides) via the learning management system equal to three hours of in-class lecture time. The instructor implemented exactly the "basic" PM/PC approach described by Brown et al. 2019. As these authors encourage, the instructor frequently reminded students to think of their group assignments as actual business activities, to remember their roles and responsibilities, and to behave accordingly.

In the comparison course, the instructor formed groups, graded individuals, and scheduled meetings using traditional processes. The instructor assigned students to groups randomly with a target number of four students per group. The instructor assigned seven group projects worth 50 percent of students' final grades, including six Harvard Business School cases and one comprehensive project on company financial analysis.[2] Student groups completed Microsoft Excel application exercises and prepared discussion briefs for each case. The instructor in the comparison course graded each group project and adjusted individual grades based on two peer evaluation surveys administrated in the middle and at the end of the term. These peer evaluation scores measured students' citizenship contributions such as responsiveness to group communications, willingness to contribute, attitude, timeliness, and each member's relative percent contribution to the overall group effort (Kaufman and Felder 2000). To facilitate group meetings, the instructor in the comparison course allowed six 50-minute class periods (5 hours total) for in-class group interactions. Groups completed the semester-long company financial analysis projects completely outside the class meeting time with a 70-minute class period for final project presentations.

The treatment and comparison courses were similar but not identical with respect to student backgrounds. Figure 1 shows frequency distribution comparisons for these variables. The medians of all such measures are the same in the two classes. A typical student from our sample has senior class standing with a cumulative GPA between 2.6 to 3.0 and an age less than 20 years old. With respect to the group project experience, a typical student in the sample reports having more than 12 months of paid work experience and reports learning to work in groups about as much from their past college classes as from

[1] "Upon the completion of this course, students will be able to (1) explain financial concepts used in the financial management, (2) apply financial concepts and analytic tools to real world problems, (3) use Microsoft Excel to solve financial problems, and (4) have enhanced written and oral communication skills for solving problems that require leadership and/or teamwork" (quote taken verbatim from the treatment course syllabus and the comparison course syllabus).

[2] While the number of group assignments in the comparison course (n = 7) was more than the number of group assignments in the treatment course (n = 3), neither course instructor received any direct or perceived any indirect signals indicating student fatigue with the number of group assignments. If unobserved fatigue was higher in the comparison course, we may overestimate the treatment effect.

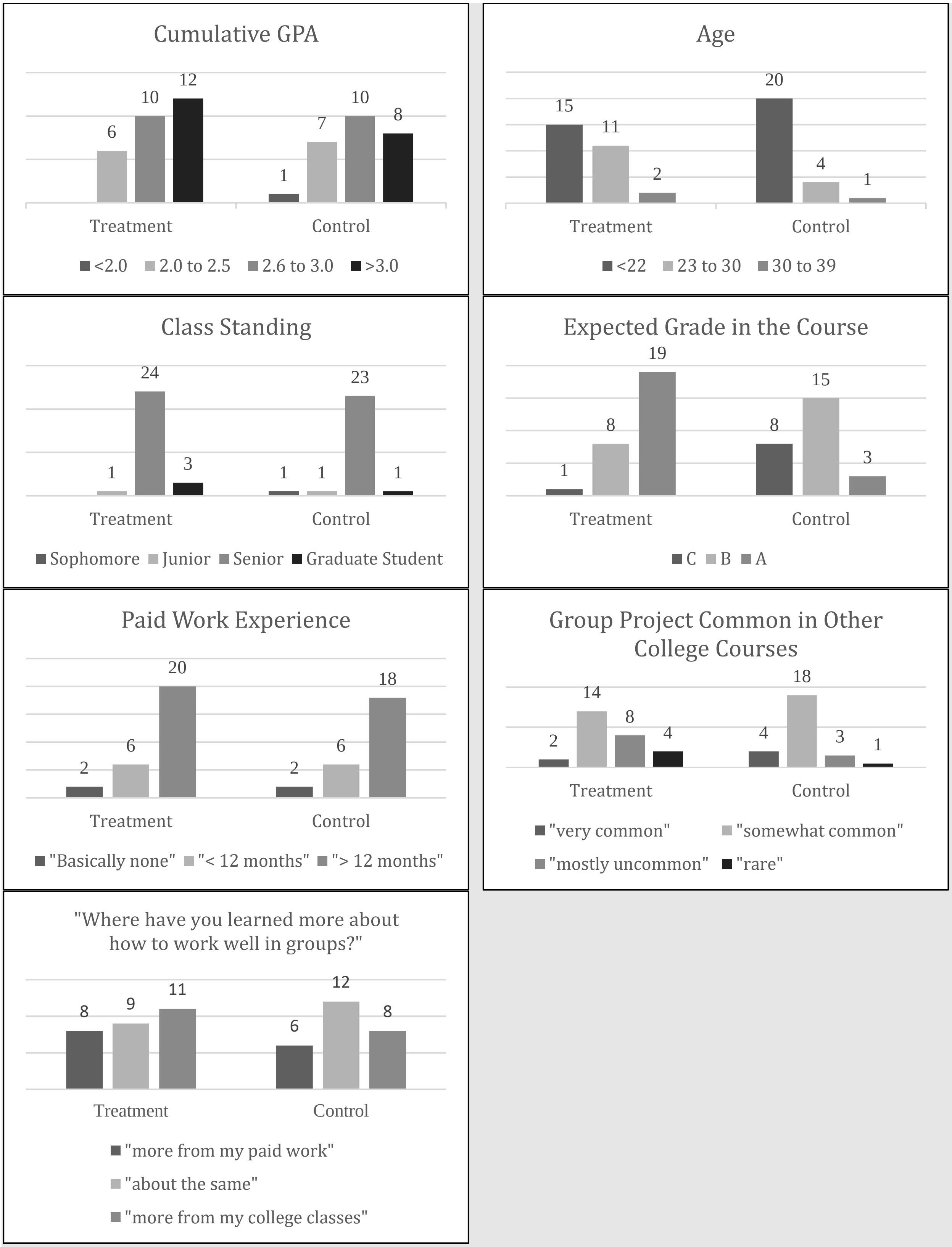

Figure 1. Student Background Comparisons Between Treatment and Control Groups

their paid work experiences. We apply the Mann-Whitney test further to determine whether our two independent samples of students were from populations having the same distribution. Three variables show significant differences between treatment and comparison courses at the 90 percent confidence level based on the tests. Students in the treatment course were older, expected higher grades in the course, and had less experience with group projects in their past college courses (Figure 1). Taking advantage of the panel structure of the data, which provides two survey observations per student, we modify the simple DID estimator with the inclusion of student fixed effects. This modified DID approach controls for all student-specific characteristics that do not vary between each student's "before" and "after" responses.[3]

4 Discussion of Research Design

One concern with any quasi-experimental design is that assignment to the treatment group is not random, raising concerns about selection bias. In our situation, students registered for their course generally without knowledge of the course's planned approach to group assignments and without other meaningful options such as enrolling in the same course at a different institution. These factors diminish selection bias that might occur if study participants, for example, selected into the treatment course based on the expected benefits of that particular approach. The above factors diminish similar concerns that nonrandom assignment to the treatment course will result in baseline differences between the treatment and comparison groups, potentially confounding outcome effects. The advantage of using the DID approach with student fixed effects is that the student fixed effects help control for any unobserved time-invariant student-specific characteristics.

A second concern for the DID estimator is the assumption of parallel trends. This assumption allows analysts to attribute a divergent evolution of the treatment group over time, if observed, to the impact of the treatment. Ideally, we would have multiple pre-period observations of all participants to assess whether the outcome variables and/or covariates exhibited parallel evolutions over time in the historic pre-period. Unfortunately, we only have two periods of data and so cannot directly test for empirical evidence of parallel trends using historic data. However, we see no meaningful argument to suggest that the parallel trend assumption should not hold. Students at both institutions share many similarities. We draw all study participants from two advanced undergraduate agricultural finance courses offered at large, public, research-oriented, land-grant universities. Although we do not know the residency mix of students in each course, the Education Commission of the States (Macdonald, Zinth, and Pompelia 2019) reports that secondary school graduation requirements are similar for each institution's in-state students who compose the majority of undergraduate students at each institution.[4] In general, we feel comfortable maintaining the parallel trends assumption to permit a causal interpretation of our estimated impacts.

The third concern of the DID approach is the Stable Unit Treatment Value Assumption (SUTVA). This assumption requires no interference between treatment and comparison groups and no different versions of treatment. Since we taught the treatment and comparison courses at different institutions, we expect minimal interference or spillover effects between the two groups of students. Also, we implement the basic version of the PM/PC approach fully without variable levels of treatment. Thus, the SUTVA holds.

A final concern of the DID approach is that interactions with all study participants during the study period should be the same with the only difference being that the treatment group receives the treatment. A limitation of our study is that we have different instructors for the treatment and comparison courses, creating the possibility that we cofound the effects of exposure to the PM/PC approach with the effect of exposure to instructor-specific qualities. However, both instructors in our study were early career full-time assistant professors with similar levels of teaching experience. They both adopted active learning practices and cultivated collaborative and active learning environments for their students.

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[3] The final data set used for the fixed effects regression models has 108 observations from 54 students; the ratio of the number of parameters to be estimated to the number of observations is 0.55.

[4] During the period of study (2017/2018), the resident population at the comparison course institution was 57 percent, and at the treatment course institution, it was 69 percent. Both states required secondary school graduates to complete 22 Carnegie units total, including four units of English, three units of social studies, three units of science, and either three or four units of math.

5 Survey Design and Administration

To measure student attitudes about group work in the treatment and comparison courses, we elected to use a retrospective pretest survey. Retrospective pretest surveys, as described by Hill and Betz (2005), require respondents to think about a prior time (e.g., experiences in courses prior to this one) and complete a retrospective rating and then immediately afterward complete a rating of the current practice (e.g., experiences in this course). Investigators often prefer such surveys to traditional pretest/post-test surveys when they think respondents are unlikely to maintain constant standards for judging their attitudes or self-assessments from pre- to post-test (Skeff, Stratos, and Bergen 1992). Respondents are more likely to change their rating standards as the length of time from pre- to post-test increases and the more that the treatment stimulates respondents to think about the dimensions being rated. We chose to use a retrospective pretest survey rather than a traditional pre- to post-test intervention survey for this reason. We wanted student ratings to reflect only the effects of the intervention and not changes in the standards students used for their self-ratings. In our case, a four-month academic term seems a relatively long time, and our experience implementing the PC/PM approach previously suggests to us that the approach increases students' understanding of how groups can form, how individuals can be graded, and how meetings can be scheduled (i.e., the very dimensions we seek to measure).

In our retrospective pretest survey, we asked students six different five-point Likert-style questions to measure their attitudes about the three areas of concern previously discussed, namely how groups are formed, how individuals are graded, and how meetings are scheduled (Table 1). We use the student responses to these six questions as dependent variables in six different DID models. For each, we asked students to indicate their level of agreement with each statement both retrospectively ("before") and currently ("after") using a five-point Likert scale. The Likert scale options were "Strongly Disagree," "Disagree," "Neither Agree nor Disagree," "Agree," and "Strongly Agree." Our survey also included questions about students' general background, including their current cumulative GPA, age, year in school, expected final grade in the course, and group project experience in other college courses, as well as their paid work experience (Figure 1). We administered our retrospective survey in our treatment and comparison courses near the end of their respective semester terms, December 2017 and April 2018, respectively. We received 54 total responses, 28 from the treatment course and 26 from the comparison course.

Table 1. Likert-Scale Measures of Six Student Attitudes from Survey (Dependent Variables)

Type of Student Concern	Survey Prompt
Forming Groups	(1) "Forming groups reflected the real world."
	(2) "I liked the group forming process."
Grading Individuals	(3) "The grading process was fair."
	(4) "I liked the grading process."
Scheduling Meetings	(5) "It was easy to find times to work together."
Overall	(6) "I like class group projects."

6 Empirical Specification

The discrete choices from our survey are logically ordered, where one refers to "strongly disagree" and five refers to "strongly agree." Thus, we adopt an ordered logit model to estimate changes in our dependent variables (Greene 2012, p. 760). Assume that one latent preference, Y^*, varies continuously in the space of individual utility and underlies students' discrete responses, Y, in the survey, as shown in equation (1). Then:

$$Y_{it}^* = \beta_1(Treat_i \times After_t) + \beta_2 After_t + c_i + \varepsilon_{it}, \quad (1)$$
$$Y_{it} = j \ if \ \gamma_{j-1} < Y_{it}^* < \gamma_j, j = 1,2,3,4,5$$

We can interpret Y^* as the continuous student attitude about a given group process. The parameter γ_j is the unobserved cut points to convert the continuous latent preference into discrete responses. The dummy variable *Treat* equals one if the observation is from the treatment group and zero if from the comparison group. The dummy variable *After* equals one if the observation occurs post-treatment and zero if the observation occurs pretreatment. The parameter c_i represents a fixed effect for student *i* that controls for all time-invariant, student-specific characteristics (e.g., historic GPA, race-ethnicity, gender, secondary school education, etc.), including whether the student is in the treatment group or not. Under the identification assumptions, the sign of β_1 indicates the sign of the treatment effect, and the magnitude of the effect can be obtained using post-estimation predictions. An ordered logit model (Equation 2) can be used to estimate the nonlinear DID specification (Athey and Imbens 2006; Karaca-Mandic, Norton, and Dowd 2012; Puhani 2012). The probability of having $Y_i = j$ conditional on the vector x corresponds to a standard logistic distribution function, $L\ (\omega)$:

$$P(Y_{it} = j|x) = F(\beta_1(Treat_i \times After_t) + \ \beta_2 After_t + c_i) \tag{2}$$

where $F(\cdot) = L\ (\omega) \equiv \frac{e^{\omega}}{1-e^{\omega}}$ and $j = 1,2,3,4,5$.

As shown by Karaca-Mandic, Norton, and Dowd (2011) and Puhani (2012), the sign of the treatment effect in a logit DID model is equal to the sign of the coefficient of the interaction term, β_1. We estimate all models with student fixed effects. We obtain marginal effects with post-estimation predictions, which we interpret as average treatment effects, following Norton, Wang, and Ai (2004) and Karaca-Mandic, Norton, and Dowd (2012).

7 Results

We first present basic DID comparisons (Table 2) without including any control variables and without relying on our fixed effects assumption. These basic comparisons show that students exposed to the traditional group assignment processes generally exhibit no statistically significant change in attitudes "after" such exposure. Students in the PM/PC course, however, liked the group forming process more ($p < 0.01$) and found it to be a better reflection of real business settings ($p < 0.01$). These students also agreed more strongly that the group grading process was fair ($p < 0.10$) and that scheduling group meetings was easier ($p < 0.01$). They also agreed more strongly that they liked class group projects overall ($p < 0.01$).

The lone exception to the statistically significant differences noted above is that students exposed to the PM/PC approach did not like the individual grading process any more or less than students exposed to the traditional approach. Students thought grading under the PM/PC approach was fairer ($p < 0.10$), but they did not like the grading process any more or less ($p \geq 0.10$). It appears that the authenticity of the group assignment approach does not affect how much students like grading in a course. In our experience implementing the PM/PC approach, we note that PMs regularly assign the same grade to all contractors without adjusting according to effort. If PMs do not regularly adjust PC grades based on differentiated effort, we might appropriately expect that students' attitudes about grading methods are statistically no different than traditional approaches.

To identify differences in student attitudes resulting from the PM/PC treatment in more detail, we estimate six ordered logit regression models with individual fixed effects. These independent models explain students' reported levels of agreement with each of the six statement prompts (dependent variables). Results are shown in Table 3. These six regression models reinforce our initial findings from our basic DID comparisons that the PM/PC approach positively affects student attitudes about group assignments. The signs and levels of statistical significance from Table 2 and Table 3 reflect the same findings for all six of our regression models. These basic results suggest that the instructor effect is minimal and that the observed difference in students' attitudes about group work is actually the consequence of the PM/PC group assignment approach.

Table 2. Basic Difference-in-Differences Calculations

Survey Prompt		Before	After	Difference
Real Forming	Treatment	2.46	4.43	1.96***
"Forming groups reflected the real	Comparison	3.31	3.88	0.58**
world."	**Difference**	-0.84***	0.54**	1.39***
Like Forming	Treatment	2.89	4.14	1.25***
"I liked the group forming process."	Comparison	3.38	3.23	-0.15*
	Difference	-0.49**	0.91***	1.40***
Fair Grading	Treatment	3.71	4.32	0.61***
"The grading process was fair."	Comparison	3.85	3.92	0.08
	Difference	-0.132	0.40*	0.53*
Like Grading	Treatment	3.37	4.19	0.81***
"I liked the grading process."	Comparison	3.27	3.65	0.38
	Difference	0.09	0.53*	0.43
Easy Meeting	Treatment	2.50	4.46	1.96***
"It was easy to find times to work	Comparison	3.04	2.96	-0.08
together."	**Difference**	-0.54*	1.50***	2.04***
Like Groups	Treatment	2.39	4.11	1.71***
"I like class group projects."	Comparison	2.96	3.31	0.35
	Difference	-0.57*	0.80**	1.37***

Note: ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$. Higher values indicate greater levels of agreement with survey prompt. Survey prompts (dependent variables) are five-point Likert-style measures (1 = "strongly disagree" and 5 = "strongly agree") of student attitudes about various aspects of group assignments that concern students. "*Real Forming*" and "*Like Forming*" relate to student concerns about how instructors form groups. "*Fair Grading*" and "*Like Grading*" relate to student concerns about how instructors grade individual students. "*Easy Meeting*" relates to student concerns about scheduling meetings with their other group members. "Like Groups" measures students' attitudes about group assignments overall.

Other than signs and significance levels, coefficient estimates from ordered logit models like ours can be hard to interpret. Post-estimation predictions and marginal effects can make results more understandable. Table 4 shows these post-estimation results. The values in Table 4 indicate the change in likelihood as a percentage that a student will have a particular response to a particular survey prompt due to exposure to the PM/PC approach, holding all else constant. For example, after exposure to the PM/PC approach, students are 20.4 percent more likely ($p < 0.01$) to "strongly agree" and 12.4 percent less likely ($p < 0.10$) to "strongly disagree" that they "like class group projects," holding all else constant.

Similarly and, again, holding all else constant, students exposed to the PM/PC methods are 38.8 percent more likely to "strongly agree" that scheduling meetings is easy compared with the comparison group ($p < 0.01$). The same students under the same conditions are 31.2 percent more likely ($p < 0.01$) and 17.2 percent more likely ($p < 0.10$) to respond this way about the likability of the group forming process and the fairness of the grading process, respectively. When students in the treatment course are relatively more likely to strongly agree that a particular positive statement is true (e.g., +38.8 percent for easy scheduling versus +17.2 percent for fair grading), we interpret that difference as a measure of students' relative enthusiasm for one component of the PM/PC model versus others. By this logic, the marginal effects indicate that the factors most contributing to students' improved attitudes are, in descending order of importance, improvements in group scheduling, group formation, and group grading processes effectuated by the use of the PM/PC approach.

Table 3. Ordered Logit Model Results of the Treatment Effect

	(1)	(2)	(3)	(4)	(5)	(6)
	"Forming groups reflected the real world."	"I liked the group forming process."	"The grading process was fair."	"I liked the grading process."	"It was easy to find times to work together."	"I like class group projects."
Y =	*Real Forming*	*Like Forming*	*Fair Grading*	*Like Grading*	*Easy Meeting*	*Like Groups*
Treat × After (DID)	**4.796*****	**4.833*****	**2.539***	**1.626**	**8.940*****	**4.267*****
	(1.427)	(1.583)	(1.424)	(1.242)	(2.351)	(1.419)
After (Current Course)	2.031**	-0.521	0.554	1.628*	-0.278	1.354
	(0.876)	(0.878)	(1.175)	(0.928)	(0.780)	(0.889)
N	108	108	108	107	108	108
Pseudo R^2	0.449	0.343	0.488	0.345	0.535	0.449
Log-likelihood Value	-86.953	-93.145	-64.352	-88.194	-73.346	-86.953
Individual Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: We estimate ordered logit models with individual fixed effects (number of students = 54). The individual fixed effects control for all time-invariant student characteristics, including assignment to the treatment or comparison course and students' self-reported cumulative GPA, age group, class standing, expected final grade in the course, months of paid work experience, the common level of group projects in other college classes, and most meaningful source of group work experience (college classes or paid employment). Standard errors are clustered by individuals. "Treat" is a dummy variable indicating that a student was exposed (one) or not exposed (zero) to the PM/PC approach. "After" is a dummy variable indicating that a student response includes (one) or does not include (zero) consideration of experiences in the "Current Course" (i.e., the treatment or comparison course). ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$

8 Conclusions and Discussion

In this study, we evaluate the effects of the PM/PC approach on students' attitudes about group assignments. Our analysis provides empirical support that the basic PM/PC approach, likely due to its increased authenticity, yields improved student attitudes toward group scheduling, group formation, and group grading processes. We identify limitations of our data and analysis, including reasonable concerns about the parallel trends assumption, the quasi-experimental study design with different instructors, and nonrandom assignments of participants to the treatment and comparison courses. Our study results are limited also by the small sample sizes of about 30 participants in each course. Further investigation using more robust study designs and richer data is needed to increase confidence in our conclusions.

Additionally, further examination about how student attitudes change in response to alternate versions of the PM/PC approach is required. For our study, we implement and examine only the "basic" version of the approach as described by [citation omitted for blind review]. These authors mention several ways to modify their basic approach, for example, by using alternate rules for grading or by offering guided reflections about leadership attributes as part of the group formation process. Regarding the latter, existing scholarship indicates that choosing leaders is a complex social process involving gender, ethnic, and other biases that should not be approached naively (Carnes, Houghton, and Ellison 2015; Brescoll 2015; Beckwith, Carter, and Peters 2016). The specific adaptations of the PM/PC approach that are needed to deal with these biases most appropriately have not been studied.

Further study could also examine impacts beyond improving student attitudes, for instance, how the PM/PC and other simulated business approaches affect student academic performance. Weldy and Turnipseed (2010) assess how working in groups on actual—not simulated—business management

Table 4. Summary of Marginal Effects

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Real Forming					
"Forming groups reflected the real world."	-0.127*	-0.256***	-0.036	0.061	0.359***
	(0.068)	(0.07)	(0.023)	(0.038)	(0.091)
Like Forming					
"I liked the group forming process."	---	-0.542***	-0.069	0.300***	0.312***
		(0.151)	(0.042)	(0.071)	(0.100)
Fair Grading					
"The grading process was fair."	---	-0.081	-0.142*	0.051	0.172*
		(0.053)	(0.084)	(0.035)	(0.093)
Like Grading					
"I liked the grading process."	-0.018	-0.07	-0.12	0.086	0.121
	(0.022)	(0.052)	(0.087)	(0.067)	(0.086)
Easy Meeting					
"It was easy to find times to work together."	-0.153	-0.697***	0.18*	0.282***	0.388***
	(0.106)	(0.147)	(0.109)	(0.097)	(0.065)
Like Groups					
"I like class group projects."	-0.124*	-0.217***	-0.046*	0.184***	0.204***
	(0.072)	(0.045)	(0.027)	(0.064)	(0.071)

Note: We estimate ordered logit models with individual fixed effects. The individual fixed effects control for all time-invariant student characteristics, including assignment to the treatment or comparison course and students' self-reported cumulative GPA, age group, class standing, expected final grade in the course, months of paid work experience, the common level of group projects in other college classes, and most meaningful source of group work experience (college classes or paid employment). Standard errors are clustered by individuals. ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$

projects affects students' learning. They find that both student perceptions of learning and actual learning are high as a result of such group projects with actual business ties. The impact of the PM/PC approach on student learning outcomes calls for future research.

Finally, further consideration and study is needed to assess how well the PM/PC approach works for different disciplines and different course types. For our study, we implemented the approach in an undergraduate agricultural finance course. Students may demonstrate better attitudes and more learning if the approach is used in courses with students who, as a group, have more diverse knowledge, skills, and experiences (Fleischmann and Daniel 2010). In such cases, students would need to wrestle more with the advantages and disadvantages of their choices of managers and contractors. Given a group project assignment of sufficient complexity, forming teams would likely be more challenging, the consequences of choosing well or poorly would likely be more impactful, and the student experience overall would therefore likely be more enriching. Further study is needed to confirm these hypotheses.

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Research Article

Valuing College Graduate Attributes and Skills: Employer Willingness to Pay as Elicited through Design Valuation

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Abstract
Design valuation (DV) is a new valuation method adapted from the Build-Your-Own (BYO) method used within the marketing literature. Within design valuation, subjects design their optimal good by selecting various attributes at select prices. Through a DV survey of college graduate employers, interval-censored willingness-to-pay (WTP) data are collected for 10 college graduate attributes. Both tangible and intangible attributes are evaluated. Average WTP estimates for the college graduate attributes are estimated relative to the type of college (agricultural, business, engineering, or other) from which the employer prefers to hire recent graduates. A high degree of character, ability to work well with others, and excellent communication skills are among the most highly valued attributes. In general, we find that intangible attributes such as these are valued higher than tangible attributes, which require relatively less subjectivity to determine. This finding points to the importance of the job interview, which is often the best tool employers have to evaluate whether candidates possess these intangible attributes. Analysis of the DV survey results will help academic advisors prepare students for the job market and students to better align their own goals with development of specific skills and attributes to increase their marketability and return on education investment on entering the job market.

1 Introduction

The total value of a good is often assumed to be the sum of the values of its components. Following this logic, we could similarly describe the value of a recent college graduate as a sum of the individual values of the attributes the graduate possesses. As employers seek to hire recent graduates, they may value some attributes more than others. Additionally, the values employers place on these attributes are likely heterogeneous and could differ significantly based on individual employer characteristics.

A significant amount of research has evaluated the relative importance of various college graduate attributes and skills in the context of employability. Suleman (2016) demonstrated that, although research points to the need for relational skills, namely interpersonal, communication, and teamwork abilities, there exists little consensus on which skills best foster employability. Using a web-based choice experiment, Noel and Qenani (2013) surveyed California-area agribusiness employers and found that skills such as creativity and critical thinking were becoming quite important in the labor market.

In addition to studies measuring the relative importance of graduate attributes, numerous studies have estimated the value of these attributes using various techniques (Barkley 1992; Barkley et al. 1999; Norwood and Henneberry 2006). Barkley (1992) and Barkley et al. (1999) regressed survey data of the salary of recent graduates on individual attributes to estimate the value of specific attributes. Norwood and Henneberry (2006) used a choice experiment to value recent graduate attributes by presenting respondents with job candidates who had differing attributes and salaries. The purpose of this study was to present a new method of stated preference elicitation called design valuation (DV) as well as to estimate the value employers place on various college graduate attributes. We add to this literature on graduate attribute values by further classifying these values by employer type. Our analysis uses four types of employers categorized based on preference for hiring graduates from an agricultural, business, engineering, or other college. We compare the value estimates for specific attributes across employer types.

2. Design Valuation

Numerous economic studies have developed, tested, and refined tools for measuring stated preferences through surveys (see Lusk and Hudson 2004 for an overview). The literature tends to use two methods: conjoint analysis and contingent valuation (CV). The goods evaluated with these survey instruments are defined as a collection of attributes. For example, a lake may be described by water clarity, frequency of algae blooms, and boat ramp access; and steaks may be described by their tenderness, marbling, and days of carcass aging. Harris and Briggeman (2019) used conjoint analysis to estimate willingness to accept changes in salary for preferred job attributes in the grain merchandising industry. Their analysis demonstrates how conjoint analysis can be particularly useful when parties to a transaction have incomplete information about one another.

In using these stated preference methods, the researcher designs various goods by assigning each good a unique collection of attributes. Subjects are then asked to make selections on the basis of preferences for the goods. Researchers then try to infer a consumer's preference for each attribute level based on his or her stated choices for selected versions of the product. For this reason, conjoint analysis is referred to as a decomposition approach; researchers must infer (decompose) preferences of individual attribute levels from choices made based on selected versions of the product as a whole. Subjects are involved in the research in a post-design stage, after the good has been designed. Post–design valuation is often touted because it mimics many real decisions, such as which brand of flour to purchase or whether to approve a referendum providing a public good.

However, consumers often face real decisions in the pre-design phase, decisions which can be mimicked using the DV process. Households purchasing a new home will often design it themselves by selecting the attributes they prefer; such as ceiling height, number of bathrooms, and number of stories. The chosen attributes are determined by both preferences and attribute prices.

Consider an alternative example, a computer upgrade. Assume a marketing researcher is interested in the values a consumer places on different computer components or upgrades (e.g., larger monitor, more powerful processor). A conjoint approach would present the consumer with upgrades above the baseline computer at varying prices. The upgrade is a collection of attributes with unique prices for each attribute collection. If the attribute list is long and the number of alternatives to peruse is large, the cognitive burden on the consumer could be significant. Imagine having to keep track of 5 upgrades, each described by a unique combination of 15 attributes.

An alternative to a decompositional conjoint analysis approach is a compositional approach. In a compositional approach, researchers directly ask individual participants about their preferences for each attribute (or level of attribute or both), and their preferences for a given product are then obtained by combining their preferences for the product's included attribute levels. One of the most well-known compositional approaches is the self-explicated approach. There are many variations of this method (see Green and Srinivasan 1990) but in general, participants are first asked to state their desire for various levels of a given attribute. Then, the participants are asked to allocate a constant sum (i.e., 100 points) across all attributes in which their allocations correspond to the importance of each attribute (Park et al. 2008). Within marketing, this approach is desirable because it is easy to implement and allows decision makers to evaluate a large set of attributes that may vary across many levels. However, this approach is not without its limitations, not the least of which is that it is not similar to a real-world situation and can be unfamiliar to respondents (Park et al. 2008). To help overcome some of the perceived weaknesses of the self-explicated approach, Park et al. (2008) introduced the upgrading method. They describe its steps as follows:

> *(1) A participant accesses the Web-based upgrading study through a Web browser (e.g., Internet Explorer); (2) the participant is endowed with a bare-bones configuration of the product; (3) the participant is shown all attributes that are available for upgrading (he or she can upgrade only once for each attribute) and is asked to select the attribute to upgrade next; (4) the participant is shown all levels in that attribute and is asked to state his or her willingness to pay (WTP) to upgrade from the current level to each of the desired levels for that attribute; (5) the computer randomly generates a cutoff price for each level and determines whether a level is upgradable (i.e., the stated WTP for this level is larger than or equal to the randomly drawn cutoff price for the same level); (6) the participant's product remains the same if no level is upgradable; otherwise, it will be upgraded to one of the upgradable levels (randomly chosen by the computer), but the participant pays only the randomly chosen cutoff price for the upgraded level; and (7) Steps 3-6 are repeated until the participant has upgraded all attributes of interest or until he or she decides not to upgrade any remaining attributes* (Park et al. 2008, 563).

When comparing the preference structures uncovered by the upgrading method and the self-explicated method, the researchers found the external validity of the upgrading method to be superior to that of the self-explicated method. They attributed much of the improvement to the added realism of the upgrading method. The authors noted that the upgrading method mirrors the real task that people engage in when they choose a product in the marketplace (Park et al. 2008).

Using the upgrading method, participants enter the maximum amount they would be willing to pay for each level of an attribute. However, in reality, consumers are not asked the price they would be willing to pay but rather are shown prices for the upgrades and must determine whether they are willing to pay them. Therefore, additional realism could be achieved if participants could evaluate the individual levels separately (decompositional approach) at stated prices. This is the idea behind what has become known as the build-your-own (BYO) method and is also the fundamental idea behind the DV method used in this study. BYO and DV methodology operates by defining a general good as a collection of attributes and assigning prices to those attributes. Respondents are then asked to design their optimal good based on those attribute prices (much like customers design their optimal personal computer). By varying the attribute prices across surveys, the value of each attribute can be inferred.

There are many variations of the BYO method (see Ben-Akiva and Gershenfeld 1998; Liechty et al. 2001; Dahan and Hauser 2002) but in general, the price of attribute levels does not vary within a survey. Even across surveys, the price variation typically used is similar to conjoint analysis in which the researcher predetermines price levels, and prices can only vary at those levels. The DV method used in this study builds on the ideas of the BYO method and is similarly constructed but allows prices of attribute levels both within and across surveys to update dynamically. The dynamics of the survey are described in more detail in the “Data” section.

In a sense, design valuation is similar to asking multiple CV questions. Returning to the computer example, the marketing researcher could ask the customer if she would purchase each individual upgrade at the stated price, which is analogous to one CV question per upgrade component. Each purchase would be in addition to the baseline computer at a base cost. But provided in a mail or phone survey, multiple CV questions might be too difficult for the customer to process. The customer might not be able to easily track the total price of her computer or her previously purchased upgrade and its price, and she might be unable to change her selections. Our proposed DV survey alleviates this problem with a built-in calculator that presents the individual with a relatively direct and concise question.

Design valuation has no obvious statistical advantages over post–design methods. If humans were perfectly rational, had well-defined preferences, did not suffer from survey fatigue, and had perfect memory, both design and post–design methods would elicit identical preferences. However, design valuation is preferred over traditional post–DV methods in this paper because it can extract much information from a simple question.

To achieve its purpose, our study called for creation of an internet-based DV survey of employers of college graduates that evaluate attributes resembling those in Norwood and Henneberry (2006), Boland and Akridge (2004), Berle (2007), and Litzenberg and Schneider (1987). In total, we evaluate 10 attributes. We divide the attributes into two groups of five—Attribute Set A and Attribute Set B—and evaluate each set separately using DV survey questions. Attribute Set A includes internship or work experience (as opposed to none), at least one high-quality academic award (as opposed to none), ability to speak and write in Spanish and other languages (as opposed to no such ability), at least one high leadership position in an academic organization (as opposed to none), and outstanding letters of recommendation (as opposed to mediocre letters). Attribute Set B includes high number-crunching ability (as opposed to low number-crunching ability), high degree of character (as opposed to difficult-to-perceive character), ability to work well with others (as opposed to uncertain ability to work well with others), excellent oral and written communication skills (as opposed to communication skills that need improvement), and excellent problem-solving abilities (as opposed to difficult-to-perceive problem-solving abilities).[1]

Norwood and Henneberry (2006) employed a choice-based conjoint survey or a post–design survey to estimate employer's willingness to pay for college graduate attributes. Therefore, their results can be compared with the results from our DV method. Our DV format provides interval-censored willingness-to-pay data (an interval known to contain the individual's true value) for attribute values. Using interval regression on the collected interval-censored data, we estimate the value that employers place on specific attributes.

3. Theory

Any good can be thought of as a collection of attributes and the goods' value a function of the individual attribute values (Rosen 1974). Let a hypothetical good be a set of attributes a_i where $i = 1, \dots, I$. An attribute a_i may be a dummy variable indicating the presence or absence of some trait (e.g., excellent communication skills), or it may be a continuous variable denoting the level of some attribute (e.g., grade point average). Only the binary variable case is considered here. Further, let the value of attribute a_i to an individual be denoted v_i, assumed independent of other attributes, and stated in money metric form. The value of good j is then measured by the function $\sum_{i=1}^{I} a_{i,j} v_i$, where a_{ij} refers to the presence or absence of attribute i in good j. If the price of the good j is P_j, the welfare surplus received from good j, defined U_j, is:

$$U_j = \sum_{i=1}^{I} a_{ij} v_i - P_j. \tag{1}$$

Assuming a consumer of good j is a welfare maximizer, the optimization problem the consumer faces is:

$$\max_{a_{ij}} U_j = \sum_{i=1}^{I} a_{ij} v_i - P_j. \tag{2}$$

Post–DV methods such as contingent valuation and conjoint analysis utilize questionnaires to determine whether U_1, the welfare surplus associated with selecting good one, is less than, equal to, or greater than U_2, the welfare surplus associated with selecting good two. Researchers observe only the sign of $U_1 - U_2$, and from this sign must infer the values of the v_i's. For example, suppose a respondent is asked to choose one of the following two goods: good 1 ($a_{11} = 1,\ a_{21} = 1, a_{31} = 1, a_{41} = 0, a_{51} = 0, P_1 = 1$) or good 2 ($a_{12} = 0,\ a_{22} = 0, a_{32} = 0, a_{42} = 0, a_{52} = 0, P_2 = 0$). This particular choice resembles a CV

[1] As an attribute, number-crunching ability is intended to help employers assess the quantitative/mathematical abilities of a potential job candidate.

question in which the respondent is asked if she would like a public good provided that it increases taxes by 1. If good 1 is chosen, all the researcher knows is that $v_1 + v_2 + v_3 \geq 1$.

Now consider a DV question in which the individual is given the baseline good or good 1 $(a_1 = 0,\ a_2 = 0, a_3 = 0, a_4 = 0, a_5 = 0, P = 0)$ and is allowed to purchase any attribute a_i at a price of 0.4. Suppose attributes a_1 and a_2 are purchased, revealing to the researcher that $v_1 > 0.4$, $v_2 > 0.4$ and that v_3, v_4, and $v_5 < 0.4$. Clearly more information is obtained from the DV question, which does not imply that demand valuation is necessarily superior to post–design methods. The same information could be obtained through five CV questions, one comparing $(a_{11} = 1,\ a_{21} = 0, a_{31} = 0, a_{41} = 0, a_{51} = 0, P_1 = 0.4)$ to $(a_{12} = 0,\ a_{22} = 0, a_{32} = 0, a_{42} = 0, a_{52} = 0, P_2 = 0)$, another comparing $(a_{11} = 0,\ a_{21} = 1, a_{31} = 0, a_{41} = 0, a_{51} = 0, P_1 = 0.4)$ to $(a_{12} = 0,\ a_{22} = 0, a_{32} = 0, a_{42} = 0, a_{52} = 0, P_2 = 0)$, and so on. In fact, demand valuation can be thought of as a series of CV questions, one posed for each attribute and the respondent makes their decision for each attribute jointly in the same general question.

The statistical information gleaned from a DV question will then be equivalent to a number of CV questions. The advantage of design valuation is that it contains those CV questions in one compact question, easily answered in internet browsers. The DV format will also be familiar to consumers who, through manufacturers, design their own products, whether cars, computers, or homes. Subjects should be able to perform the DV task with little instruction, ensuring high response rates and greater information.

4. Data

In fall 2006, employers of Oklahoma State University graduates were asked to participate in an internet survey eliciting their preferences for new hires. The invitations were mailed to 4,401 employers, yielding 507 responses, for a response rate of 12 percent. This rate is similar to the response rate of employers surveyed by Norwood and Henneberry (2006). Unlike the Norwood and Henneberry study, we did not restrict the list of employers only to those who are known to hire agricultural graduates; the list included employers of all undergraduate degrees, yielding WTP estimates for those hiring graduates from agricultural and non-agricultural colleges, which may provide insightful information as comparisons are made.

Figure 1 illustrates one of this study's DV questions evaluating Attribute Set "B". Employers of college graduates are presented with a baseline graduate requiring a \$25,000 salary and possessing low levels of five attributes. The employer is allowed to purchase any of the five attributes at different prices. The cognitive burden of this question is relatively low, especially considering it is the equivalent of five CV questions.

Internet surveys are the ideal platform for hosting DV questions because automatic calculators can be easily installed in the survey software. Within our survey, respondents could click on a "Recalculate Salary" button at any point while responding to a DV question to see an updated salary based on the attributes they had selected (see Figure 1).

CV questions often have a similar follow-up question, in which the price of the good purchased (or not purchased) in the first question rises (or falls) in the second question. This sequence is referred to as dynamic updating. The questions are dynamic in the sense that one question depends on the answer to a previous question. Following the previous example, because good 1 $(a_{11} = 1,\ a_{21} = 1, a_{31} = 1, a_{41} = 0, a_{51} = 0, P_1 = 1)$ is preferred to good 2 $(a_{12} = 0,\ a_{22} = 0, a_{32} = 0, a_{42} = 0, a_{52} = 0, P_2 = 0)$, the respondent can be asked to make the same choice wherein P_1 is increased to 2. Because the value of multiple attributes is of concern, researchers would rarely repeat the same combination of attributes as in this example. Additionally, attempting to dynamically update CV questions addressing each attribute in this context would result in a survey far too lengthy.

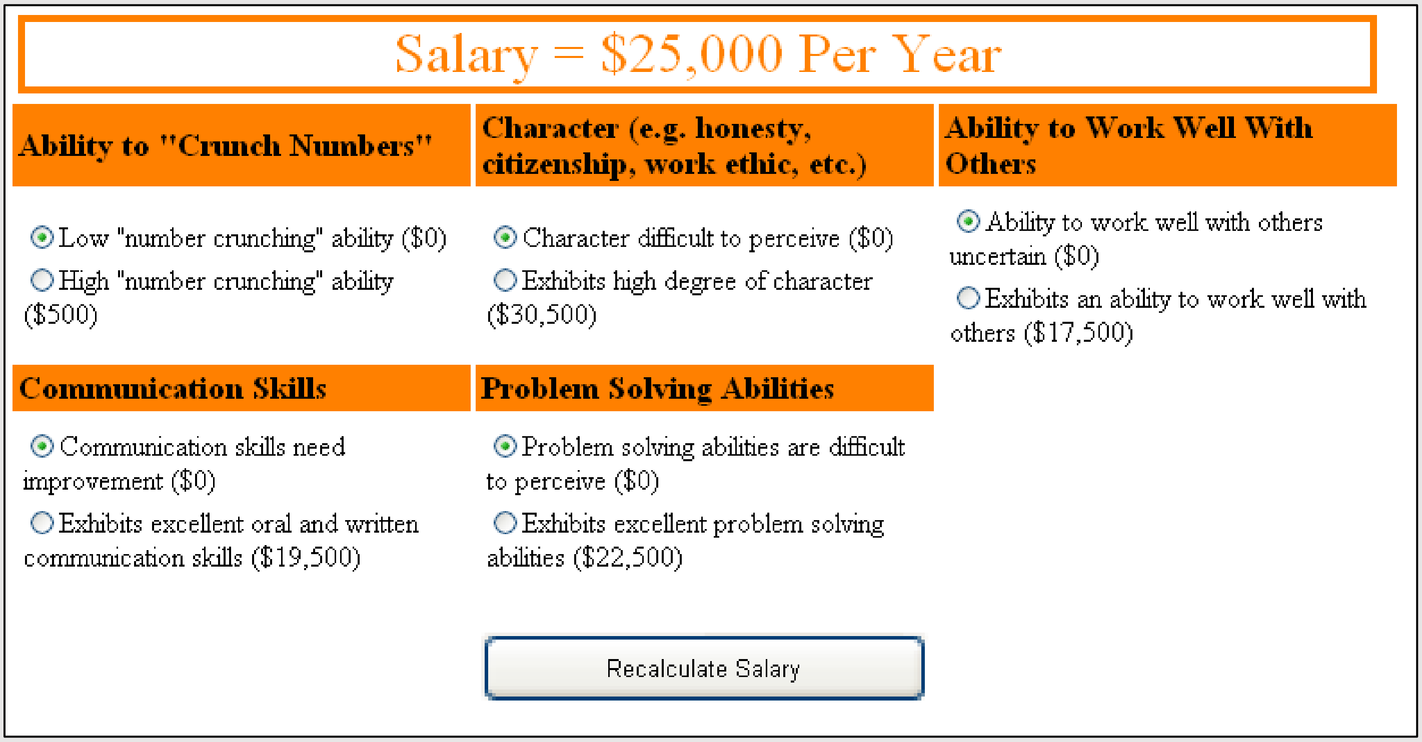

Figure 1. Design Valuation Question

Dynamic updating is straightforward in design valuation. Refer again to Figure 1. Suppose that the respondent chooses to purchase high number-crunching ability at $500 and ability to work well with others at $17,500, but none of the other attributes. A follow-up question would then increase the price of number-crunching ability and ability to work well with others while lowering the price of the remaining attributes. Such dynamic updating is employed in the survey, producing data on attribute values that are interval censored. For example, if the respondent purchased number-crunching skills for $500 in the first question but declined to purchase it in the second question when the cost rose to $5,000, the interval-censored observation would be ($500, $5,000). The true value of this attribute for the employer is known to reside within this interval. If the attribute is purchased at both prices, the interval would be $5,000, and an upper bound. If an attribute is purchased at neither price, assuming attribute values are non-negative, the interval would be zero, and the lowest price offered of $500.

The first page of the survey informed respondents that the purpose of the survey was to seek input on what kind of college graduate they prefer to hire, and it asked them to answer questions in a manner that best reflected their actual hiring practices. On the second page, a simple practice question was presented to help prepare respondents for the more complex DV questions later in the survey. Before the employer was asked to answer questions similar to the one in Figure 1, an information script was provided. This script on page 3 provided information on the DV questions and how to answer them. For example, respondents were told to assume that the graduate holds a degree from a four-year educational institution and possesses any unlisted attribute at an “average” level. If they would hire no college graduate at the $25,000 salary level, respondents were instructed to leave the questions unanswered. Because it is impossible to distinguish these respondents from respondents who simply did not wish to answer the questions, all nonresponses were excluded from the data analysis.

The fourth page of the survey contained the first DV question for Attribute Set A. Employers were first presented with a low-quality graduate earning a $25,000 salary with none of the attributes in Set A. They were then allowed to purchase each attribute at a particular price.

Some employers have direct control over the salary they offer. Others, such as government agencies, have a set salary they must pay, and they hire the most qualified applicant they can obtain at this salary. These employers will select the attributes they deem both most important and affordable, up to the preset salary they can offer. These employers resemble a consumer who can spend no more than $1,000 on a computer upgrade and who purchases valued and affordable upgrades until the $1,000 limit is exceeded by any additional upgrade.

After making their attribute selections, respondents were presented with a question (page 5) in which only the attribute prices differed. If an attribute was purchased in the previous question, its price was increased by a randomly selected percentage on the 1–100 percent interval. Otherwise, its price was decreased by the same random percentage. The purchase decision for any one attribute on the two DV questions provides an interval known to contain the employers' true WTP value.

The survey introduced a second dynamic element: On the basis of respondents' willingness to purchase a given attribute in prior surveys, the initial price of that attribute was increased or decreased for each successive respondent. For example, if more than 50 percent of respondents purchased internship experience, its initial price would increase on subsequent surveys. The initial price would increase across surveys until less than 50 percent purchased it, at which point the initial price would begin to decline. While the survey was administered, the initial price would drift up and down such that on average 50 percent purchased the attribute, increasing the statistical efficiency of the survey design. The degree to which attribute values increased or decreased varied across attributes. Attributes whose values were hypothesized to be lower increased or decreased in $200 increments; others rose or fell in increments of $500. Hypotheses of attribute values were based mainly on the Norwood and Henneberry (2006) study.

Pages 7 and 8 of the survey presented two similar DV questions designed to elicit the value for Attribute Set B, shown in Figure 1. The remaining questions concerned employer information, such as the type, size, and preference for employers' college degree. In addition, respondents were asked if they had influence over hiring decisions. If they did not, their responses were not included in the analysis. Excluding these respondents and those who purchased no attributes reduced the sample size from 507 to 453.

Summary statistics on the survey respondents are provided in Table 1. Most employers identified themselves as a government organization, a manufacturer, or other. Almost half are large employers with more than 500 full-time employees.

Respondents were presented with a list of degrees and were asked to select their one preferred degree: accounting; business; communications; finance; economics; management; marketing; agricultural engineering; agricultural communications; agricultural economics / agribusiness; agronomy; animal science; food science; horticulture; civil, electrical, mechanical or chemical engineering; industrial engineering; other. From these preferred degrees, we then grouped employers into four categories according to the type of college (agricultural, business, engineering, or other) from which they prefer to hire graduates.

5. Model

Responses to the DV questions were used to construct interval-censored willingness-to-pay (ICWTP) data for each attribute and employer. For example, employer *i's* value for a particular attribute j is given by the interval (L_{ji}, U_{ji}), where L_{ji} and U_{ji} are the attribute value's lower and upper bounds, respectively. Recall that each employer was given the opportunity to purchase each attribute at two prices. For employers that purchased an attribute at one price but not another, the values of L_{ji} and U_{ji} are taken directly from those two prices. For employers that declined the purchase at both prices, it is assumed that $L_{ji} = 0$ and U_{ji} equals the lowest of those two prices. Finally, for those who purchased the attribute at both prices, L_{ji} equals the larger of the two prices, and U_{ji} is set equal to the largest value of L_{ji} for other employers. Thus, we would expect that V_{ji}^{*}, the true value of attribute j in a recent college graduate when being hired by the ith

Table 1. Employer Demographics (Sample Size = 453)

Organization Type	Percent	Preferred Degree	Percent Preferred Degree	Number of Full-Time Employees	Percent
Government organization	15	Accounting	6	< 10	4
Manufacturer	20	Business Communications	4	10–49	16
Financial service provider	9	Finance	4	50–59	13
Consultant	10	Economics	0	100–500	22
Food processor	2	Management	8	> 500	45
Retailer	4	Marketing	6		
Wholesaler	3	Ag Engineering	2		
Farm or livestock producer	2	Ag Communications	1		
Farm input supplier	3	Ag Economics / Ag Business	8		
Other	32	Agronomy	3		
		Animal Science	4		
		Food Science	1		
		Horticulture	1		
		Civil, Electrical, Mechanical, or Chemical Engineering	22		
		Industrial Engineering	3		
		Other	24		

Notes: Numbers may not sum to one due to rounding.

employer, resides within the constructed interval $[L_{ji}, U_{ji}]$ but is unobservable or latent. To estimate this latent value for each attribute, we could simply use the midpoint of each interval. However, as noted by Stewart (1983), this method would generally result in inconsistent estimates. Stewart (1983) outlined approaches to yield maximum likelihood estimates under the assumption of normality. STATA's "intreg" command facilitates the estimation of the maximum likelihood function for interval regression estimation. The interval regression estimates the probability that a latent variable exceeds one threshold but is less than another threshold; it estimates the probability of the latent variable within a certain interval (Cawley 2008; Corso et al. 2013). The interval regression model fit by intreg is a generalization of a tobit model because it extends censoring beyond fixed left-censored data or fixed right-censored data to allow for interval-censored data (StataCorp, 2019). Although V_{ji}^* was not directly observed for respondent i, it is known to lie in the interval $[L_{ji}, U_{ji}]$, and the corresponding likelihood contribution is:

$$\Pr\left(L_{ji} \leq V_{ji}^* \leq U_{ji}\right) = \Pr\left(L_{ji} \leq X_{ji}\beta + \varepsilon_{ji} \leq U_{ji}\right). \tag{3}$$

When an upper bound is unknown (right-censored data) the likelihood contribution is:

$$\Pr\left(L_{ji} \leq X_{ji}\beta + \varepsilon_{ji}\right). \tag{4}$$

When a lower bound is unknown (left-censored data), we set a lower bound of zero, and the likelihood contribution is:

$$\Pr(0 \leq X_{ji}\beta + \varepsilon_{ji} \leq U_{ji}). \tag{5}$$

Thus, the data generating process for this study is:

$$V_{ji}^{*} = \beta_{0j} + \beta_{1j}Buscollege_i + \beta_{2j}Engcollege_i + \beta_{3j}Othercollege_i + \varepsilon_{ji} \tag{6}$$

where V_{ji}^{*}, is the true (latent) average value of attribute j in a recent college graduate when being hired by the ith employer; $Buscollege_i$ is a dummy variable equal to 1 when the ith employer most often prefers to hire graduates from a business college and equal to 0 otherwise; $Engcollege_i$ is a dummy variable equal to 1 when the ith employer most often prefers to hire graduates from an engineering college and equal to 0 otherwise; $Othercollege_i$ is a dummy variable equal to 1 when the ith employer most often prefers to hire graduates from a college other than an agriculture, business, or engineering college and equal to 0 otherwise; and $\varepsilon_{ji} \sim N(0, \sigma_{ji}^2)$. To avoid the dummy variable trap, no variable is included when the ith employer most often prefers to hire graduates from an agricultural college. Thus, the constant β_0 can be interpreted as the value for attribute j when the ith employer most often prefers to hire graduates from an agricultural college. The estimates for $\beta_{2j}, \beta_{3j,}$ and β_{4j} can be interpreted as the value premiums or discounts associated with attribute j when the ith employer most often prefers to hire graduates from a business college, engineering college, or other type of college respectively.[2]

6. Results

The mean value of each college graduate attribute was estimated using MLE as outlined in equation (6). Each attribute's value estimates and their estimated standard errors for employers that most often prefer to hire graduates from agricultural colleges are summarized in Table 2. The table also contains the attribute value premiums or discounts estimated for employers that typically prefer to hire from non-agricultural colleges.

Consider the types of attributes valued. Attribute Set A (internship experience, at least one high-quality award, foreign language, held leadership position, and recommendation) includes attributes that are tangible in the sense that they are easily verifiable and measurable. Attribute Set B (number-crunching ability, high degree of character, works well with others, excellent communication, and problem-solving ability) includes attributes that are intangible in the sense that they are unmeasurable and require the employer's subjective judgment to evaluate. On average, the intangible attributes have a much higher value to employers than the tangible attributes. The larger mean values as well as greater variability within the intangible attributes is not unexpected. Velasco (2012) demonstrated that intangible attributes (soft skills) are the most desired attributes in the hiring process. Additionally, we expect that employers will have varying interpretations of intangible attributes and hence those attributes will be subject to greater heterogeneity than more tangible attributes, which require much less subjectivity. As shown by Briggeman et al. (2007), the assessment of these intangible attributes is most critically accomplished through a personal interview by the potential employer.

According to our survey analysis, possession of an academic award is the attribute with the lowest value ($381). Ability to work well with others is the attribute with the highest value ($17,920), followed closely by high degree of character and excellent communication ($17,366 and $17,464, respectively).

Statistical differences between estimates for employers that prefer to hire from agricultural colleges and for employers that prefer to hire from business, engineering, and other colleges have been noted in Table 2. For many of the attributes, there are no statistical differences (at 0.05 significance level). This finding indicates that we have insufficient evidence to suggest that the value estimated for employers that

[2] Equation 6 assumes independence among attributes. We could modify equation 6 to relax the independence assumption and allow for correlation among attributes to be estimated, as shown in the appendix.

Table 2. Value for Recent College Graduate Attributes with Respect to the Type of College from Which the Employer Prefers to Hire

Attribute	Value If Employers Prefer to Hire from Agricultural Colleges	Change in Value If Employers Prefer to Hire from		
		Business Colleges	Engineering Colleges	Other Colleges
Internship experience	$15,681 (1,741)	$2,233 (2,158)	$5,383* (2,251)	-$689 (2,241)
At least one high-quality award	$381 (66)	-$100 (82)	$49 (86)	$77 (87)
Foreign language	$1,376 (212)	-$191 (260)	-$279 (268)	-$379 (272)
Held leadership position	$2,890 (288)	-$467 (356)	-$376 (371)	-$1,161* (369)
Recommendation	$2,392 (294)	-$406 (360)	$40 (379)	-$36 (381)
Number-crunching ability	$2,473 (302)	-$491 (369)	-$262 (390)	-$1,118* (383)
High degree of character	$17,366 (2,319)	$4,542 (2,874)	$6,917* (2,991)	$6,372* (3,022)
Works well with others	$17,920 (1,854)	-$1,767 (2,295)	$1,986 (2,405)	-$161 (2,417)
Excellent communication	$17,464 (2,329)	$4,033 (2,878)	$8,745* (3,026)	$4,513 (3,021)
Problem-solving ability	$14,638 (2,274)	$6,527* (2,817)	$11,733* (2,953)	$8,551* (2,970)

Notes: Numbers reported in parenthesis are standard errors.
* indicates estimates that are significantly different at the 0.05 level from value if employers prefer to hire from agricultural colleges

prefer to hire from agricultural colleges (the omitted category) would be different than the value estimated for employers that prefer to hire from the other types of colleges.

With regard to the tangible attributes, the only statistical differences we see are for internship experience and held leadership position. On the basis of our estimates, we expect employers that prefer to hire from engineering colleges to place a higher value ($5,383 premium) on internship experience than employers that prefer to hire from agricultural colleges. Accordingly, the total expected value for internship experience would be $21,064 for employers that prefer to hire from engineering colleges. This value indicates relevant past experience would be expected to garner a larger premium within engineering careers. In the case of the leadership position attribute, however, we would expect a discount of $1,161 for employers that prefer to hire from other (nonagricultural) colleges compared with employers that prefer to hire from agricultural colleges.

With regard to the intangible attributes, we see a greater variability in attribute value among types of employers. Significant differences are found within all but one attribute: works well with others. The attribute with the greatest value heterogeneity is problem-solving ability. For employers that prefer to hire graduates of agricultural colleges, the estimated value of this attribute is $14,638—significantly less than the estimated value for the other three employer types.

The average value of foreign language skills is $1,376, but this value is not the best rate-of-return estimate for students acquiring this skill. The average value refers to the value of that attribute for both employers that do and employers that do not need employees fluent in Spanish and other languages. We assume that graduates with foreign language skills will be more likely to interview at jobs stressing multiple language skills, and we assume those jobs would be with employers that place comparatively high value on these skills. For students considering learning Spanish, a rate-of-return higher than the average would be expected. The same argument can be made for number-crunching ability. Many jobs do not require employees to possess significant quantitative skills, thus the relatively low average value of $2,473 for number-crunching ability. But graduates with this ability will likely interview with employers that place a greater-than-average value on this skill, and thus they could expect to receive a return higher than the average value.

To get a better idea of the distribution for attributes values, we use the Turnbull estimator, which is best described as a nonparametric maximum likelihood estimator (Turnbull 1974). Suppose that observation i contains a lower bound L_i and an upper bound U_i known to contain the true value willingness to pay WTP_i. The Turnbull estimator requires ordering of the L_i and U_i values (stacked in the same column) in ascending order and then identification of those intervals (L_i, U_j) (where j can equal i but does not have to) for which no other lower or upper bound are captured. These so-called equivalence classes are the only intervals over which the likelihood can assign probability mass (Day 2007).

Suppose these equivalence classes are denoted $C_0 < C_1 < C_2 <, \ldots, < C_E$. The Turnbull estimator estimates the cumulative distribution for WTP_i—specifically, the cumulative distribution at each C_i, denoted $F(C_i)$—by maximizing the log-likelihood function:

$$LLF = \sum_{i=1}^{I} \ln\left[\sum_{e=1}^{E} d_{ie} \left(F(C_e) - F(C_{e-1})\right)\right], \tag{7}$$

where $d_{ie} = 1$ indicates the WTP interval (L_i, U_i) spans the equivalence class (C_{e-1}, C_e). The optimization routine must be constrained so that $0 < F(C_0) < F(C_1) <, \ldots, < F(C_E) < 1$.

After estimation of the CDF for both language skills and number-crunching ability, we see that, as expected, the value of these attributes for the majority of employers is much lower than the mean.[3] However, for a minority of employers, the value of these attributes is much greater than the average. For language skills, the estimated CDF indicates that for nearly 49 percent of employers the value of language skills would be less than $255. For approximately 15 percent of employers, the value of these skills would be between $3,096 and $5,852, and for just less than 10 percent of employers, the value would be more than $8,000. This same pattern appears within the estimated CDF for the number-crunching ability attribute. For approximately 50 percent of employers, the value of number-crunching ability would be less than $540, but for 25 percent of employers, the value would be more than $6,435 and for 13 percent of employers, more than $10,920. Thus, we would expect graduates with these attributes for which the dispersion of employer values is quite large to seek out employers that highly desire what they have to offer. These graduates could likely realize returns much greater than the average value estimates would otherwise indicate.

Because the study conducted by Norwood and Henneberry (2006) employed a choice-based conjoint survey or a post–design survey to estimate employer's willingness-to-pay for college graduate attributes, its results can be compared to the results from our DV method. The values for internship experience, character, and communication skills are consistent with those values calculated by Norwood and Henneberry (2006) using a traditional choice experiment and conventional estimation techniques.

[3] Figures A1 and A2 in the appendix show the estimated CDFs for language skill and number-crunching ability, respectively.

Using the parameter estimates in Table 4 of Norwood and Henneberry (2006, 490), and the conventional value (WTP) calculation, their value estimates for internship experience, character, and communication skills are $22,000, $39,430, and $35,602, respectively. These estimated values are either equal to or greater than the values reported in Table 2. Moreover, Norwood and Henneberry report average values for at least one academic award and one leadership position of $663 and $2,406, both of which are similar to those reported in Table 2.

7. Future Research and Limitations

Design valuation is a unique survey method that allows respondents to participate in the pre-design survey process. Respondents are given a general good described by various attributes and are allowed to change the attribute levels at prescribed prices. In this way they design the good. Design valuation is equivalent to a number of CV questions; the two are statistically equivalent, but they are implemented differently. Thus, the preference of one design valuation or multiple CV questions depends on the practicality and the cognitive burden posed on the respondent.

Future research should measure the cognitive burden of each approach and respondent preferences for the two methods. Similar research could be expanded to compare design valuation to conjoint analysis. Essentially, we suggest that researchers measure preferences for stated preference instruments. If two methods elicit the same degree of information but one is answered more easily by respondents, that instrument should receive some preference.

Future studies should also measure the extent to which design valuation is subject to anchoring. It is well known that in double-bounded CV questions, individual values depend on the initial prices posed (Chien et al. 2005; Kato and Hidano 2007). Such biases would then be expected in design valuation as well. Yet, even single-bounded contingent valuation is subject to anchoring (Green et al. 1998), so conjoint analysis may be as well. More information on the presence of anchoring under these three alternative formats is desirable.

The attribute value estimates beg a number of questions. Attributes like ability to work well with others is valued highly, but what exactly does this mean? Does it imply ability to engage in stimulating conversations, general manners, or emotional intelligence as often studied by psychologists and others (Khalili 2012)? Similarly, although problem-solving abilities are highly valued, what type of problems are employers thinking of when they complete the DV questionnaire? Finally, when employers indicate they value “high character,” what percent of college graduates do they perceive have such high character? If academic advising is to make full use of the values estimated in this paper, these questions would should be further addressed.

The attributes evaluated in this paper varied at only two levels, perhaps oversimplifying respondents’ comparison task. Representation of many of these attributes, especially the intangible attributes in Attribute List B, as all or nothing qualities may make the task for employer respondents difficult. When making hiring decisions, they would be accustomed to evaluating these attributes over a continuum of possibilities. Further research should evaluate these attributes at additional levels.

For many hiring decisions, the choice employers face might be finding the best-fitting candidate at a predetermined salary. Or perhaps employers have some flexibility in the range of salaries they can offer but must remain within the range regardless of the candidate’s qualifications. It is unknown within our pool of respondents how many of them would face such a decision. This limitation of our research is reflected in our DV method, which assumes that employer respondents have flexibility in the salaries they can offer. Although this limitation may reduce the applicability of specific value estimates, the results still provide clear evidence of the importance of the attributes relative to one another and relative to employer type.

Because the survey that collected the data for this study was conducted in 2006, it is reasonable to expect that some employer preferences may have changed. The extended amount of time between data collection and the publishing of these results is also a noted limitation of this study.

8. Conclusions

Despite these limitations, the study provides useful information for advisors and students alike, particularly regarding the importance (magnitude of value estimates) of attributes to employers that prefer to hire from specific types of colleges. Employers that prefer to hire graduates of agricultural colleges put the highest value on ability to work well with others, excellent communication skills, and a high degree of character. As compared with employers that prefer to hire graduates of other types of colleges, they put the least value on problem-solving ability. This finding does not necessarily indicate that graduates with this attribute would be better suited for majors outside of agriculture, but rather it demonstrates that employers that prefer to hire from agricultural colleges place less importance on this attribute than employers that prefer to hire from other colleges. Employers that prefer to hire from agricultural colleges. Place the highest value on number-crunching ability. This finding demonstrates the relative importance of this attribute for students who intend to seek employment from such employers. This information, along with this study's other estimated values for recent college graduate attributes, allow students to better align their own goals with development of specific skills and attributes to increase their marketability and return on education investment on entering the job market. This information also benefits college advisors. Comparing attribute value estimates by employer classification type demonstrates heterogeneity among the employer types. As students graduate and seek employment, they must market themselves according to their talents, skills, experience, and abilities. Students are not always successful at initially finding a job. Knowing that firms are heterogeneous in their valuation of attributes supports advisors' advice to students that finding a job may require finding the employer that best values the student's specific skills and attributes. Additionally, intangible attributes are found to consistently be among the highest valued attributes among all employer types. As past research has shown, these types of attributes are best evaluated through a job interview (Briggeman et al. 2007), and our findings provide support for the importance of interviewing well in order to highlight possession of these intangible attributes.

Appendix

In conjoint or stated choice experiments, the independence-among-attributes assumption can be relaxed. Similarly, within design valuation we could easily modify equation 6 to allow for correlation between attributes to be estimated. The data could be "stacked" to estimate an equation as:

$$\boldsymbol{V_{ji}^{*}} = \sum_{j=1}^{J} \boldsymbol{X_{ij}}(\boldsymbol{\beta_{0j}} + \boldsymbol{\beta_{1j} Buscollege_i} + \boldsymbol{\beta_{2j} Engcollege_i} + \boldsymbol{\beta_{3j} Othercollege_i} + \boldsymbol{\varepsilon_{ji}}) \quad (8)$$

where $\boldsymbol{X_{ij}}$ equals 1 if the observation concerns attribute $\boldsymbol{j}$ and 0 otherwise and all other variables are as previously defined in equation 6. This equation would give the same estimates as those in Table 2. The equation could then be modified such that the parameters $\boldsymbol{\beta_{0j}}$ are random and correlated, allowing us to estimate the correlation between attributes 1 and 2 by the correlation between $\boldsymbol{\beta_{01}}$ and $\boldsymbol{\beta_{02}}$. Interaction terms could be added to the equation to allow the value of $\boldsymbol{\beta_{0j}}$ to rise or fall when the respondent happens to purchase one of the other attributes. For example, $\boldsymbol{\beta_{01}}$ could be specified as $\boldsymbol{\beta_{01}} = \widetilde{\boldsymbol{\beta_{01}}} + \widetilde{\boldsymbol{\alpha_{01}}}\boldsymbol{Z_{i2}}$, where $\boldsymbol{Z_{i2}}$ equals 1 if the individual purchased attribute 2 in the question and 0 otherwise. Because we were concentrating mostly on the mean values for the attributes, and values across different employer types, we did not include such techniques in the current study. Future research using DV techniques may benefit from further exploration of the method demonstrated above.

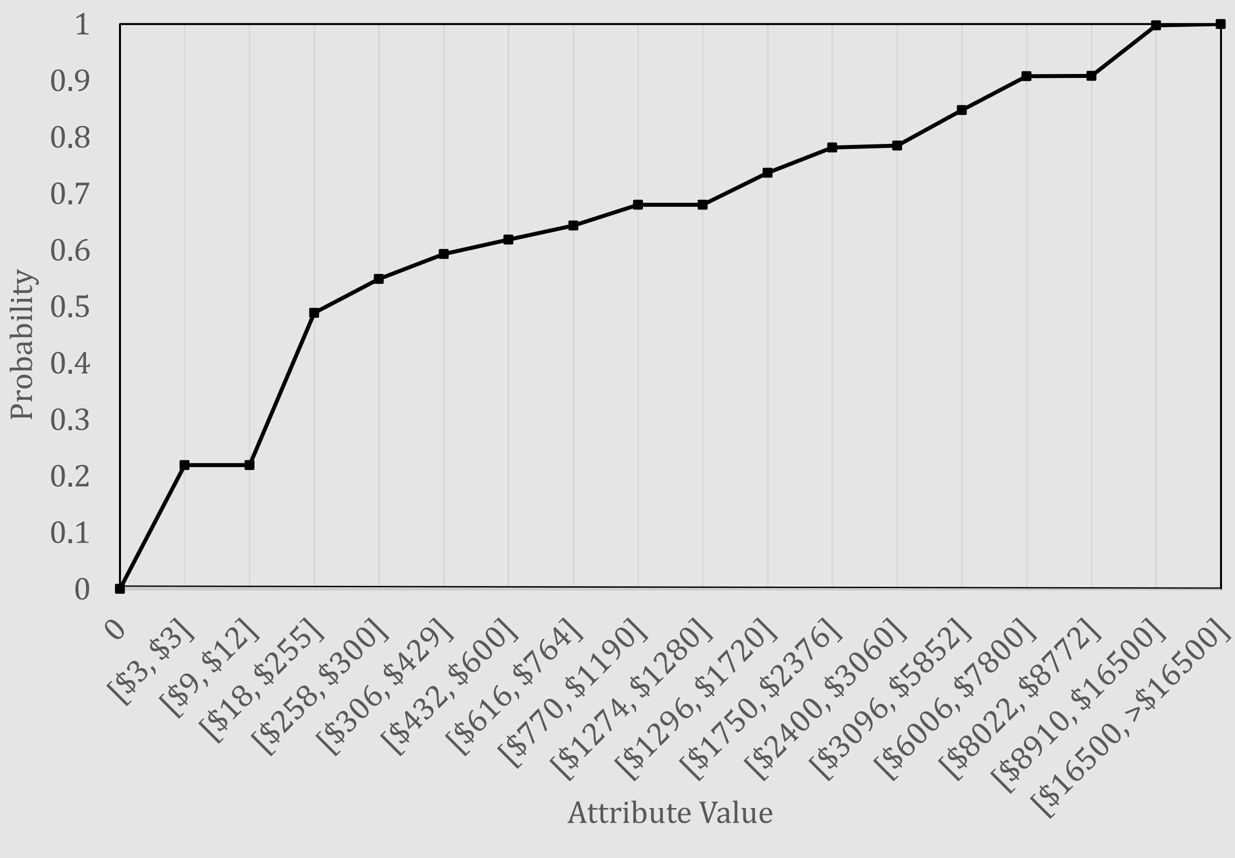

Figure A1. CDF Mean Value of Language Skills

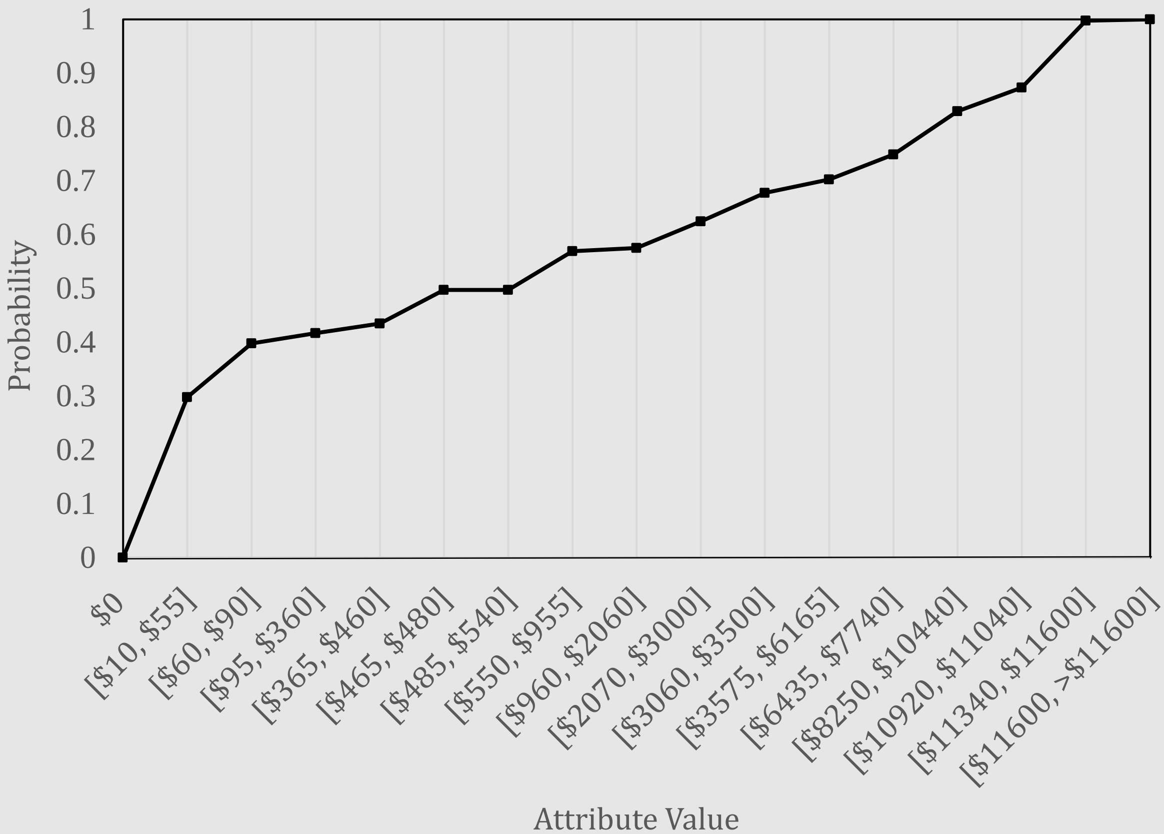

Figure A2. CDF Mean Value of Number-Crunching Ability

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Research Article

Outstanding Seniors: Where Have All the Young Men Gone?

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JEL Codes: A22, Q10
Keywords: Gender Gap, Outstanding Seniors, Undergraduate Education

Abstract
The gender gap reversal in higher education, first noted in the early 1980s, has evolved into an educational policy issue due to its persistence. We explore the gender gap among outstanding graduating seniors within a college of agriculture and life sciences. Our investigation found a predominance of female outstanding seniors in the college, including in STEM-like, male-dominated academic majors. We attribute this significant gender gap to national behavioral trends (e.g., male disadvantages in non-cognitive skills) and to organizational changes within the college.

> *Do we in higher education care about the gender imbalance? So far, the answer is probably not.*
>
> (Mortensen 1999, 16)
>
> *The rise of women, however long overdue, does not require the fall of men.*
>
> (Sommers 2013a)

1 Introduction

Historically, a gender gap reflected the perceived or actual advantage men had over women in education, compensation, politics, business, academia, and leadership throughout society. The traditional gender gap has long been the subject of domestic and international analysis, policy prescriptions, and policy interventions. In the United States, feminism, along with a change in societal attitudes, has played a key role in reversing the gender gap by "leveling the playing field" for women through policy and program initiatives. In the case of higher education, efforts to recruit, mentor, recognize, and graduate young women continue to be a core academic value. These efforts have garnered significant organizational time and resources, especially in STEM majors (Kanny et al. 2014; White 1970).

The data on college enrollments and undergraduate graduation rates reveal that women persist, prosper, and perform in higher education to a greater extent than men. In fact, the "historical" gender gap reversed many years ago. Nationally, nearly 60 percent of undergraduate degrees now awarded go to women, a percentage that has remained remarkably stable for nearly four decades (Klevan et al. 2016). This disparity is easily overlooked because of the continued dominance of men in positions of political and economic power in our society (Autor and Wasserman 2013). Yet the current impact of this long-run educational reversal reveals itself in the increasing representation of women in the health fields, government, academia, media, entertainment, and business (Blau et al. 2013). Even previously male-dominated occupations may be becoming predominately female (Pan 2015).

Some analysts view the gender gap reversal positively, suggesting that society gains when men become more like women and women control more levers of power (Valian 1999). Other analysts consider it a "crisis," a "national scandal," or a "war" against young men that has important social implications (Sommers 2013b; Farrell and Gray 2018). They contend that the failure of young men to realize their abilities academically, socially, and relationally has an adverse impact on family formation and sustainability, children, social stability (e.g., crime), and economic productivity. As noted by Owens

(2016, 252), "Men's educational attainment predicts their long-term health and well-being, and their well-being in turn affects that of their children and families."

Over the last 10 years, the professional literature in economics, sociology, and education has devoted significant attention to the gender gap in higher education. With this research note we intend to go beyond graduation rates as the variable of interest to explore the outstanding senior gender gap, if it exists, among students who are recognized for outstanding performance by departments and colleges. We are unaware of any similar research at the departmental or college level. Students recognized by their departments and a college of agriculture and life sciences is our target. Our objectives are to (1) analyze the outstanding senior data for the 2004 to 2017 academic years at the college and departmental levels and (2) pool our experience to reflect on possible causal factors, both structurally and behaviorally, that may have led undergraduate men to underperform in a college of agriculture.

2 Explaining the Gender Gap Reversal in Higher Education

The gender gap reversal is a global phenomenon. Since the 1940s, both men and women have increased their enrollment in post-secondary education; however, the rate of increase of female enrollment has surpassed that of men, irrespective of ethnicity or socioeconomic status, in almost all OECD countries (Buchman and DiPrete 2006; Goldin et al. 2006). Becker et al. (2010) expanded this research to 120 countries and found that the boom in higher education worldwide is largely due to women. In a majority of the countries studied, women have now surpassed men in university performance. In the case of the United States, several reversals of the gender gap have occurred over the last century (Ball 2012). During the first three decades of the 20th century, men and women were attending colleges and universities at nearly the same rate. But over the next two decades, due to the Great Depression and World War II, the male-to-female enrollment ratio in higher education was 2.3. Following WWII, women began to "catch up" in enrollment and graduation rates, reaching parity in the early 1980s, and now they surpass men in these rates (DiPrete and Buchman 2013).

The relatively lower enrollment, persistence, and performance of men in higher education produce a complex puzzle of causal and predictive factors. Explanations range from empirically based analyses that conclude that men are less socially and academically integrated in college experiences (Ewert 2012) to popular, opinion essays arguing that the increasing presence of women in higher education creates an unwelcoming and high-cost learning environment for men that can be bypassed for a successful career in manufacturing, the military, protective services, construction, and technology (Niemi 2018). We attempt to summarize the findings and conclusions of a sample of the empirically based, large-scale national studies with specific attention to causal factors with statistical significance.

2.1 Lower Net Benefits

The social benefit-cost ratio for an undergraduate education generally is assumed to be significantly greater than one and, therefore, an undergraduate degree is worthy of public support and encouragement. A private benefit-cost ratio guides an individual's schooling decision and behavior. Under this benefit-cost framework, Becker et al. (2010) discovered that private benefits of higher education accrue equally to men and women on a global scale, *ceteris paribus*. Traditional costs (e.g., tuition, room and board, fees) also are equal. What are not equal are the non-traditional costs that the authors label as non-monetary psychic costs. These costs are lower for women than for men; hence, net benefits attributed to a university degree are lower for men than for women. Goldin et al. (2006) found similar results for college students in the United States.

Why are non-monetary psychic costs lower for female college students than for male college students? Some analysts point to the "non-cognitive skills" or "soft skills" of women. Self-motivation, class attendance, ability to pay attention in class, time management, exam preparation, collaboration, and appropriate behavior in the college environment are easier for women. Females, it is argued, worked harder in high school to earn higher grades, learned a foreign language, became outstanding readers, and improved their science and math skills while young men did not. Therefore, participation in the academic life of a university represents greater adjustment and effort costs for males, affecting their rates of enrollment, persistence, and graduation. Females more easily navigate university life because of their higher non-cognitive abilities (Conger and Long 2010). Borghan et al. (2006) even provide evidence that points to a female advantage in "people skills" that, in some cases, can lead to a people skills premium in wages.

The net benefit of earning a college degree, often referred to as the college premium, is higher for women than for men (Jacobs 2002; Forling et al. 2015). However, a higher college premium for women does not imply that earnings for college graduates are the same for men and women. Young female graduates face discrimination and bias in hiring on their graduation (Quadlin 2018) and a persistent wage gap once they participate in the workforce (Blau and Kahn 2017). These disadvantages exist at all education levels, widen with age, and extend across the professions. Putting this challenge into context, Carnevale et al. (2018) suggest that women plan to earn an advanced degree so they will earn equivalent earnings to a man with an undergraduate degree.

This "need" to go to graduate school became widespread beginning in 1990. As early as 8th grade, girls may begin planning to attend graduate school in order to meet their career goals, be more competitive in the job market, and bridge the salary gap beyond graduation (Almås et al. 2016; Jensen 2010). Jacobs (2002) found that 80 percent of the gender gap in higher education is explained by more developed non-cognitive skills and higher college premiums for women as they pursue graduate degrees. As a result, women invest more time and money in their schooling than their male peers because their superior academic performance at the undergraduate level is a necessary condition for acceptance into graduate school. In contrast, boys focus on traditional male occupations (e.g., engineering, architecture, military service) that do not often require advanced degrees. Women use advanced higher education as their principal strategy for achieving economic parity (Carnevale et al. 2018).

2.2 Less Social Capital

The strength and breadth of key human relationships, observed as social capital, explains a significant part of the gender differences in college enrollment decisions. Combs et al. (2010) and Klevan et al. (2016) find that young men and women benefit equally from their mutually beneficial relationships but that women have more of these relationships, which they consciously cultivate. This literature identified social capital with peer-to-peer, parent-to-child, parent-to-parent, and student-to-teacher relationships. Female students are more likely to work on academics with their friends, whereas male students focus on non-school activities (e.g., video games). Family structure matters (see below) to college enrollment. The data appear to indicate that parents may have different expectations for boys and girls with respect to college attendance. Researchers have found that students with parent-to-parent social capital (i.e., students with parents who have relationships with other parents of students) are seven times less likely to drop out. Finally, young girls are closer than boys to their teachers; these relationships are academically oriented and benefit young women in their preparation for college. So, as they enter college, young women are more likely to become more socially and academically integrated into the university community (Combs et al. 2010; Klevan et al. 2016).

2.3 Lack of Male Mentorship

The breakdown of the two-parent family over the last 40 years emerges in the gender gap literature as an important explanatory variable. Male role models are extremely important for a boy's development. Birth outside of marriage, a mother working full time outside the home, or an absent father can turn a young man to unproductive, non-school activities for support and encouragement (Jacobs 2002; Buchmann and DiPrete 2006; Autor and Wasserman 2013). Participation in organized sports fills the need for male mentorship, but only a small percentage of young men participate in athletic activities at either the high school or college (e.g., intramurals, intercollegiate) levels (Ewert 2012).

2.4 Slower Adjustment to a Changing Environment

Young men, on average, have struggled to adjust to a service-producing economy (Mortensen 1999) and to increased urbanization, which heavily relies on communication, cooperation, and social networking—skills that young women, on average, tend to have in greater abundance than their male peers and that are often developed in high school. Mortensen notes that a UCLA survey of college freshman found that college females are more likely to spend their time reading, doing homework, participating in student groups, and doing volunteer work while their male counterparts are exercising, partying, watching television, and playing video games.

Kahn et al. (2011) argue that higher education, as viewed by young men, places too much emphasis on "feminine" activities (e.g., reading, writing, analysis, oral discussion, and debate) while actively downplaying masculine goals of physical work, self-reliance, and competition (i.e., winning). Masculine norms often are challenged in higher education, and many young men are uncomfortable with, or even rebel against, self-evaluation activities. As a result, young men in this "new" environment begin to disengage from their traditional academic, economic, civic, and family roles.

2.5 An Uninviting K–12 Learning Environment

Finally, Mortensen (1999) argues that our primary and secondary schools have failed to create a learning environment that recognizes the needs and learning styles of boys. Owens (2016) argues that a boy's behavioral problems in kindergarten are a good predictor of the gender gap in education by the age of 26. Young boys have more difficulty self-regulating, paying attention, and demonstrating social competence and as a result, they are more likely to be disciplinary challenges in school. Whereas girls find school environments compatible with who they are, boys do not perceive these environments as welcoming, intellectually stimulating, and socially rewarding. Owens concludes his analysis with the frequently stated claim that many school environments fail to encourage the academic and social success of boys.

But why? Across the board, researchers note that boys have few male role models in school. Three-quarters of the teachers in the K–12 educational system are female and as one researcher observes, these "teachers treat boys different from girls" (Owens 2016). Boys disengage from school as the result of excessive, in their minds, disciplinary actions. In addition, boys often find a lack of cognitive stimulation in the classroom, leading to boredom. Research shows that boys' motivation to learn also is more negatively impacted than girls' motivation by family instability and a father's absence. The female advantage in the school system is so pervasive that schools have become more "feminized" because teachers and administrators promote and reward qualities that are more common to female students than to male students (Tyre 2009).

3 Outstanding Graduating Seniors: A Case Study

University academic units commonly recognize their outstanding graduating senior annually or at each graduation when there is more than one commencement ceremony in the calendar year. Each unit determines its own selection criteria that often include the student's GPA and extra-curricular activities. The criteria may also include gender, race, age, and family obstacles overcome.

We employ a revelatory case study with an embedded single-case design to analyze the gender ratio of outstanding seniors in the College of Agriculture and Life Sciences at the University of Arizona (CALS/UA) (Yin 2009). With the college and departments as units of analysis, we utilize the archival records of the college's Office of Career and Academic Services (CAS) for the names of outstanding seniors at the college and departmental levels over the study period: fall semester 2004 to spring semester 2018. CAS staff validated all gender- and outstanding senior-related data. The authors directly observed the outstanding senior recognitions over the study period. We test the hypothesis that the gender ratio of outstanding seniors in the college and departments reflect their enrollment by gender. The case study concludes with our heuristic analysis of the data (Patton 2015).

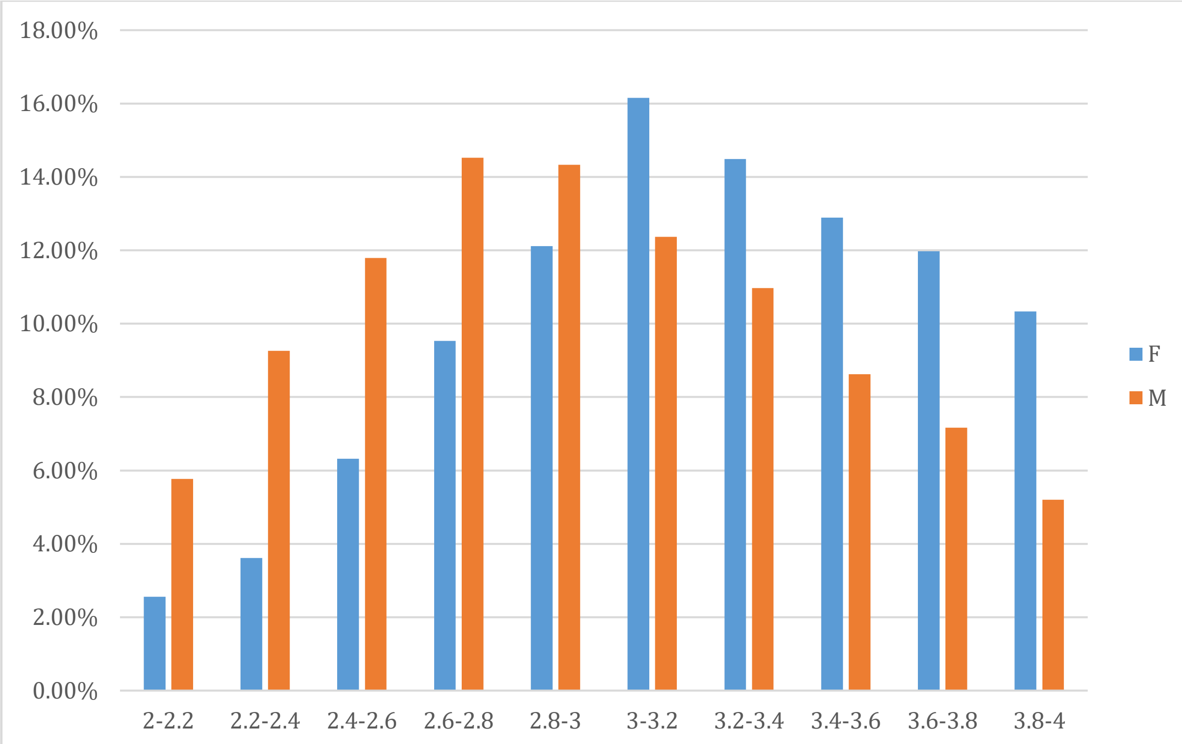

Figure 1. GPA frequency distribution by gender, 2004–2017

CALS/UA represents a wide range of academic majors, from STEM-like fields in physical, biological, and social sciences to agricultural education. Schools of Renewable Natural Resources, Family and Consumer Sciences, and Plant Sciences are within CALS/UA's organizational structure. CALS/UA had 10 academic units that offered 15 undergraduate majors between the 2004–2005 and the 2017–2018 academic years. During this study period, undergraduate enrollments in individual academic units ranged from less than 30 to more than 700, totaling between 2,500 and 3,300 students each academic year. During this period, women graduated with an average GPA of 3.2 compared with 3.0 for men (Figure 1). The female GPA distribution reflected lower GPAs from a higher mean, whereas the male GPA distribution reflected higher GPAs from a lower mean.

CALS/UA recognizes its Outstanding Graduating Senior at graduation ceremonies in December and May. The CALS/UA Outstanding Graduating Senior is selected from the from the academic departments' nominees for the CALS/UA recognition. All outstanding seniors from the departments are recognized at a luncheon at the end of the fall and spring semesters; the Outstanding Graduating Senior for the college is recognized at the December and May graduation ceremonies. The selection criteria for the CALS/UA award are presented in Table 1. In light of the previous discussion, it is noteworthy that 50 percent of the evaluation weight is given to GPA and extra-curricular activities. Individual departments generally follow these same criteria in selecting their outstanding senior, although they may place more weight on GPA than on other criteria. In some semesters, a department may not select or nominate an outstanding graduating senior. The CALS/UA data set represents academic department nominations for the CALS/UA Outstanding Graduating Senior recognition.

Table 1. Selection Criteria for Outstanding Graduating Senior, College of Agriculture and Life Sciences, University of Arizona

I. Mission Statement with Goals (15 points)
Career, academic, and personal goals (300 words maximum)

II. Academic Program (25 points)
Cumulative GPA, University of Arizona only (attach current Advisement Report)
Write an analysis of your academic program, placing emphasis on specific educational endeavors, goals, etc. that also include any internship and/or independent study experiences that have enhanced your academics. (200 words maximum)

III. University, College, Departmental Activities (25 points)

Activity	Dates	Hours Per Semester

IV. Community Activities (15 points)

Activity	Dates	Hours Per Semester

V. Work Experience (15 points)
Career and non-career related

VI. Recognition, Scholarships, Awards, Honors (5 points)
College of Agriculture and Life Sciences related
University of Arizona related
Other

4 Results

Undergraduate CALS/UA enrollment ranged from 2,500 to 3,300 students during the study period. On average, women made up 70 percent of the student body per year. Even when female-dominant majors like nutritional sciences and family and consumer sciences are removed from the data set, female students accounted for a greater percentage of the CALS/UA student body than the average student body of U.S. colleges and universities.

The gender gap is even greater among outstanding graduating seniors at CALS/UA. During the study period, women made up 80 percent of these seniors, a higher percentage than would be expected with a 30/70 enrollment split. This consistent female dominance, at least in part, can be explained by the non-GPA evaluation criteria presented in Table 1. Female students participate to a greater degree than men in on-campus, extra-curricular activities. Even when a male student has a high GPA, he is not competitive with a female student who has a comparable GPA and who has volunteered for college activities and events while providing leadership in departmental, college, or university clubs or organizations.

Figure 2 captures the dominance of women in outstanding senior recognition across all departments in CALS/UA during the 2004–2017 academic years. In any given year, 59 percent to 87 percent of the outstanding seniors selected by units in the college were women. Although significant variability exists across academic years, the gender gap in departmental outstanding seniors exceeded the college's 30/70 enrollment split in the early years of the study period. Since 2013, that gap has mirrored the enrollment split.

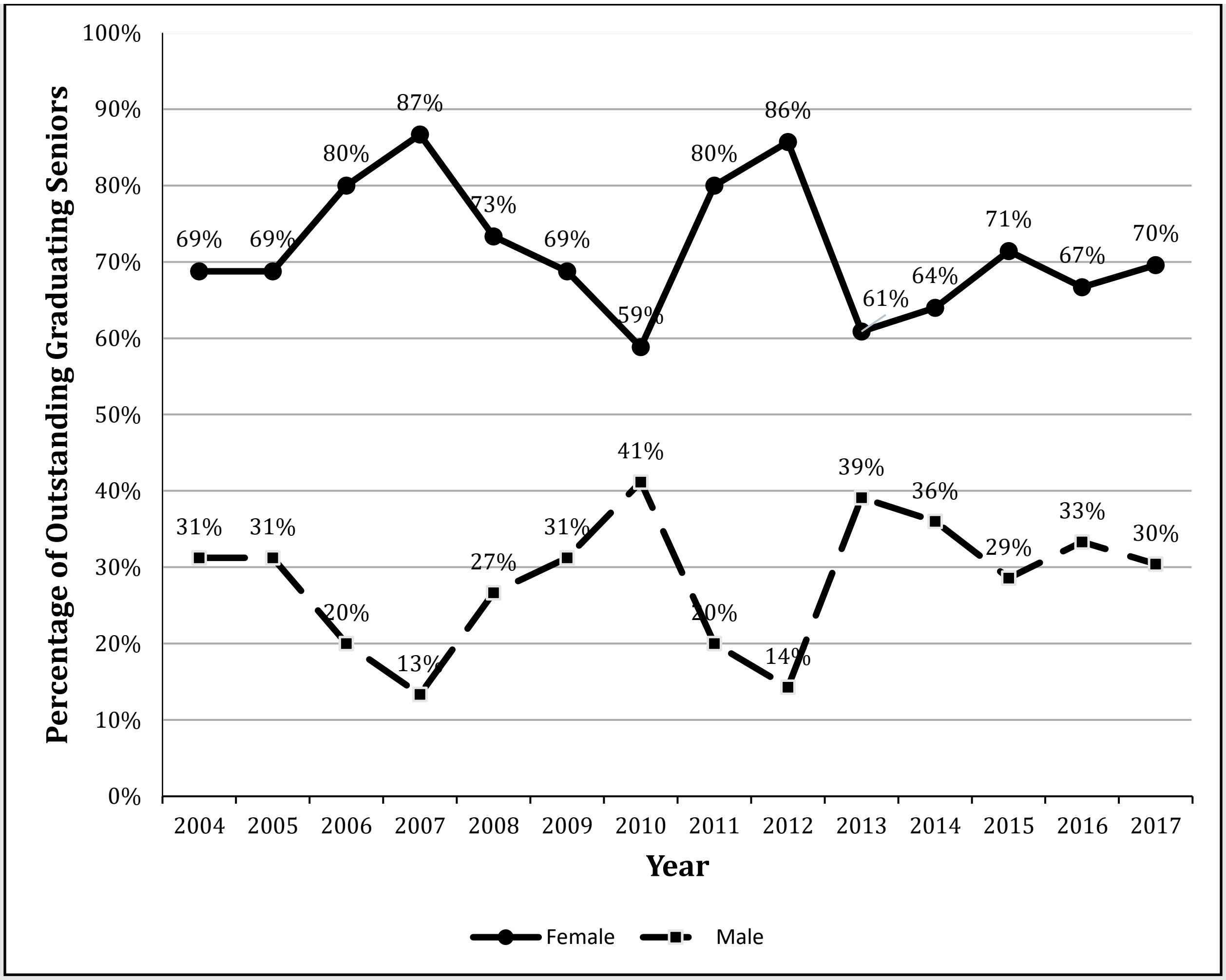

Figure 2. Percentage of outstanding graduating seniors by gender, 2004–2017

Department-level gender gaps are more interesting when each academic unit's gifted seniors are analyzed (Figure 3). In 9 of the 10 departments, the average male outstanding seniors percentage was lower than the average male enrollment percentage. That difference was more than 10 percent in seven departments. As a result, the gender of the outstanding seniors does not reflect the department's undergraduate enrollment during the study period. For example, the Agricultural and Resource Economics Department has an enrollment of 71 percent male and 29 percent female undergraduates. However, the department's outstanding seniors were 47 percent male and 53 percent female. Similar "flipping" occurs in Agricultural Education, Agricultural Engineering, Animal Sciences, School of Natural Resources, and Soil, Water, and Environmental Sciences units. Several of these units offer STEM majors in which outstanding female students are consistently performing at a higher level than their outstanding male peers.

5 An Exploratory Discussion from Inside a College of Agriculture

This case study's descriptive data show a college of agriculture's outstanding senior gender gap but do not point to causality. The following heuristic analysis is based on the university-level teaching, academic advising, club sponsorship, and mentoring experience of two generations of authors—senior (male) and junior (female) faculty—who propose some possible explanations for the persistent gender gap in outstanding seniors. We complement these explanations with our reflections, which are based on our personal experience with the outstanding senior selection process at the departmental and college levels, discussions with students, and conversations with staff.

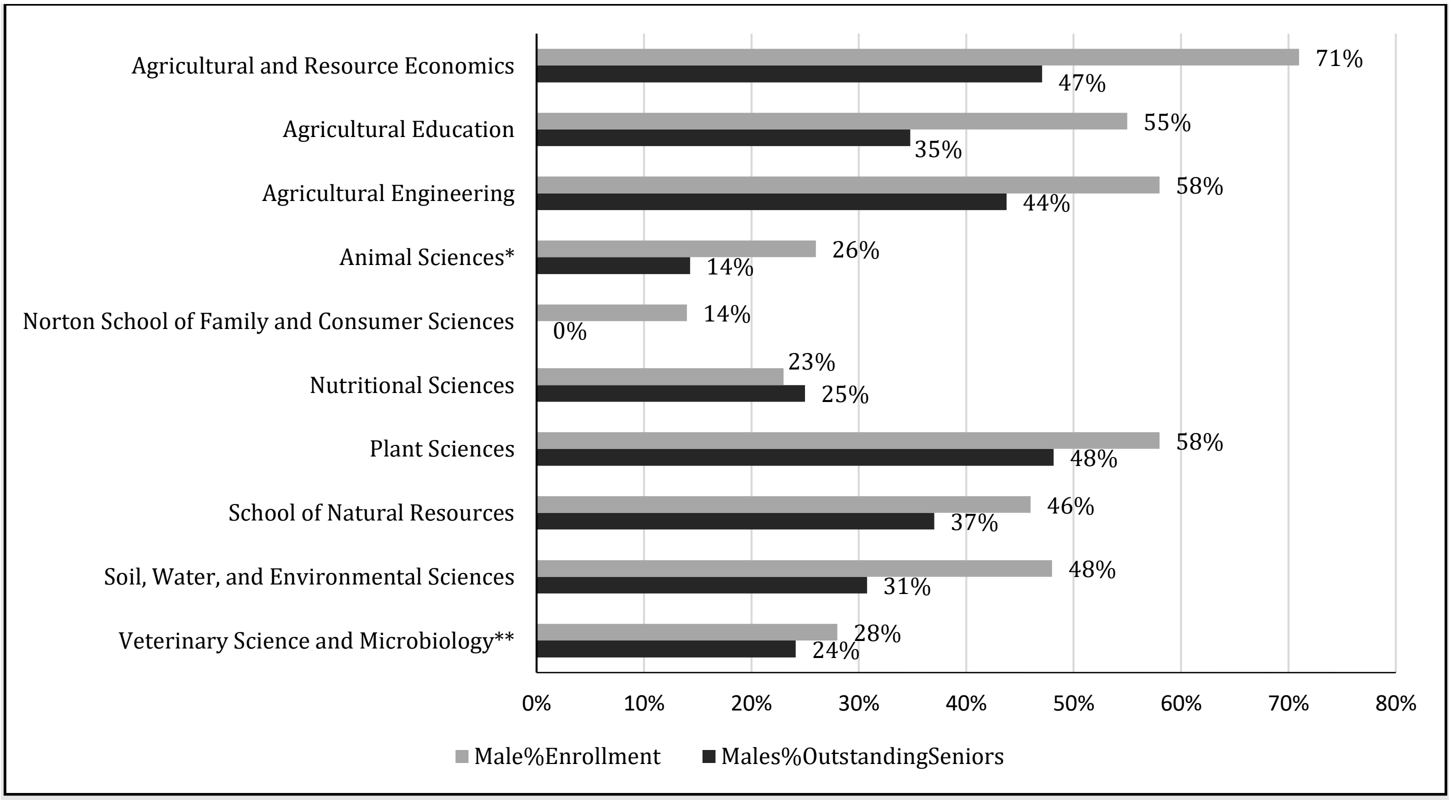

Figure 3. Male enrollment and male outstanding graduating seniors by academic unit, 2004–2017
* Includes Animal Sciences (2004–2017) and Animal and Comparative Biomedical Sciences (ACBS) (2013–2017).
** Data for 2004–2012. Department was combined with Animal Sciences in 2013 to form the ACBS school within CALS/UA.

5.1 Structural Issues

Several structural issues may deter the development of male outstanding seniors.

A Female-Dominated Environment. With female enrollments at the university and college levels of 60 percent and 70 percent, respectively, male undergraduates are in a more female-dominated academic environment than they experienced in K–12 grades. Many have failed to adjust to this new reality. In addition, academic advising is now almost solely the responsibility of female staff. Fifteen years ago, universities began to slowly professionalize academic advising, shifting the responsibility away from faculty and hiring full-time, mostly female, academic advisors. For example, 92 percent of academic advisors in this college are women. Moreover, because female faculty are more likely than male faculty to volunteer to be club advisors and mentors of students, male undergraduates may only interact with a male faculty or staff member in the formal classroom setting several times a week (Strada-Gallup 2018).

STEM Departments Promote Women. Departments are regularly encouraged to promote diversity and inclusion in their units and, historically, that has implied encouraging promising female students in their majors. University administrators track the level of diversity in colleges and departments, monitoring progress toward the university's diversity goals. However, given our data, at least for outstanding senior recognition, greater attention should be directed toward women *and* men.

Incompatible Learning Environments. As noted earlier, men prefer hands-on, real-world learning activities rather the passive, largely abstract lecture format employed in most college classrooms. Efforts are being made to promote participatory learning strategies in the classroom, but do these strategies actually improve male students' performance? Group learning and teaching environments place significant demands on the average male undergraduate's existing and potential social-capital formulation skill.

5.2. Behavioral Issues

Analysis of data sets at the university level shows that many of the causes of the gender gap in higher education are behavioral and that they are well established by the time students graduate from high school. We complement this quantitative analysis with a qualitative analysis built on face-to-face interactions with students. The following reflections represent our understanding of the behavioral challenges facing many young men in a college of agriculture.

Not Masculine. Somewhat surprisingly, some male students express the attitude that being educated is not masculine. Therefore, beginning in their freshman year, they appear to optimize their social life preference function subject to a minimum investment in school activities. Graduation, not outstanding performance, is the goal.

Video Games and the Internet. Discussions with faculty, staff, and other student program personnel suggests that many male undergraduates spend up to five hours a day online, doing potentially unconstructive activities like viewing pornography or playing video games. A campus recruiter asked one graduating senior how he spent his non-classroom time. His forthright response, “I play video games,” is not atypical.

Terminal Degree. Incoming male undergraduates are often overconfident in their academic abilities and are unconcerned about finding a good-paying job with benefits on graduation. Some may already have post-graduation job offers not dependent on their academic performance. Sadly, many of these students, after being in the workforce for three years, want to apply for graduate programs with a 2.2 GPA. Male undergraduates, from their freshman year, do not have a long-term view of the value of the educational opportunity presented to them.

Non-Academic Social Capital. Young men, in the university environment, develop valuable social capital, but not in a manner that would allow them to compete for outstanding senior recognition (Table 1). Beneficial social capital, both in the short and long run, is developed and maintained by male undergraduates in fraternities, sports (including sport video games), partying with friends, and just hanging out, or in summer and off-campus employment. The value of on-campus social capital building, either in or out of class, is not viewed as a productive use of their time.

6 Where Do We Go from Here?

Action in four areas will bring the outstanding senior gender gap more in line with college and department enrollments.

First, both male and female faculty should regain a role in undergraduate advising. Over the last 20 years, faculty have been removed from student advising under the assumptions that (1) most faculty do not want to advise undergraduates, (2) when they do advise students they do a poor job, and (3) their time is better spent on grant writing and research. Full-time academic advisors were hired and the student advising system kept faculty from frequent, in-office interaction with students. Those faculty who continued to advise clubs, spend long hours with students, and encourage students to participate in extracurricular activities received little professional reward other than the admiration of their colleagues. The advising system should value the engagement of faculty in student affairs. As one faculty member noted, “My most effective teaching about the major, potential careers and life choices occurred in academic advising sessions.”

Second, universities and colleges need to recognize that the quality of the educational experience is often based on on-campus relationships between students and faculty. The once-important educational role of clubs, small specialized classes, and field trips have fallen on hard times with budget cuts, an emphasis on larger classes, and the lack of professional incentive to organize outside-of-class activities. Yet it is in these active learning spaces that young men find motivation for their major and their career and develop social capital with students who are different from them.

Third, faculty need to increase competition and game playing in their classrooms and labs. Resources exist to design collaboratively competitive environments, but they normally make up a small part of didactic strategy. All faculty need support, including release time, to energize their courses with appropriate learning environments for young men without alienating women.

Finally, to overcome male students' perception that higher education is "boring," faculty must go beyond abstract storytelling to the use of cases, examples, scenarios, and data sets that are current, local, intriguing, and relevant to the topic at hand. Faculty should not underestimate the ability of students to grasp the problem statement, methodological approach, data needs, and results of most research projects when this work is presented in an engaging manner. And they should begin sharing their exciting work with freshman. Doing so may motivate more young men to actively engage in their education and to attain recognition as outstanding seniors at the conclusion of their undergraduate studies.

7 Conclusion

A well-known concern associated with case study research is the reduced opportunity for statistical generalization. However, a case study design is ideal for analytical generalization when theories are expanded. The goal of this paper is to extend the established gender gap literature in higher education to highlight the outstanding senior gender gap at the college and departmental levels. We challenge our colleagues to explore this issue on their campuses or with a national panel data set of departments/colleges in order to statistically test the hypothesis that men are underperforming, relative to their enrollment levels, when it comes to being recognized for overall excellence. Gender disparities may or may not exist in some departments and colleges. We expect that geographic location (e.g., Midwest versus East Coast), urban location (e.g., large city with a university versus a college town), and size of the university (e.g., large research university versus small teaching-centric university) could produce results that differ from those reported in this paper. However, based on our conversations with colleagues from other universities and colleges, we are not dissuaded from raising the gender gap as a valid educational issue. In addition, we are struck by how few faculty members understand the process for selecting outstanding seniors in their departments and colleges and by how few professors know who these exceptional undergraduate students have been.

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Teaching and Educational Methods

Teaching Competition Topics: Applications of Seller Market Power in Agricultural Industries

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JEL Codes: L11, L22, Q11, Q13
Keywords: Agricultural marketing, competition, peanut industry, potato industry, seller market power

Abstract
The article presents a simple theoretical framework that can be used to explain conduct and performance of agricultural industries and seller market power in these industries. The framework components include a linear inverse demand function, a constant marginal cost function, and a set of measures of costs, revenue, and profit. The theoretical framework is consistent with agricultural supply and price cycle, and the decision-making process of agricultural producers. The theoretical framework is used to develop applications for the U.S. peanut and potato industries represented by two problem sets provided in the teaching note, which also includes four sets of assessment questions. The article discusses implementation and practical applications of the proposed teaching activity. The target audience includes students taking undergraduate courses in agricultural economics and agribusiness programs as well as extension and outreach audiences.

1 Introduction

Structural changes taking place in agricultural and food industries and changes in the regulatory environment affecting marketing and pricing of agricultural and food products reveal the importance of understanding competition processes in the modern food supply chains.[1] This highlights the need for teaching competition topics in a variety of undergraduate courses in agribusiness and agricultural economics programs.

A review of the relevant textbooks indicates that competition topics are typically considered to be elements of "markets and prices." Kohls and Uhl (2002) in their "Marketing of Agricultural Products" offer a thorough descriptive introduction of competition in agricultural and food industries. Hudson (2007) in "Agricultural Markets and Prices," Norwood and Lusk (2008) in "Agricultural Marketing and Price Analysis," and Tomek and Kaiser (2014) in "Agricultural Product Prices" introduce traditional economic models of seller market power (monopoly and oligopoly) and buyer market power (monopsony and oligopsony). These economic models are similar to the ones included in classic textbooks in the areas of microeconomics (Varian 1996) and industrial organization (Carlton and Perloff 2005) recommended for undergraduate courses in economics departments and business schools.

A discussion of applications of these traditional economic models in agribusiness systems, especially in agricultural industries, which can be used as examples in undergraduate teaching, is limited. At the same time, there are many examples of the presence of competition problems in national and global

[1] Simply defined, competition is a business conduct. The examples of structural changes include increasing consolidation and concentration at all stages of the food supply chain and increasing presence of firms with seller and/or buyer market power (U.S. Department of Justice, Antitrust Division, and U.S. Department of Agriculture 2010; Organisation for Economic Co-operation and Development [OECD] 2014). The examples of changes in the regulatory environment include decreasing effects of domestic government programs affecting agricultural marketing and pricing, as well as increasing effects of international trade policies (Food and Agriculture Organization [FAO] 2003, 2015; Greenville 2017).

industries comprising modern food supply chains (U.S. Department of Justice, Antitrust Division, and U.S. Department of Agriculture 2010; OECD 2014).

The first objective of this article is to present a simple theoretical framework that can be used to explain conduct and performance of agricultural industries and seller market power in agricultural industries and agribusiness. The framework components include a linear inverse demand function, a constant marginal cost function and a set of measures of costs, revenue, and profit. The key decision (strategic) variables are product quantity and product price. The second objective is to present applications of this framework in the U.S. peanut and potato industries. The target audience includes students taking undergraduate courses in agricultural economics and agribusiness programs as well as extension and outreach audiences.

The article is organized as follows. Section 2 presents the theoretical framework, which is used to develop a generic problem set and two problem sets illustrating applications in the U.S. peanut and potato industries. Section 3 provides a background of the U.S. peanut and potato industries. Section 4 discusses factors affecting agricultural product quantity produced and marketed by agricultural industries. Section 5 discusses collective agricultural marketing and relevant antitrust issues. Section 6 explains data necessary to develop applications for other agricultural industries. Section 7 discusses implementation, assessment, and practical applications of the proposed teaching activity. A separate teaching note includes three problem sets, four sets of assessment questions, and a summary of the background concepts and definitions required to effectively learn the proposed lecture topic.

2 Theoretical Framework

This section discusses the theoretical framework, agricultural supply and price cycle, and decision-making process of agricultural producers; and provides a summary of teaching materials.

2.1 Theoretical Framework

A simple theoretical framework explaining conduct and performance of agricultural industries and seller market power in these industries focuses on product (output) price-quantity relationships and industry profitability. The theoretical framework components include a linear inverse demand function (a price-dependent demand function), a constant marginal cost function (a cost assumption), and a set of measures of costs, revenue, and profit.[2]

A brief description of the framework is as follows. Three typical market scenarios that agricultural industries can experience are introduced: a product over-supply scenario, a perfectly competitive industry scenario, and a seller market power scenario. They differ due to the total product quantity produced and marketed, product price, and industry profit. These market scenarios can be thought of as different production and marketing seasons (or different years).

All firms (agricultural producers) comprising the industry make individual production decisions, which affect the total product quantity produced. This quantity determines market price.[3] The product quantity, price, and costs determine industry profit. Seller market power is the industry ability to decrease product quantity, which would increase product price and would increase industry profit. The framework is explained in two stages by using a graphical approach (Appendix: Figures 1 and 2) and an analytical approach (Problem Set #1 included in the teaching note).

At the first stage, the focus is on explaining the product price-quantity relationship by using an inverse demand function (Appendix: Figure 1). Product quantity (Q) determines product price (P), or product price is a function of its quantity. The relationship between product price and its quantity can be

[2] A discussion of this framework and its applications in the U.S. dairy and potato industries is presented in Bolotova (2016). A comprehensive discussion of a more complex version of this framework, as applied to the U.S. cotton industry, is presented in Moore (1919).

[3] While individually agricultural producers are price takers, the total product quantity produced by all of them (this is the total industry quantity) determines market price. Market price is a function of quantity. So, the industry is a price maker.

interpreted using two alternative approaches: (a) an increase in product quantity causes price to decrease, or (b) a decrease in product quantity causes price to increase.

To introduce seller market power, two market scenarios differing due to product quantity and price are presented. Scenario A "a larger quantity and a lower price" and Scenario B "a smaller quantity and a higher price." Seller market power is the industry ability to decrease product quantity produced and/or marketed, which would cause product price to increase: moving from Scenario A to Scenario B. The results are interpreted using the perspectives of sellers and buyers. Producers (sellers) sell a smaller product quantity and receive a higher price. Buyers have access to a smaller product quantity and pay a higher price.

At the second stage, a constant marginal cost function (MC) is introduced.[4] Having inverse demand and marginal cost allows for the evaluation of industry profitability in a set of typical market scenarios, which differ due to product quantity, price, and industry profit (Appendix: Figure 2).[5] The industry profit is measured using a price-cost margin (PCM) expressed in $ per unit (P-MC). Table 1 summarizes three typical market scenarios for agricultural industries: a perfectly competitive industry scenario, a product over-supply scenario, and a seller market power scenario.[6]

Seller market power is the industry ability to decrease product quantity produced and/or marketed, which would cause product price and industry profit to increase. This corresponds to the industry moving from the over-supply scenario (Scenario O) to a perfectly competitive industry scenario (Scenario C) and possibly to a seller market power scenario (Scenario M). The results are interpreted using the perspectives of sellers and buyers. If producers (sellers) sell a smaller product quantity, they would receive a higher

Table 1. Three Typical Market Scenarios for Agricultural Industries: Perfect Competition, Over-Supply, and Seller Market Power

Market scenario	Price and quantity depicted in Figure 2 in the Appendix	Comparison of prices and quantities between scenarios	Profit
A perfectly competitive industry scenario	Scenario C Qpc and Ppc[a]	Ppc = MC	PCMpc = Ppc – MC = 0; Zero profit for the industry and firms
A product over-supply scenario	Scenario O Qo and Po	Qo > Qpc Po < Ppc Po < MC	PCMo = Po – MC < 0; Loss for the industry and firms
A seller market power scenario	Scenario M Qm and Pm	Qm < Qpc Pm > Ppc Pm > MC	PCMm = Pm – MC > 0; Profit for the industry and firms

[a] Q, P, MC, and PCM are quantity, price, marginal cost, and price-cost margin, respectively. Subscripts "pc", "o," and "m" are used to denote a perfectly competitive industry scenario, a product over-supply scenario, and a seller market power scenario, respectively.

[4] A constant marginal cost is assumed to develop a cost assumption for agricultural industry applications.
[5] It is assumed for simplicity that product price-quantity relationship (demand) and marginal cost do not change across the analyzed market scenarios.
[6] A seller market power scenario is related to a standard monopoly (or oligopoly) model explained in microeconomics textbooks. Marginal revenue for monopoly is not introduced for a simplicity purpose. However, a hypothetical monopoly scenario can be developed as an additional scenario. Assuming a linear inverse demand function $P = a - bQ$, a marginal revenue function for monopoly is $MRm = a - 2bQ$. The profit-maximizing quantity produced by monopoly is 50 percent smaller than the profit-maximizing quantity produced by a perfectly competitive industry (assuming the same demand and supply conditions). While

price and would earn a higher profit. At the same time, buyers would have access to a smaller product quantity and would pay a higher price.[7]

A classic interpretation of seller market power is the one based on the Lerner Index of market power (a percentage price-cost margin). The Lerner Index is equal to $\frac{P-MC}{P}$. Seller market power is the ability of a large firm (or a group of large firms) to increase product price (P) above marginal cost (MC; or above a perfectly competitive price). Increasing product price would require decreasing product quantity. The Lerner Index falls in the range of 0 to 1 (or 0 to 100 percent). In perfectly competitive industries, product price is equal to marginal cost, and the Lerner Index is equal to zero. In industries with seller market power, product price is greater than marginal cost, and the Lerner Index is positive.

The degree of industry seller market power depends on the number of firms operating in the industry, their size relative to the overall industry size, and the own price elasticity of demand. Industries with a smaller number of firms have greater seller market power than industries with a larger number of firms. Industries with less elastic demand have greater seller market power than industries with more elastic demand.[8] The own price elasticity of demand is affected by the availability of products-substitutes.

The theoretical framework (in the manner it is presented in this article) has a few limitations, which are mostly due to its simplicity. The first limitation is that it is assumed that product quantity produced each year determines market price. In reality, product quantity available for domestic consumption (market) and various demand factors determine market price. Product quantity produced constitutes the largest share in the total product quantity available for domestic consumption.[9] In addition, various demand factors affect market prices. For example, the availability of products and substitutes, changes in prices of related products, changes in consumer income, and changes in consumer preferences affect market prices.

The second limitation is the assumption that marginal cost does not change across the three market scenarios presented. In reality, marginal cost might increase or decrease, which would represent a shift of the original marginal cost curve and would cause changes in product quantity produced, market price, and industry profit.[10] This will impact the classification of a particular market scenario as product over-supply, perfect competition, or seller market power.

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agricultural industries are not likely to exercise monopoly (or oligopoly) market power, agricultural industries can exercise a small degree of seller market power. This is the reason why a generalized version of the seller market power scenario is used, without explicitly introducing monopoly or oligopoly.

[7] Note that while buyers might benefit from a product over-supply scenario (a larger product quantity available at a lower price), this scenario is detrimental for producers.

[8] For a monopoly: $Lerner\ \ Index = -\frac{1}{\varepsilon_{Q,P}}$. For an oligopoly (assuming the firms are the same size): $Lerner\ \ Index = -\frac{1}{N\varepsilon_{Q,P}}$. $\varepsilon_{Q,P} = \frac{dQ}{dP} \times \frac{P}{Q}$ is the own price elasticity of demand, which indicates a percentage increase (decrease) in product quantity demanded following a 1-percent decrease (increase) in product price. N is the number of firms. A discussion of the Lerner Index of market power is presented in microeconomics and industrial organization textbooks (for example, see Carlton and Perloff 2005).

[9] Product quantity available for domestic consumption during each year is equal to product stock at the beginning of the year plus product quantity produced during this year plus imported quantity minus exported quantity minus stock at the end of the year.

[10] For example, an increase in agricultural input prices (variable inputs: fertilizers, agricultural chemicals, feed, gasoline, seeds, etc.) would cause an upward shift in the marginal cost curve, causing agricultural industries to decrease product quantity, thus increasing product price to try to maintain the same level of profitability. Some agricultural input markets are concentrated, where agricultural input suppliers have seller market power, which causes agricultural input prices to increase over time. In addition, some agricultural commodities used as agricultural inputs (for example, grains used as feed) are characterized by high price volatility, which contributes to increases or decreases in marginal cost over time. A discussion of the theoretical framework in a scenario of a marginal cost shift, as applied to the U.S. broiler and pork industries, is presented in Bolotova (2019).

Depending on the course where this lecture topic is taught (a junior or senior level) and the background knowledge students have, the extensions of the theoretical framework can be developed by introducing shifts in a marginal cost curve and/or an inverse demand curve.

2.2 Agricultural Supply and Price Cycle, and Decision Making by Agricultural Producers

The introduced market scenarios (product over-supply, perfect competition, and seller market power) reflect agricultural supply and price cycle and decision-making processes of agricultural producers.[11] Agricultural producers expand their production (increase product quantity) in response to higher prices, and they contract their production (decrease product quantity) in response to lower prices. These production decisions are based on the previous year prices and profit. If the previous year price received by agricultural producers was relatively high, then during the current year they would increase product quantity produced anticipating a higher price. A simultaneous increase in the total product quantity produced by all agricultural producers would cause the current year price to decrease. In response, during the next year, agricultural producers would decrease product quantity produced anticipating a lower price. A simultaneous decrease in the total product quantity produced by all agricultural producers would cause the next year price to increase.

A year (a single production and marketing season) characterized by a large product quantity produced and a low price might be an example of a product over-supply scenario. A year characterized by a small product quantity produced and a high price might be an example of a seller market power scenario. Given that agricultural industries are characterized by a high level of agricultural supply and price volatility, a decrease in product quantity as a result of natural factors from one year to another year might lead to a higher price received by agricultural producers. An increase in product quantity as a result of natural factors from one year to another year might lead to a lower price received by agricultural producers. For example, bad weather conditions or disease outbreaks might decrease crop yield per acre, which would decrease total crop quantity produced leading to a higher crop price. On the other hand, good weather conditions might increase crop yield per acre, which would increase total crop quantity produced leading to a lower crop price. These examples consider agricultural environmental factors affecting product quantity, which are out of the agricultural producers' control.

Collective marketing activities of agricultural producers are used to purposely affect agricultural product quantity produced and marketed and/or agricultural product prices. Collective agricultural marketing might increase seller market power of agricultural producers leading to higher agricultural product prices and profits. Factors affecting agricultural product quantity produced and marketed are summarized in Section 4, and collective agricultural marketing is discussed in Section 5 of this article. The information presented in these two sections can be used to develop simple examples than can facilitate effective explanation and learning of the theoretical framework.

2.3 Teaching Materials: Summary

The theoretical framework was used to develop a generic problem set (Problem Set #1 included in the teaching note), two problem sets representing applications in the U.S. peanut and potato industries (Problem Sets #2 and #3 included in the teaching note), and four sets of assessment questions (Assessment Questions Sets #1–#4 included in the teaching note). The sets of assessment questions include additional

[11] A discussion of agricultural supply and price cycle and decision-making processes of agricultural producers is presented in Kohls and Uhl (2002). The cobweb model is often used to explain agricultural supply and price cycle in light of the decision-making process of agricultural producers. This model assumes that agricultural producers have adaptive expectations about prices. Agricultural producers use past prices to form expectations about future prices, while making decisions on product quantity to produce.

applications developed for the U.S. peanut and potato industries and applications developed for the U.S. corn and dairy industries.

The background information used to complete the problem sets and assessment questions includes inverse demand function, product quantities corresponding to three market scenarios, and assumption on marginal cost. A logical sequence of steps (questions) is as follows:

(a) calculating market prices for the three market scenarios by using the inverse demand function and product quantities;
(b) calculating industry profit (a price-cost margin expressed in $ per unit and as a percentage of market price) by using the calculated prices and marginal cost;
(c) classifying each market scenario as product over-supply, perfect competition, or seller market power;
(d) calculating the industry total costs, revenue, and profit in the analyzed market scenarios; and
(e) calculating the industry break-even quantity and price (i.e., a perfectly competitive industry quantity and price).

3 U.S. Peanut and Potato Industries

This section provides a background on the U.S. peanut and potato industries, which can be used to facilitate effective explanation and learning of the industry applications. The industry background includes a brief discussion of products and production regions, a discussion of changes in product quantities and prices over several recent years, and a brief introduction of the recent industry events, which affected product quantities and prices.

3.1 U.S. Peanut Industry

Peanut production is concentrated in the South: the Southeast (Alabama, Arkansas, Florida, Georgia, Mississippi, and South Carolina), the Southwest (New Mexico, Oklahoma, and Texas), and Virginia and North Carolina. There were 6,561 farms growing peanuts in the U.S. in 2012, an increase from 6,182 farms in 2007 (U.S. Department of Agriculture, National Agricultural Statistics Service 2012).

Georgia is the leading peanut producer in the country. In 2017 Georgia produced 3.57 billion pounds of peanuts, representing 50 percent of national peanut production (7.12 billion pounds; U.S. Department of Agriculture, National Agricultural Statistics Service 2019). Texas and Alabama produced 0.70 billion pounds each in 2017, representing approximately 20 percent of national peanut production.

Peanuts are planted in the spring (April/May) and are harvested in the fall (September/October). Four types of peanuts produced include the Runner, Spanish, Virginia, and Valencia. Peanuts may be consumed in fresh form, but typically are consumed as processed products. The latter include peanut butter, roasted peanuts (snacks), peanut oil, and peanut flour. Peanuts are also used to produce biodiesel.[12]

Table 2 summarizes yearly data on area planted, area harvested, yield, production, and price for the U.S peanut industry for the period of 2000–2016.[13] The area harvested is typically smaller than the area planted.[14] The area harvested multiplied by yield per acre is equal to total peanut quantity produced ("peanut production" in Table 2). This quantity affects peanut price. Figure 1 is a simple logical representation of the relationship among all these variables in light of the peanut production and marketing seasons.

[12] A peanut profile is available on Agricultural Marketing Resource Center's (2018a) webpage.

[13] Peanut price and quantity are depicted in Figure 3 in the Appendix. Peanut price and quantity for the most recent years were used to estimate (using a regression analysis technique) a linear inverse demand function for the U.S. peanut industry used in the peanut industry problem set (additional details can be found in Bolotova 2018a).

[14] The area harvested may be smaller than the area planted due to crop failure (because of weather, insects, and diseases), lack of labor, low market prices, or other factors (U.S. Department of Agriculture Economic Research Service 2019b).

The data presented in Table 2 reveals the following market scenarios reflecting agricultural production and price cycle and decision-making process of peanut growers.[15] The first market scenario is that an increase in peanut production in the current year, as compared with the previous year, leads to a decrease in peanut price received by peanut growers in the current year, as compared with the previous year (2001, 2004, 2005, 2012, 2014, and 2015). The second market scenario is that a decrease in peanut production in the current year, as compared with the previous year, leads to an increase in peanut price received by peanut growers in the current year, as compared with the previous year (2006, 2011, and 2016).

The peanut industry is characterized by a high level of production and price volatility, which reflects changes in peanut production and price over time. For example, as compared with 2010, in 2011 peanut area planted decreased by 11 percent, area harvested decreased by 14 percent, and yield increased by 2 percent. As a result, peanut production decreased by 12 percent, and peanut price increased by 41 percent. As compared with 2011, in 2012 peanut area planted increased by 44 percent, area harvested increased by 48 percent, and yield increased by 24 percent. As a result, peanut production increased by 85 percent, and peanut price decreased by 5 percent.

Table 2. U.S. Peanut Industry: Acres Planted, Acres Harvested, Yield, Production, and Price (2000–2016)

Year	Peanut acres planted	Peanut acres harvested	Peanut yield	Peanut production	Peanut price[a]
	thousand	thousand	pounds/acre	billion pounds	$/pound
2000	1,537	1,336	2,444	3.27	0.274
2001	1,541	1,412	3,029	4.28	0.234
2002	1,353	1,292	2,571	3.32	0.182
2003	1,344	1,312	3,159	4.14	0.193
2004	1,430	1,394	3,076	4.29	0.189
2005	1,657	1,629	2,989	4.87	0.173
2006	1,243	1,210	2,863	3.46	0.177
2007	1,230	1,195	3,073	3.67	0.205
2008	1,534	1,507	3,426	5.16	0.230
2009	1,116	1,079	3,421	3.69	0.217
2010	1,288	1,255	3,312	4.16	0.225
2011	1,141	1,081	3,386	3.66	0.318
2012	1,638	1,604	4,211	6.75	0.301
2013	1,067	1,043	4,001	4.17	0.249
2014	1,354	1,323	3,923	5.19	0.220
2015	1,625	1,561	3,845	6.00	0.193
2016	1,671	1,536	3,634	5.58	0.197

[a] Peanut price is a survey-based price reported by the U.S. Department of Agriculture, National Agricultural Statistics Service (USDA NASS Quick Stats database 2019). This is the price received by peanut growers (i.e., the price paid by the first-level handlers/buyers of peanuts).
Data Source: USDA NASS Quick Stats database (2019).

[15] These patterns of peanut quantity and price changes are consistent with an inverse demand framework. The decisions of peanut growers on peanut area to plant each year are affected by the expected peanut prices and profit and by the expected prices and profit of alternative (competing) crops grown in rotations with peanuts. These alternative crops commonly include corn and cotton.

April/May				**September/October**	
PLANTING				HARVEST	Time →
	Production Season Ag producers grow crop			*Marketing* Season Ag producers market (sell) crops	
Area Planted	**Yield** * per acre	**Area** harvested	**=Quantity** produced	will determine **Market Price** and **Prices received** by individual ag producers	

Figure 1. Peanut and Potato Production and Marketing Seasons: Quantity Produced and Price

Beginning in the 1930s and through 2002, Federal government programs affected the peanut industry production and marketing.[16] In particular, peanut marketing quotas (a form of supply management) affected the quantity of peanuts produced each year. The peanut marketing quota system was a form of price support program, which included two loan rates and limited the quantity of peanuts produced for domestic market for food uses ("quota peanuts"), which were eligible for the higher level of the two loan rates. The U.S. Department of Agriculture established a peanut marketing quota level on an annual basis based on projected demand for peanuts. The rights to sell "quota peanuts" were allocated to quota owners, who farmed or leased these quotas. Peanuts produced in excess of the marketing quota ("additional peanuts") had to be exported or diverted to lower value uses and were eligible for a lower loan rate.

In 2002, the peanut industry was deregulated through the implementation of a marketing quota buyout program. Peanut growers became eligible for marketing assistance loans that were previously only available to growers of selected field crops (corn, cotton, soybeans, wheat, etc.). These changes in the regulatory environment and a shift toward a market-oriented environment affected production, marketing, and pricing decisions of peanut growers. A high degree of peanut production and price volatility observed since 2002 might reflect the effects of industry deregulation.

3.2 U.S. Potato Industry

While potatoes are grown in many states, the Pacific Northwest is the leading potato production region. In 2017, Idaho and Washington produced 135 thousand hundredweights (cwt)[17] and 99 thousand cwt of potatoes, respectively, representing 30.5 percent and 22.4 percent of national potato production (442 million cwt). Wisconsin and North Dakota produced 6.4 percent and 5.5 percent, respectively, and Colorado and Oregon each produced 4.8 percent of national potato production (U.S. Department of Agriculture, National Agricultural Statistics Service 2018). There were 21,079 farms growing potatoes in the United States in 2012, an increase from 15,014 farms in 2007 (U.S. Department of Agriculture, National Agricultural Statistics Service 2012).

Depending on the harvesting season, potatoes are classified as fall, winter, spring, and summer potatoes. The majority of potatoes produced in the United States are fall potatoes (91 percent of total potato production in 2017). Fall potatoes are planted in the spring (April/May) and are harvested in the fall (September/October). The most common potato types produced include Russets, Reds, Whites, and Yellows. Potatoes are consumed in fresh and processed forms. The latter include French fries and other frozen potato products, potato chips, canned products, etc. In 2017, 24 percent of all potatoes produced were sold as fresh potatoes, and 63 percent were used in processing.[18]

[16] The Federal programs affecting the U.S. peanut industry in the past, the changes in these programs, and the current programs are discussed in Jurenas (2002), Dohlman and Livezey (2005), Dohlman, Foreman, and Da Pra (2009), and Schnepf (2016).
[17] One hundredweight (cwt) is equal to 100 pounds.
[18] A potato profile is available on Agricultural Marketing Resource Center's (2018b) webpage.

Table 3 summarizes yearly data on area planted, area harvested, yield, production, and price for the U.S potato industry for the period of 2000–2016.[19] The area harvested is typically smaller than the area planted. The area harvested multiplied by yield per acre is equal to total potato quantity produced ("potato production" in Table 3). This quantity affects potato price. Figure 1 is a simple logical representation of the relationship among all these variables in light of the potato production and marketing seasons.

The data presented in Table 3 reveals the following market scenarios reflecting agricultural production and price cycle and the decision-making process of potato growers.[20] The first market scenario is that an increase in potato production in the current year, as compared with the previous year, leads to a decrease in potato price received by potato growers in the current year, as compared with the previous year (2002, 2009, 2012, and 2014). The second market scenario is that a decrease in potato production in the current year, as compared with the previous year, leads to an increase in potato price received by potato growers in the current year, as compared with the previous year (2001, 2005, 2008, 2010, 2013, and 2016). A general trend was for the potato area planted to decrease and yield to increase. Potato production decreased and stabilized during the most recent years, and potato price increased.

Table 3. U.S. Potato Industry: Acres Planted, Acres Harvested, Yield, Production, and Price (2000–2016)

Year	Potato acres planted	Potato acres harvested	Potato yield	Potato production	Potato price[a]
	thousand	thousand	cwt/acre	million cwt	$/cwt
2000	1,383	1,348	381	514	5.08
2001	1,247	1,221	358	438	6.99
2002	1,300	1,266	362	458	6.67
2003	1,274	1,250	367	458	5.88
2004	1,192	1,166	391	456	5.65
2005	1,108	1,086	390	424	7.04
2006	1,139	1,120	393	441	7.31
2007	1,142	1,122	396	445	7.51
2008	1,060	1,047	396	415	9.09
2009	1,071	1,044	414	433	8.25
2010	1,027	1,009	401	405	9.20
2011	1,101	1,079	399	430	9.41
2012	1,155	1,139	408	465	8.63
2013	1,074	1,051	414	435	9.75
2014	1,076	1,051	421	442	8.88
2015	1,083	1,054	418	441	8.76
2016	1,057	1,008	437	441	8.90

[a] Potato price is a survey-based price reported by the U.S. Department of Agriculture, National Agricultural Statistics Service (USDA NASS Quick Stats database 2019). This is the price received by potato growers (i.e., the price paid by the first-level handlers/buyers of potatoes).
Data Source: USDA NASS Quick Stats database (2019).

[19] Potato price and quantity are depicted in Figure 4 in the Appendix. Potato price and quantity for the most recent years were used to estimate (using a regression analysis technique) a linear inverse demand function for the U.S. potato industry used in the potato industry problem set (additional details can be found in Bolotova 2017).

[20] These patterns of potato quantity and price changes are consistent with an inverse demand framework. The decisions of potato growers on the potato area to plant each year are affected by the expected potato prices and profit and by the expected prices and profit of alternative (competing) crops grown in rotation with potatoes. In the case of commercially grown potatoes, these alternative crops commonly include wheat, corn, and barley.

The potato industry is characterized by some degree of production and price volatility. For example, as compared with 2011, in 2012, potato area planted increased by 5 percent, area harvested increased by 6 percent, and yield increased by 2 percent. As a result, potato production increased by 8 percent, and potato price decreased by 8 percent. As compared with 2012, in 2013 potato area planted decreased by 7 percent, area harvested decreased by 8 percent, and yield increased by 2 percent. As a result, potato production decreased by 7 percent, and potato price increased by 13 percent.

At the beginning of the 2000s, a high level of potato supply and price volatility led to an over-supply of potatoes, which adversely affected the profitability of potato growers. In 2005, potato growers organized a marketing cooperative, the United Potato Growers of America, and a number of regional cooperatives, which developed and implemented a potato supply management program. It included a potato acreage management program and a potato flow control program. The potato acreage management program (2005–2010) affected the area of potatoes planted each year. In particular, the objective was to decrease the area planted to decrease potato quantity produced in order to eliminate the potato surplus, which was expected to increase potato prices received by growers. This program was also expected to reduce the potato supply and price volatility. A decrease in potato area planted and potato quantity produced, as well as an increase in the potato price over time might reflect the effects of the potato supply management program.

The potato acreage management program raised legal concerns. Buyers of potatoes filed antitrust lawsuits claiming that a decrease in potato quantity produced led to higher potato prices paid by potato buyers (i.e., the industry was engaged in price-fixing). Buyers of potatoes argued that implementation of the potato acreage management program was a violation of Section 1 of the Sherman Antitrust Act (1890).[21]

4 Factors Affecting Agricultural Product Quantity Produced and Marketed

Given that agricultural industries include many agricultural producers making individual production decisions, it is important to take into consideration factors that might affect agricultural product quantity produced and marketed each year by all agricultural producers comprising the analyzed industry. This quantity would eventually affect market price, prices received by agricultural producers and their profitability. Factors affecting agricultural product quantity produced and marketed are summarized in Table 4.

5 Collective Agricultural Marketing and Antitrust Issues

The Capper-Volstead Act (1922) allows agricultural producers to form organizations to market their products collectively (i.e., to engage in collective agricultural marketing). Section 1 of the Capper-Volstead Act defines in a very broad manner the scope of collective agricultural marketing activities.

"Persons engaged in the production of agricultural products as farmers, planters, ranchmen, dairymen, nut or fruit growers may act together in associations, . . . in collectively processing, preparing for market, handling, and marketing in interstate and foreign commerce, such products of persons so engaged. Such associations may have marketing agencies in common; and such associations and their members may make the necessary contracts and agreements to effect such purposes" (Capper-Volstead Act [1922] 7 U.S.C. §291).

The Capper-Volstead Act is a limited antitrust exemption from the Sherman Act (1890). Section 1 of the Capper-Volstead Act allows agricultural producers to act together in a cartel-like manner to collectively market their products. By acting collectively through properly organized organizations,[22] agricultural producers might gain seller market power they would not have had by acting individually. This type of

[21] The potato supply management program and its market and price effects are discussed in Bolotova et al. (2010), Guenthner (2012), and Bolotova (2014, 2015, and 2016). Legal issues associated with implementation of the potato acreage management program are discussed in Bolotova (2015).

[22] To be an exempt organization, it must conform to the requirements established in Section 1 of the Capper-Volstead Act.

Table 4. Factors Affecting Agricultural Product Quantity Produced and Marketed

Factor	Affected economic variables
Field Crops, Fruits, and Vegetables	
Production decisions of agricultural producers: the area to plant	Total product quantity
Production decisions of agricultural producers: product varieties to plant	Yield per acre and total product quantity
Crop rotations, prices, and profits of alternative crops	Area to plant and total product quantity
Agricultural production management practices implemented by agricultural producers	Yield per acre and total product quantity
Weather conditions and disease outbreaks	Yield per acre, area harvested (as compared with area planted) and total product quantity
Livestock, Dairy, and Poultry	
Production decisions of agricultural producers: the herd size (the number of heads)	Total product quantity
Production decisions of agricultural producers: livestock breeds to raise	Yield per head and total product quantity
Agricultural production management practices implemented by agricultural producers	Yield per head and total product quantity
Weather conditions	Yield per head and total product quantity
Disease outbreaks	Yield per head, slaughter rates, and total product quantity
All industries	
Marketing programs of the organizations of agricultural producers (marketing cooperatives)	Product quantities and/or market prices
Government programs directly and indirectly affecting agricultural product quantities and/or prices: Federal and State Marketing Orders and Agreements[a]; Marketing Assistance Loans[b]	Product quantities and/or market prices
International trade policies	Product quantity available for domestic market and market prices

[a] Federal and State Marketing Orders and Agreements are government programs for fruits, vegetables, and specialty crops; milk and dairy products. A description of these programs is available on the webpage of the U.S. Department of Agriculture, Agricultural Marketing Service (2019).
[b] Marketing Assistance Loans are the Federal government programs for selected field crops (wheat, corn, cotton, soybeans, rice, peanuts, etc.), selected pulse crops (dry peas, lentils, chickpeas, etc.), honey, mohair and wool. A description of these programs is available on the webpage of the U.S. Department of Agriculture, Farm Service Agency (2019).

business conduct is generally prohibited by Section 1 of the Sherman Act, which considers agreements among competitors potentially affecting product prices and/or quantities to be illegal. Agricultural producers are competitors, and by being members of their marketing organizations they make agreements, which may affect product quantities produced and marketed and/or market prices.

Table 5. Examples of Agricultural Supply Management Programs: U.S. Potato, Dairy, and Egg Industries

Industry	Cooperative	Supply management programs
Potato industry	United Potato Growers of America (UPGA): Members include several regional cooperatives representing potato growers in major potato growing regions[a]	*Potato acreage management program* affected potato area planted *Potato flow control program* affected the flow of already produced potatoes to the market
Dairy industry	Cooperatives Working Together (CWT): Members include approximately 30 cooperatives and many individual dairy farmers; dairy farmers-members produce the majority of national milk quantity[b]	*Herd retirement program* affected the size of the national dairy herd (the number of cows) *Export assistance program* affects (facilitates) export of manufactured dairy products
Egg industry	United Egg Producers (UEP): Members represent approximately 95 percent of U.S. egg production[c]	*Supply control and United Egg Producers Certified Program* affected the total number of hens, the number of hens per cage, the total egg quantity produced, and the egg quantity exported

[a] United Potato Growers of America (2019).
[b] Cooperatives Working Together (2019).
[c] United Egg Producers Fact Sheet (2017).

The Capper-Volstead Act is interpreted on a case-by-case basis. There is a well-established case law informing that price-fixing by the organizations of agricultural producers is generally within the scope of the Capper-Volstead Act immunity. During recent decades, the organizations of agricultural producers in the U.S. potato, egg, and dairy industries implemented supply management (control) programs, which affected the quantity of agricultural products produced, marketed, and available for domestic consumption (Table 5).[23] There is no well-established case law interpreting the legal status of agricultural supply management programs in light of the Capper-Volstead Act.

Agricultural supply management activities may be classified as those implemented at the pre-production stage, production stage, and post-production stage.[24] The analysis of the most recent legal decisions and discussions may suggest the following. Agricultural supply management activities implemented at the post-production stage are likely to be within the scope of the Capper-Volstead Act immunity, as they tend to be consistent with the definition of "marketing" included in Section 1 of this act. Agricultural supply management activities implemented at the pre-production and production stages are likely to be outside the scope of the Capper-Volstead Act immunity.

[23] The dairy industry supply management program is discussed in Siebert and Lyford (2009), Brown et al. (2010), and Bolotova (2014, 2015). The potato industry supply management program is discussed in Guenthner (2012) and Bolotova (2014, 2015).

[24] Agricultural supply management activities aiming to decrease product quantity produced are also referred to as production restrictions or output control practices. Contemporary legal issues involving the interpretation of the legal status of agricultural supply management (control) practices in light of the Capper-Volstead Act are discussed in Varney (2010), Frackman and O'Rourke (2011), and Ondeck and Clair (2012).

6 Agricultural Industry Applications: Data

The data required to develop an industry-specific application include a linear inverse demand function and a cost assumption. The yearly production and price data for many agricultural commodities are available in the USDA National Agricultural Statistics Service Quick Stats database (U.S. Department of Agriculture, National Agricultural Statistics Service 2019). The quantity (production) variable is the total product quantity produced. The price variable is the product price received (a marketing year price). The quantity and price variables can be used to estimate a linear inverse demand function using linear regression. The assumption on marginal cost can be formulated using information presented in relevant enterprise (production) budgets. The USDA Economic Research Service maintains a large collection of commodity costs and returns estimates (U.S. Department of Agriculture, Economic Research Service 2019a). Land-grant universities maintain collections of the enterprise budgets for agricultural commodities produced in specific geographic regions.

The following issue (limitation) related to using cost estimates in developing industry applications should be mentioned. If the inverse demand functions are estimated using national data (the case of this article), the cost estimates for the national industries are used in the industry applications. In reality, agricultural production costs vary substantially across different geographic regions. The cost assumption affects the calculated product quantity, price and industry profit, and the classification of the analyzed market scenarios as product over-supply, perfect competition, or seller market power.

7 Implementation, Assessment, and Practical Applications

7.1 Lecture Topic Fit: Course Content and Curriculum

This lecture topic was taught in two undergraduate courses in the agribusiness program at Clemson University during several semesters. The material is explained generally as it is presented in this article and teaching note in a junior level “Economics of Agricultural Marketing” course taken by agribusiness major and minor students. A more advanced discussion of the same theoretical framework and a wider range of industry applications are presented in a senior level “Prices” course taken by the agribusiness major students. In the latter course, students are asked to download data (agricultural product quantities and agricultural product prices received by agricultural producers) from the USDA National Agricultural Statistics Service Quick Stats database and to use these data to estimate linear inverse demand functions by using linear regression. The estimated linear inverse demand functions are further used to evaluate alternative market scenarios differing due to product quantity and market price.[25] Also, a modified version of the inverse demand function is estimated by replacing the total quantity produced by two variables: area harvested and yield per acre.

This lecture topic may be suitable for “Agribusiness Management” (a section focusing on the economics for agribusiness managers) and for “Agricultural Economics” and “Applied Microeconomics” courses taught in agricultural economics and agribusiness undergraduate programs.

In addition, the theoretical framework and its industry applications can be used in extension and outreach activities to explain to agricultural producers the economics of conduct and performance of

[25] As an additional market scenario, a hypothetical monopoly scenario is introduced. First, a linear inverse demand function is used to derive a marginal revenue function for a hypothetical monopoly. Using a general version of a linear inverse demand function $P = a - bQ$, a marginal revenue function for monopoly is $MRm = a - 2bQ$ (note that marginal revenue is the derivative of the total revenue (TR) with respect to quantity (Q): $MRm = \frac{dTR}{dQ} = \frac{d(PQ)}{dQ} = \frac{d((a-bQ)Q)}{dQ} = a - 2bQ$). Second, the profit-maximization rule $MRm = MC$ is used to calculate the profit-maximizing product quantity to produce for the hypothetical monopoly. The inverse demand function and this quantity are used to calculate the hypothetical monopoly price.

agricultural industries and how their individual production and marketing decisions affect market prices, the industry revenue, and profit as well as their individual profit.[26]

7.2 Student Background Knowledge

This lecture topic requires some background knowledge. Students typically obtain this knowledge in an introductory microeconomics course or in an introductory agricultural economics course. The main background concepts include: (a) the firm's economic objective (profit-maximization) and the output quantity and price as key decision (strategic) variables affecting this objective; and (b) the profit-maximization rule for a perfectly competitive firm (industry): to maximize its profit, the firm (industry) produces the output quantity, at which output price is equal to marginal cost. A summary of the background concepts and definitions is included in the teaching note.

If in-class activities include estimation of the inverse demand functions (empirical demand and price analysis), then students are expected to be familiar with regression analysis. The inverse demand functions can be conveniently estimated using Excel.

7.3 Teaching Strategies

Two alternative teaching strategies are summarized in Table 6. They differ due to the number of classes allocated to this lecture topic: four classes in the case of teaching strategy #1 and two classes in the case of teaching strategy #2. Teaching strategies are discussed in a greater detail in the teaching note.

Table 6. Teaching Strategies

Class	Lecture topic	Teaching strategy #1: 4 classes	Teaching strategy #2: 2 classes
1	Introduction to competition: market structures and market power	+	
2	Theoretical framework	+	+
3	Agricultural industry applications	+	+
4	Collective agricultural marketing and antitrust issues	+	

7.4 Assessment Materials

The assessment materials used in a junior level "Economics of Agricultural Marketing" course included in-class assignments, quizzes, homework, and exams. The assessment materials used in a senior level "Prices" course included in-class assignments, quizzes, homework, research projects, and exams. Four sets of assessment questions that are used in in-class assignments, quizzes, and exams are included in the teaching note.

7.5 Challenges in Learning

The lecture topic discussed in this article was taught during several semesters to relatively large groups of undergraduate students (40 to 70 students in one class). The theoretical framework and its applications are generally easy to learn for many students. While the theoretical framework and its applications are mathematically simple, it is important that students think using the perspective (decision making) of an

[26] For examples of using this theoretical framework and/or its applications in extension and outreach settings see Pavlista and Feuz (2005), Bolotova and Jemmett (2010), Loy, Riekert, and Steinhagen (2011), and Bolotova (2018b).

individual agricultural producer and also using the perspective of the agricultural industry as a seller. There are a few challenges in learning that should be taken into consideration while teaching this material.

The first challenge might be in understanding a logical connection among all variables characterizing industry conduct and performance in light of the timeline of agricultural production and marketing seasons. For example, in the case of crops, area planted will affect area harvested during the harvesting season. Area harvested and yield per acre at the harvest will determine the total product quantity produced, which is the product quantity available to market. This quantity will affect market price during the following marketing season. Figure 1, data presented in Tables 2 and 3, and the industry background information may be used to overcome this challenge in learning.

The second challenge might be in understanding the effects of individual production decisions of agricultural producers made at the beginning of the production season on prices they will receive during the marketing season and eventually on their profit. Individual production decisions made by agricultural producers (i.e., the area to plant) affect the total product quantity produced by all of them. This total industry quantity will affect market price, which will affect prices received by individual agricultural producers and subsequently profit. While agricultural producers make individual production decisions, prices they receive will be affected by the total product quantity produced by all producers. Figure 1 may be used to overcome this challenge in learning.

7.6 Strengths

The main strength of the theoretical framework and industry applications presented in this article and teaching note is that they allow students to acquire a valuable working knowledge of the conduct and performance of agricultural industries in a simple and effective manner. An additional strength of the theoretical framework includes its connection to agricultural production and price cycle and to a real-world decision-making process facing agricultural producers. Finally, agricultural industry applications allow students to become familiar with the types of data available in the U.S. Department of Agriculture databases and how to use these data to perform agricultural industry analysis, which results could be valuable in the decision-making process of agricultural producers and their marketing organizations.

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Appendix: Supplementary Figures 1 to 4.

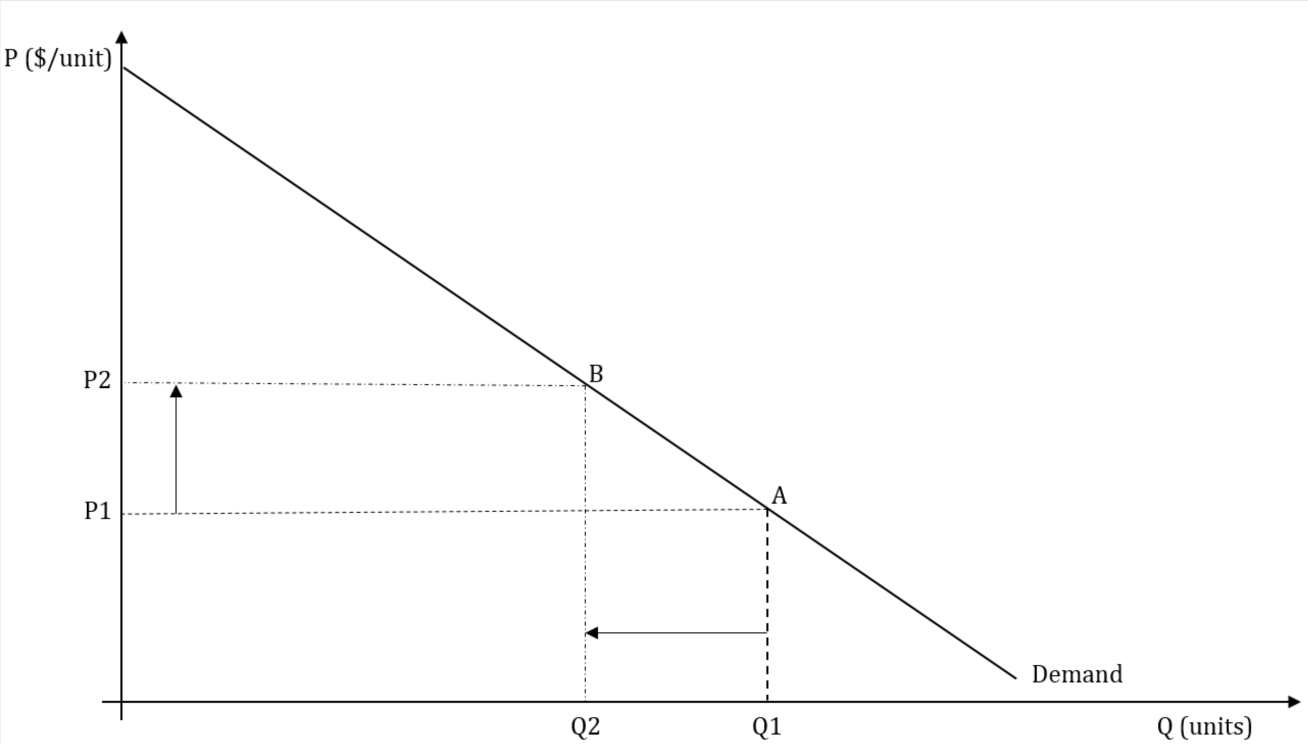

Figure 1. The Product Price-Quantity Relationship: Two Representative Market Scenarios

Note: Q1 and P1 (PointA): A *larger* quantity and a *lower* price. Q2 and P2 (Point B): A *smaller* quantity and a *higher* price. Seller market power is the industry ability to move from A to B: a decrease in quantity causes price to increase.

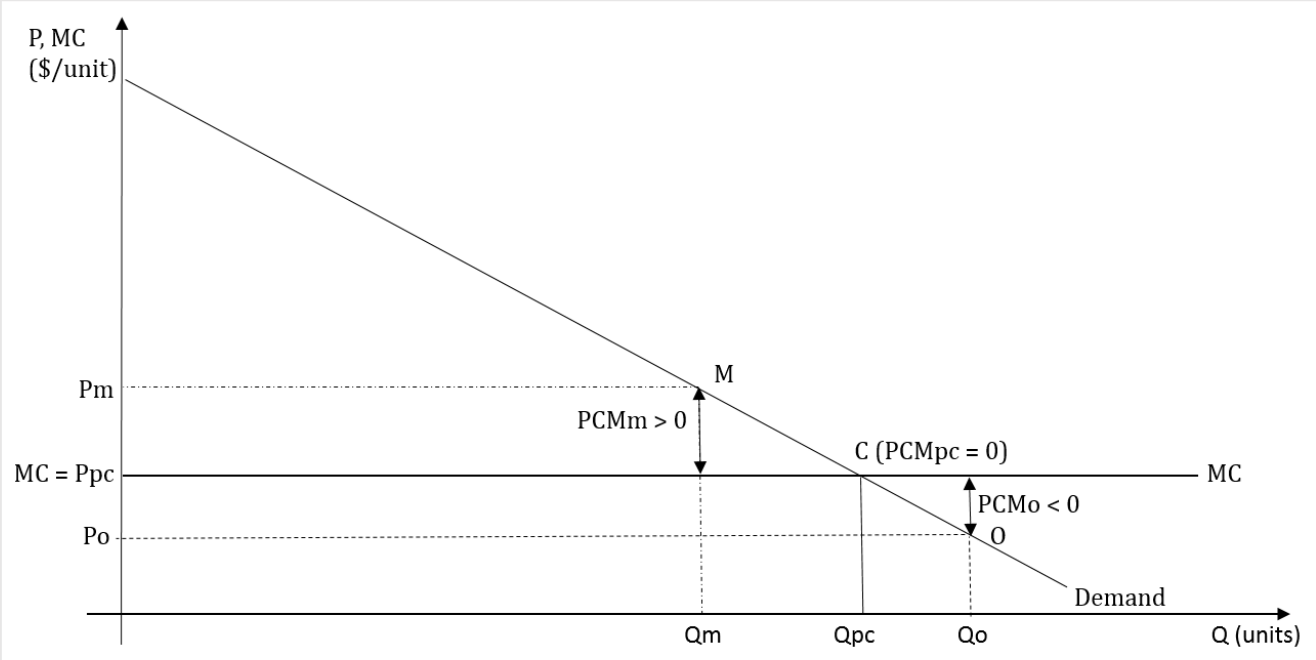

Figure 2. The Product Price-Quantity Relationship and Industry Profitability

Note: Oo and Po (Point O) is a product *over-supply* scenario. Qpc and Ppc (Point C) is a *perfectly competitive industry* scenario. Qm and Pm (Point M) is a *seller market power* scenario. Seller market power is the industry ability to move from O to C and to M: a decrease in quantity causes price to increase, which increases industry profit.

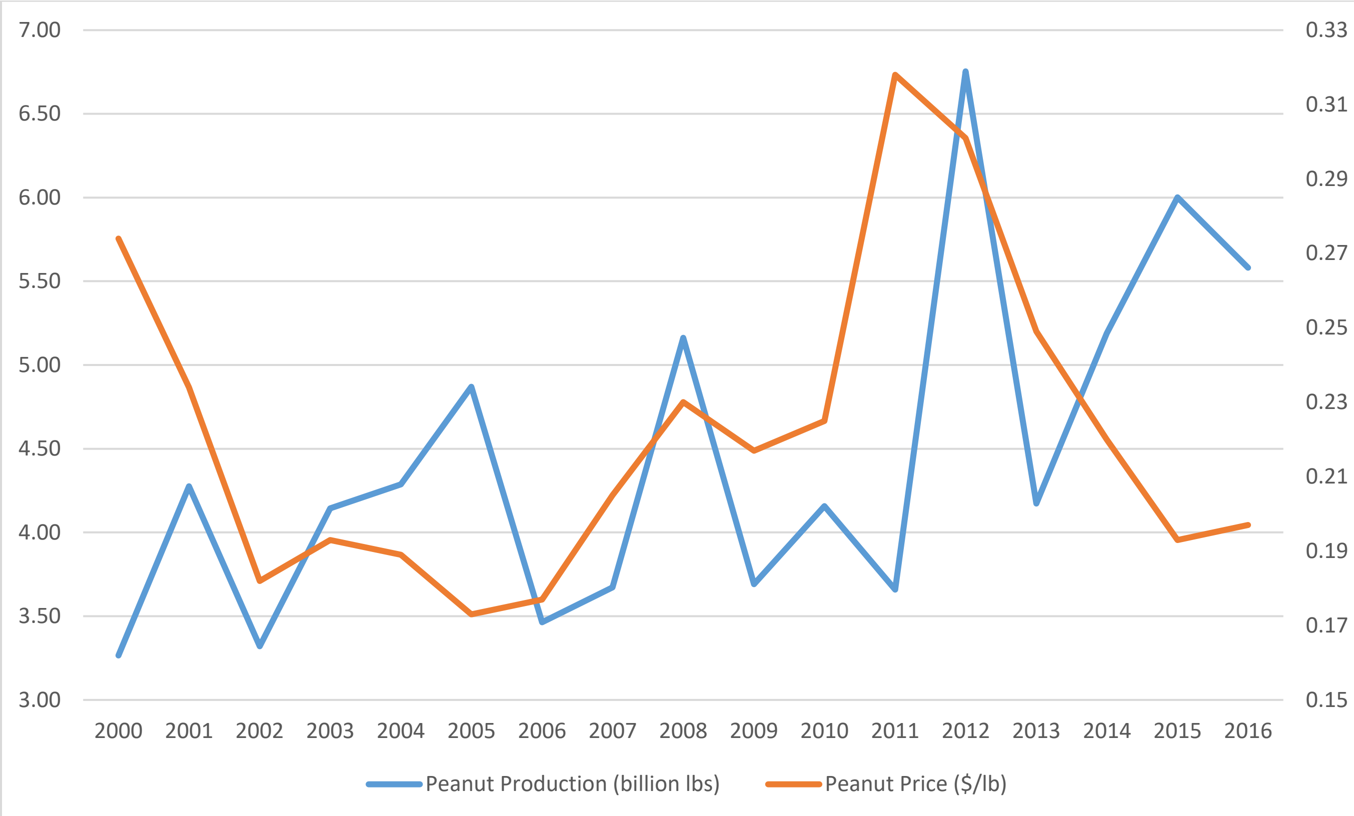

Figure 3. U.S. Peanut Industry: Peanut Production and Peanut Price (2000–2016)
Data Source: USDA NASS Quick Stats database (2019)

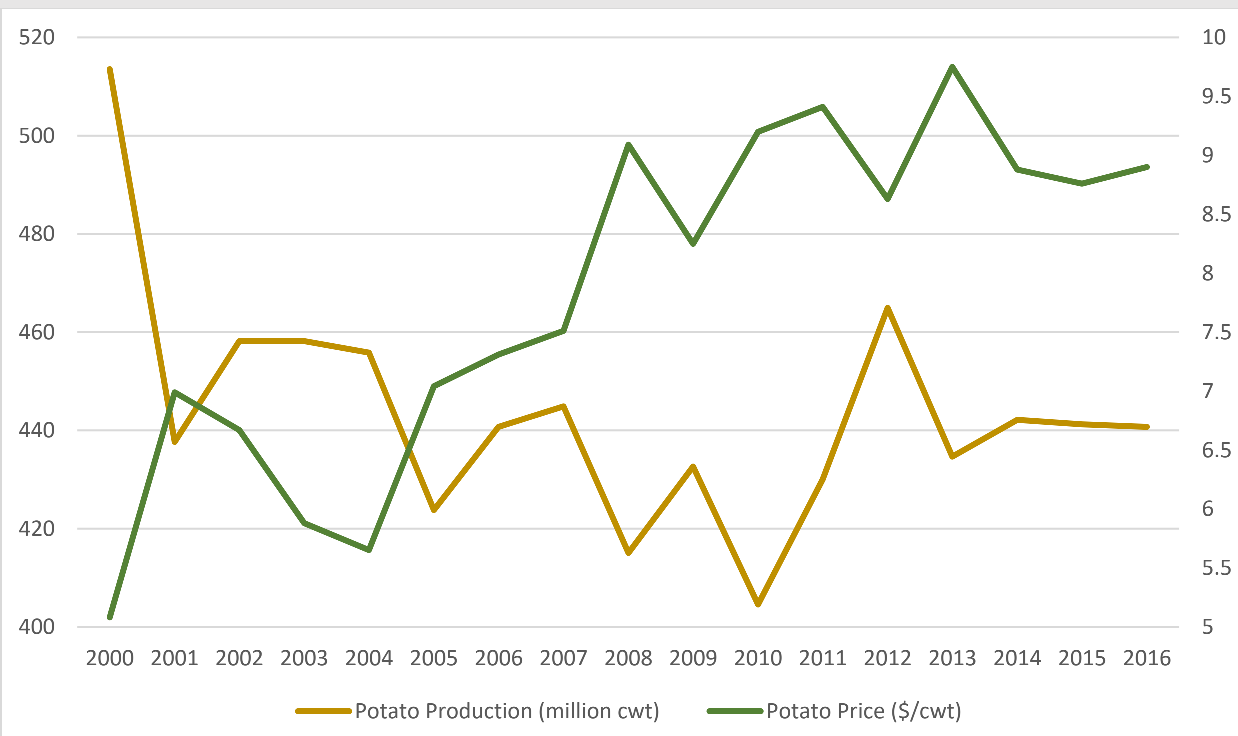

Figure 4. U.S. Potato Industry: Potato Production and Potato Price (2000–2016)
Data Source: USDA NASS Quick Stats database (2019)

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Teaching and Education Commentary

The Project Manager / Private Contractor Approach to Group Assignments

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JEL Codes: A22, A23, M12, Q00
Keywords: Authentic learning, students, teaching, teamwork

Abstract
We describe an authentic approach to group assignments whereby instructors act as corporate officers in the classroom and assign tasks to student leaders who act as project managers. These student leaders, in turn, recruit and supervise groups of their peers who act as private contractors. This approach attempts to accommodate three known student preferences for group assignments. One, students want to be involved in the group formation process, but often instructors form student groups, and then ask groups to select their leader. We propose instead to let the entire class select its own leaders and then let each leader form a group from the remaining students. Two, students want control of their individual grades, but often instructors lead efforts to assess individual contributions based on incomplete student feedback. We propose instead to let student leaders lead these efforts subject to constraints prescribed in advance by the instructor. Three, students prefer easy scheduling of their group meetings, but often they must coordinate most or all of their group meetings out of class. We propose instead to let students schedule most or all of these meetings in class. We conclude by discussing two limitations related to class size and distance learning.

1 Introduction

Instructors often require students to work jointly with other students to complete group assignments. Learning objectives typically associated with these group assignments are to improve students' abilities to write, speak, solve problems, negotiate, and coordinate plans (Chapman et al. 2006; Hansen 2006; Oakley et al. 2004). Employers highly value these skills. Surveys from the National Association of Colleges and Employers regularly show that employers want to hire people with problem-solving skills and an ability to work in teams (NACE 2017).[1] However, students often, but not always, oppose group assignments (Felder and Brent 2001; Espey 2010), and group exercises may even correlate with lower performance on other coursework like exams (Kovacs, Johnson, and Bruce 2017). Gottschall and Garcia-Bayonas (2008) find, for example, that more than half of business students have negative attitudes about group work, though these authors also review literature that supports more positive attitudes about that work (e.g., Phipps et al. 2001).

Buckenmyer (2000) and others identify many reasons that students have negative attitudes about group assignments: unclear instructor expectations, mismatched grade expectations among group members, free riders, and students' lack of knowledge about how to form groups, choose group leaders, and divide work effectively (Caspersz, Wu, and Skene 2003). Pfaff and Huddleston (2003) generalize student objections and identify three basic concerns; students do not like how instructors form groups,

[1] Other highly valued attributes include communication skills (verbal and written), leadership skills, analytical skills, and a strong work ethic (NACE 2017).

how instructors assign individual grades, and how challenging it is to schedule group meetings. We examine these three student concerns in more detail.

2 Three Student Concerns About Group Assignments

Citing existing literature and anecdotal evidence, Chapman et al. (2006) identify two typical approaches to forming groups, each of which they say instructors use about equally as often. Either instructors assign students to groups, or students select their own groups. In the former case, instructors assign students to groups randomly or on the basis of students' GPA, gender, race, age, or availability.

Random assignment of students to groups is easy to do and looks fair (Bacon, Stewart, and Anderson 2001). However, random assignment has few meaningful parallels in real business settings and completely ignores student preferences. Even when instructors assign students to groups intentionally, the sorting process is often obscure to students, limiting their awareness of and confidence in the process.

Self-selected student groups have advantages and disadvantages (Oakley et al. 2004). They are relatively easy to form, and the process is typically transparent. However, students tend to rely on convenience, popularity, or bias when they are not familiar with all classmates' credentials (Hugo, Brennan, and Gu 2013). Consequently, stronger students tend seek out one another and complete assignments with few challenges, leaving weaker student groups to struggle.

A second student concern is grading of group assignments. Instructors either assign all members of a group the same grade or adjust each student's grade on the basis of indirect observations of individual performance (Kaufman and Felder 2000). The former approach is relatively blunt and unresponsive to the variation in individual efforts, stimulating social loafing and free riding (Albanese and Van Fleet 1985). The latter approach often relies on student feedback about group members' efforts. Students assess each group member on their relative contributions to the final product or certain group citizenship expectations, such as attendance and participation at group meetings (Oakley et al. 2004). The former approach is inherently competitive, whereas the latter approach generally fails to distinguish actual impacts from attempted impacts, making it unrepresentative of most real business situations. Peer reviews are also problematic when group members tacitly or explicitly agree to rate their peers highly, identically, or both either for strategic reasons or to avoid conflict (Kaufman and Felder 2000).

A third student concern is the challenge of scheduling times for groups to meet and work together. Gottschall and Garcia-Bayonas (2008) find that the most negative aspect of group assignments for business and education students is not free riding or unequal grade expectations but the difficulty of coordinating schedules. Unfortunately, instructors have only one option to mitigate this concern: allocate class time for group meetings.

3 The Importance of Authentic Learning

To address these three student concerns, we propose an authentic learning approach. Authentic learning occurs when instructors create immersive classroom learning environments that go beyond mere reliance on an instructor's personal set of ad-hoc stories and examples (Herrington and Oliver 2000; Herrington, Reeves, and Oliver 2010). When instructors embed lessons in all-encompassing, quasi-natural contexts that reflect professional work environments, students understand and appreciate the practical value of academic content and engage in the class (Herrington, Reeves, and Oliver 2014; Betz et al. 2016; Nachtigall et al. 2018).

To create authentic learning environments, instructors must find ways to map engaging, real-world structures onto inherently constrained academic settings that refresh and extend students' interests. Increased student engagement is the goal. Authentic learning does not require a perfect match between the real and the academic worlds.[2] The instructor aims instead to create a staged world in class that is sufficiently authentic or interesting that students engage in class as if it were the real world. Instructors must persuade students to suspend their disbelief and to take on and experiment with new identities that the parallel structure evokes. Herrington, Reeves, and Oliver (2014) eloquently explain that "the physical verisimilitude to real situations is of less importance in learning than the cognitive realism provided by immersing students in engaging and complex tasks" (407). Some research even suggests that other sources of appeal (e.g., entertainment) are enough to persuade students to suspend their disbelief and engage with a scenario even if they believe it lacks authenticity (Eckhaus, Klein, and Kanto 2017).

We now describe an authentic learning approach to group assignments that we believe addresses student concerns about group formation, individual grading, and group scheduling. The approach calls on instructors to play the role of a chief executive officer (CEO) or more generally, a director, and for students to adopt the role of either a project manager (PM) or a private contractor (PC). We call this simulated business experience the PM/PC approach, referencing the two student roles.

4 The PM/PC Approach as Authentic Learning

Under the PM/PC approach, instructors act as corporate officers or directors in the classroom and assign tasks to student leaders who act as project managers. Whereas in the business world project managers are usually promoted on the basis of performance, in the classroom they are voted for by the entire class. The instructor provides all students with relevant information about each student's skills and interests, namely resumes and one-minute speeches, to facilitate a well-informed voting and matching process. To form groups, the elected student leaders then contact and recruit a prescribed number from their remaining classmates, who act as private contractors.

Like project managers who supervise contractors in real business settings, student leaders provide managerial oversight of their classmates serving as private contractors. In exchange for this additional managerial oversight, student leaders gain greater control over their individual grades. For example, the approach calls for project managers to evaluate their peers, recommend grades, and decide who shares the bonus points. The specific grading criteria and constraints in the course syllabus mimic corporate incentive structures and compensation arrangements. Like an employee handbook, the syllabus details work policies and classroom expectations.

The PM/PC approach also calls for instructors to set aside enough regular class time for well-functioning groups of students to conduct their necessary group interactions. In other words, students may schedule most or all their necessary group meetings during class time. The basic premise is that the academic corollary for a business meeting at the office is a group meeting during a regularly scheduled class period. Setting aside class time reinforces the authentic, all-encompassing nature of the approach.

The lead author (Roger Brown) first experimented with these parallels in his undergraduate agricultural marking course in 2006, after watching a popular reality television show, *The Apprentice*. In that show, businesspeople competed to become the top project manager. More recently, Brown and his coauthors have refined and extended the approach.

5 The PM/PC Approach as a Solution to Student Concerns

As a coauthor group, we have used the PM/PC approach with variations eight times in four courses at two institutions. This sample includes two advanced undergraduate/graduate agricultural finance courses at

[2] Authentic learning is similar to experiential learning in that both highlight the value of real-world learning environments (e.g., McCarthy and McCarthy 2006). However, authentic learning generally accepts the physical or online classroom as a given, whereas experiential learning typically envisions students leaving the classroom, for example, to do an internship. In practice, the former is a simulated encounter and the latter is an actual encounter with the real world.

two land-grant universities, an advanced undergraduate/graduate environmental economics course, and an undergraduate food and agricultural marketing course. Across this sample, the significance of the group assignment work varied from 10 percent to 100 percent of students' final course grades. None of these sample courses were capstone courses, and no efforts were made to create group assignments that spanned beyond a single course or more than a single semester. Our experience is that the PM/PC approach addresses students' three concerns about group assignments.

One, students want to participate in the group formation process. The PM/PC approach fulfills that desire by having the entire class elect a subset of themselves as leaders (i.e., the PMs) and by asking each of those leaders to form a group from the remaining students (i.e., the PCs). During the group formation process, PMs must find and persuade PCs to join their group. PMs often seek coaching from instructors on how to form effective groups. These engaged consultations and the guiding force of the real-world context push students to think more openly and strategically. For instance, PMs have imperfect information about who the best students are academically, and the simulated business conditions of the PM/PC approach can yield unexpected results. Academically weaker students with strong communication skills, especially those with past work experience, often find new inspiration. Under these conditions, PMs might prefer to form a group that includes students with different skills that fulfill group assignment requirements.

Two, students want control of their individual grades. Under the PM/PC approach, PMs control their own grades directly, subject to constraints prescribed by the instructor. The PCs control their grades indirectly through their election of the PMs, through their consent to join any particular PM's group, and through their evaluations of their PM. The PM/PC approach requires PMs to evaluate their peers and recommend grades to the CEO, subject to the constraint that the average grade of all PCs in a group must equal the grade assigned by the CEO before the distribution of any bonus points. This constraint forces PMs to wrestle with how to evaluate their PCs accurately.

The introduction of bonus points also gives PMs additional freedom and responsibility when recommending grades to the CEO. Interestingly, the PM/PC model does not explicitly require PCs to provide evaluations of their own or others' contributions; such evaluations tend to arise authentically among all members of the group as they would and should in real business settings. In our experience, PCs ask the instructor how they can highlight their individual contributions, and PMs ask how they can appropriately evaluate the contributions of their PCs. The role-playing aspect of the PM/PC approach also allows students to distinguish their actions as PMs and PCs from their typical in-class behavior as students. The immersive context gives students an excuse to have higher expectations or, as one student said, "I'm not being mean; I'm being professional."

Three, students want easy scheduling of their group meetings. Under the PM/PC approach, group meetings are easy to schedule because the instructor sets aside in-class meeting time for groups to complete those tasks that typically require face-to-face interaction (e.g., discussing ideas and forming plans). The in-class time, however, may not eliminate group scheduling issues. Group members should expect to spend significant additional time working individually outside of class to prepare for their group meetings, a standard business expectation. Groups that encounter unexpected challenges or that do not prepare sufficiently will likely need to schedule additional meetings outside of class.

6 Best Practices and Modifications to the PM/PC Approach

We find that the basic PM/PC approach works best with relatively small class sizes (e.g., 23 to 40 students); however, instructors may adjust various elements of the basic approach to create different incentives or accommodate special situations.[3] We suggest that instructors first identify and describe for

[3] We find that groups with a total of four students work well, though we have used the approach with groups ranging from three to six students.

students a suitable group project.[3] Explain to students that the group project will challenge them to communicate clearly, manage conflicts, solve problems, and think critically. Explain that salaries, promotions, and success in many business settings depend on a person having the right mixture of self-promotion, strategic thinking, initiative, creativity, and hard work. Specific language suitable for a syllabus is provided in the online supplementary material.

Instructors should describe for students how the PM/PC structure works and the different roles, responsibilities, and privileges of PMs and PCs. This step is important. Before students enter an instructor's simulated world, they will want and need to understand the rules and boundaries of the simulation. Clear rules and boundaries will encourage students to step into their assigned roles more readily and will allow students to think more strategically and creatively about their choices. Rules and boundaries are given for three kinds of processes: group formation (Table 1), individual grading (Table 2), and meeting scheduling (Table 3).

When presenting the PM/PC structure to students, anticipate and encourage questions. During our implementation of the PM/PC approach, we received student questions such as, "Are you saying that if I'm a project manager I will get additional bonus points added to my project grade?" To help students do some initial strategic thinking, the response might be, "Yes, that's true, but as a PM you might need to use some of your bonus points to recruit a PC who has technical skills that your group needs." Provide time for students' clarifying questions. The online supplementary material includes a section on frequently asked questions.

To help students effectively use their limited in-class meeting time, instructors may suggest that PMs circulate agendas and draft proposals to group members prior to each meeting. During the recruitment period, instructors may also advise PMs to consider PCs' out-of-class availability. Instructors may also highlight some group-working technologies, such as video conferencing (e.g., Zoom), web-based authoring (e.g., Google sheets and Google docs), and group text messaging (e.g., GroupMe).

Our basic PM/PC approach calls on instructors to gather and collate (e.g., in alphabetical order) one-page resumes from each student and to schedule time for students to give one-minute speeches in front of their peers about why they want to or should be a PM or PC. Instructors then ask all students to rank order (e.g., on a score card) a given number of their classmates (e.g., the top 20 percent) who they want to be PMs. All students who do not score high enough to be PMs become PCs by default. One extension of the basic approach is to lead students in some guided critical reflection before they make

Table 1. Forming Groups: Rules and Boundaries for the Basic PM/PC Approach

(1) The instructor is the CEO, and the CEO has final say about all compensation (grades).
(2) For this group project, students will be either a project manager (PM) or a private contractor (PC).
(3) PMs are group leaders. They have group management skills.
(4) PCs are technical experts who have specialized skills.
(5) You and your peers together will determine whether you are a PM or a PC. All students will share a one-page resume with and give a one-minute speech to their peers during the first week of the term. All students will use this information to rank the top students they want to be PMs.
(6) The CEO will sum each student's rankings. The students who receive the highest overall ranks will be PMs for this project. All other students will be PCs.
(7) The CEO will announce which students are PMs. At that time, each PM must recruit an assigned number of PCs. Every PC must join a group.

[3] Group assignments should be relatively complex tasks that naturally incline students to divide the assigned work and make decisions cooperatively. For example, students might prepare a 10-minute digital presentation on an agricultural market of their choosing that includes a description of the market's defining characteristics and evidence supporting four demand or supply changes expected to occur over five years.

Table 2. Grading Individuals: Rules and Boundaries for the Basic PM/PC Approach

(1) As groups form, the CEO will assign each a project to complete by a specific date.
(2) After the due date, the CEO will assign each group an overall project grade (up to 100 percent), which is the grade for the PM. The CEO will also give each PM bonus credit equal to 10 percent of the possible points for the project. The PM can keep or distribute this credit to their PCs.
(3) PMs must recommend individual grades (up to 100 percent) for each PC in their group with the constraint that, exclusive of any bonus credit, the average grade for all PCs in a group must equal the overall group project grade (and PM grade) assigned by the CEO.
(4) The PM must provide written justification to the CEO for each grade assigned and indicate how much bonus credit, if any, he or she wishes to share with each PC.
(5) On the basis of grade recommendations from PMs, the CEO will tabulate a final project grade (up to 100 percent) for each student.
(6) All PCs must rate their PM (up to 100 percent) and provide written justification to the CEO for their rating. PM ratings do not affect the PM's grade, but the CEO may use them to determine whether that student is eligible to serve as a PM for future projects.

Table 3. Meeting Scheduling: Rules and Boundaries for the Basic PM/PC Approach

(1) The CEO recognizes that PMs and PCs have other job duties (schoolwork) and that PMs and PCs do some of their work at the main office (in class) and some of their work remotely from their home offices (e.g., library).
(2) The CEO usually provides training (lectures) and assessments at the main office (in class) when most employees (students) are gathered together. However, as noted in the employee handbook (syllabus), the CEO has moved some trainings online to allow PMs and PCs to occasionally work on their group projects at the main office (in class). This accommodation requires PMs and PCs to access some of their main office training (lectures) online from their home offices (e.g., library).
(3) PMs and PCs should expect to spend significant additional time working at their home offices (e.g., library) as they prepare for their group meetings.

their one-minute speeches. Instructors may assign students to consider attributes of good PMs, strengths relevant to work as a PM, or ways that cultural biases misshape one's own and others' views of leadership. To shed light on these matters, instructors may invite industry guest speakers to the classroom or record interviews with actual CEOs, project managers, or private contractors. Instructors may also need to help students (e.g., through additional assignments, training, or other exercises) appreciate that choosing leaders and compensating employees is a complex social process that should not indulge gender, ethnic, or other such biases (Brescoll 2015; Carnes, Houghton, and Ellison 2015; Beckwith, Carter, and Peters 2016).

Another modification related to group formation is to write policies allowing PCs to remove their PM or for PCs to move from one group to another. For example, policies should allow PCs to lodge formal concerns about their PM in one-half-page complaint letters addressed to the CEO. If the instructor as CEO finds just cause, he or she can remove the PM and promote one of the group's PCs to PM. Related policies may also allow PCs to switch groups if each group's PM agrees. In all cases, instructors have the authority to interrupt the PM/PC simulation at any time to fix problems or make adjustments.

A grading adjustment might be needed when groups include members who are difficult to motivate, who greatly underperform other group members, or both. In these cases, the PM is highly incentivized to step up and complete the work because his or her grade equals the overall project grade.

Instructors can diminish this effect by modifying that grading constraint. For example, the CEO (instructor who assigns an overall grade) may allow PMs to recommend grades for all group members, including themselves, such that the average grade for *all* group members is equal to the overall group project grade assigned by the CEO. Separately, CEOs can award bonus points to PMs on the basis of some performance measure (e.g., the group's overall project grade) rather than simply awarding a fixed amount (e.g., plus 10 percent of the points possible on the assignment).

Another modification of the basic PM/PC approach is to create a series of increasingly more sophisticated group projects with increasing numbers of PCs managed by a decreasing number of PMs. The CEO can use PC ratings (#6 under "Individual Grading" in Table 2) from each project to narrow the field of PMs by reassigning the lowest-ranking PMs as PCs. For the final project (e.g., an in-class presentation), students from all of the other groups rate each project. The CEO then identifies the top project manager by adding (1) the overall project grade that he or she assigned, (2) the average rating from all non-group members, and (3) the PM average rating given by the group PCs. To motivate PMs to do their best, the instructor may show students a copy of a letter of recommendation that describes the unique course setup, a student's outstanding managerial achievements, and direct quotes from satisfied student contractors who appreciated the student's leadership (see the online supplementary material).[4] Such letters or an extra-curricular reward (e.g., a tour of a local consulting firm for the winning team) can help students see that their hard work has benefits beyond a good course grade.

7 Limitations of the PM/PC Approach and Conclusions

The basic PM/PC approach has two limitations. One is class size. Instructors of classes of more than 40 students would likely need to restructure the approach to maintain authenticity of the experience and engagement for students as well as to keep demands on class time, particularly during the group formation process, manageable. One solution might be to divide students into "districts," and to implement the PM/PC model simultaneously within each.

The second limitation of the basic PM/PC approach is that it requires instructors to set aside class time for group assignments. Some instructors may not be able to accommodate this time allowance within their regular class schedule. In that case, instructors have two options. They may provide an additional credit hour (e.g., lab credit) to allow for in-class meetings. Alternatively, they may free up time during regular class periods by moving some in-class activities (e.g., some lectures) online (Lage, Platt, and Treglia 2000). This option has strong empirical support, and guidance for its implementation is plentiful (DeLozier and Rhodes 2017). The viability of the option, however, will depend on local institutional policies and the instructor's willingness and ability to adapt some course activities for online delivery.

In conclusion, we highlight two emerging needs. First, empirical study is needed to assess how well the PM/PC approach affects student satisfaction and student learning outcomes. Anecdotal evidence from the classroom experience of four instructors suggests that the PM/PC approach improves student satisfaction with respect to three known student preferences regarding group formation, individual grading, and schedule coordination. We have less insight to offer on whether and how the PM/PC approach improves student learning outcomes.

Second, additional thought is needed to adapt the PM/PC approach for use in distance learning courses in which students are unable to gather in a common physical location. In our experience, students rely heavily on face-to-face interactions to form their preferences for project managers and to conduct their group business. On the other hand, businesses increasingly rely on remote interaction to perform group functions. This trend suggests that the PM/PC approach should be adapted for use in online courses.

[4] Other example documents in the online supplementary material include a syllabus describing assignments and PM/PC processes and a score sheet to rank PM candidates.

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