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# The Relevance of Graduate Programs in Agricultural and Resource Economics

Daniel A. Lass

The relevance of graduate training in the Department of Resource Economics at the University of Massachusetts is investigated through a survey of graduates. The survey questionnaire and measures of relevancy are discussed. Results are presented for three cohorts: graduates currently in Ph.D. programs, M.S. graduates currently employed, and Ph.D. graduates currently employed. Results for all cohorts indicate that their graduate training is relevant to their jobs; however, all cohorts also favored increased application and reduced mathematics and theory. In addition, graduates suggested the need to bolster graduate training in economics with applied courses in business to improve competitiveness in private job markets.

When discussing the relevance of graduate programs in agricultural and resource economics, we need to ask: relevant to what, or to whom? What current social issues do our graduate programs directly address? Research in agricultural and resource economics addresses many current issues and problems. The journals are replete with applied analyses that consider timely problems, and many of the analyses are conducted as graduate theses. However, economists are frequently accused of being out of touch with reality, and journal publications may not be sufficient, or even necessary, to establish relevancy. Furthermore, while some form of content analysis of our major applied journals seemed intriguing, and I considered undertaking such an analysis, the intent implied in my invitation to address this conference seemed fairly clear. The focus of my address should be on how well our graduate programs prepare students for careers in the real world, as well as academia. Which groups find our graduate programs relevant? Do our graduate programs fill the needs of private decisionmakers and public policymakers, or are our programs relevant only to those who remain in academia?

Graduates from our programs find jobs in a number of different sectors, including public, pri-

vate, and academic. These graduates are probably best prepared to answer this question: How relevant are graduate programs in agricultural and resource economics? This paper will focus on the opinions of graduates from the Department of Resource Economics at the University of Massachusetts (UMass) about the relevance of their graduate training to their current jobs or positions. Thus, my research problem has been narrowly defined, and the study will be empirical in nature.

Results of such studies are not common in the literature. While most universities conduct surveys of their graduates, rarely do their surveys provide enough detail to evaluate the different aspects of the educational experience, either undergraduate or graduate. Colander and Klammer (1987) investigated factors that turn students into economists. They surveyed students at six top-ranking economics programs, asking questions that allowed them to provide a profile of the students, their interests, differences between the students and the profession, and distinctive characteristics of the graduate programs. When students were asked what they liked least about their graduate program, Colander and Klammer found, "the majority of comments focused on the heavy load of mathematics and theory and a lack of relevance of the material they were learning" (p. 96). They found that many students entered graduate programs with interests in policy. However, the strong focus on theory, techniques, and methods caused some to become frustrated early in their programs. In their implications, Colander and Klammer state: "graduates are well-trained in problem-solving, but it is technical prob-

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lem-solving . . . little real world knowledge of institutions is needed, and in many cases such knowledge would actually be a hindrance since the simplifying assumptions would be harder to accept" (p. 108). Colander and Klammer conclude that a socialization process occurs that shapes economists, a process that apparently discourages policy and application interests.

In 1988, the American Economic Association (AEA) established the Commission on Graduate Education in Economics. The commission's charge was to study the structure and content of graduate education in economics. One important part of the commission's efforts was a survey of faculty, current students in economics, and recent Ph.D.s. The results reported by Hansen (1990, 1991) show that there are important differences between what faculty, students, and recent Ph.D.s find important in graduate education in economics. Recent Ph.D.s indicated that the skills used in their jobs were different from those emphasized in their graduate training. The results of the commission's study thus echo those of Colander and Klammer and provide an important foundation from which to develop a survey questionnaire useful to this study.

In the following section, a brief review of graduate curricula in the Northeast and the University of Massachusetts Department of Resource Economics is presented. The survey questionnaire used to solicit the views of this department's graduates on how important their training has been in their jobs is then discussed in the third section. The results of the survey are presented and discussed in the fourth section. These results provide information on the importance of graduate curriculum components, areas of knowledge, and skills. While the results are specific to the graduate programs of the Department of Resource Economics at the University of Massachusetts, commonalities across graduate programs in the Northeast make the results and lessons learned directly applicable to similar programs. In the final section, important results are summarized and conclusions are drawn from those results.

### **Graduate Programs in Resource Economics**

The focus of this paper is on the relevance of the graduate programs of the Department of Resource Economics at the University of Massachusetts. While the focus is on a single graduate department, the results will be applicable widely in the Northeast and the United States if the structure and content of the programs are similar to those of other departments. Are graduate programs in the Depart-

ment of Resource Economics at UMass representative of programs in the Northeast? Contrary to the findings of Thornton and Innes (1988) for master's programs in economics, my review of similar graduate programs showed that there seems to be agreement across the Northeast about what is important for graduate training in agricultural and resource economics. All programs require courses in theory and methods. Most M.S. programs require courses in both microeconomic and macroeconomic theory, typically one of each. Methods requirements are somewhat diverse and include courses in research methodology, statistics, econometric theory, and mathematical methods for economists. Students take courses in their major area (e.g., community development, marketing, natural resource economics, production economics) and select additional electives. M.S. students are typically required to complete twenty-four course credits as well as a thesis (the thesis is usually worth six credits). A number of programs also have nonthesis options for M.S. students. The Ph.D. requires course work beyond that of the M.S. degree, including advanced microeconomic theory, macroeconomic theory, and econometric methods as well as additional field courses. Ph.D. programs require qualifying or preliminary exams in theory, possibly methods as well, and a comprehensive examination in the major field.

The Department of Resource Economics at UMass offers both M.S. and Ph.D. degrees. Both degrees rely on a strong base of microeconomic theory and quantitative methods. M.S. students complete a common core during the first year, including two single-semester courses in microeconomic theory, two courses in quantitative methods (mathematical methods/programming and econometrics), and a seminar on current departmental research. Following these core courses, M.S. students take examinations in both microeconomic theory and quantitative methods. Ph.D. students follow a similar path but are required to take four single-semester courses in microeconomic theory and three courses in quantitative methods before completing their qualifying examinations in microeconomic theory and methods. Ph.D. students are also required to take a course in macroeconomic theory. As is common in graduate programs throughout the Northeast, students choose a major field and complete course work in that field. The department now offers four fields: applied econometrics, agricultural production economics, marketing/industrial organization of the food system, and natural resource and environmental economics. All students in the department complete an

M.S. thesis or Ph.D. dissertation in one of the four fields.

The structures of the M.S. and Ph.D. degree programs in the Department of Resource Economics are similar to those of other programs in the Northeast. However, the department is unique in several ways. A review of other programs suggests that while microeconomic theory and quantitative methods are common to all programs in the Northeast, the UMass departmental requirements in these two areas at the M.S. level exceed the requirements of most similar programs, something to keep in mind when reviewing the results presented below. In addition, the UMass department employs nearly all first-year graduate students (both M.S. and Ph.D.) as teaching assistants. The graduate students teach discussion sessions, provide grading assistance, and hold office hours. Thus, the curriculum and experiences of graduates from the UMass Department of Resource Economics may differ from those of other departments.

### Survey of Graduates

To assess the relevance to our graduates of various curriculum components and their contents, a survey questionnaire was developed to ask graduates how important they felt their training was for their current jobs. Graduates were also asked to provide their own assessment of the structure and the content of their graduate program. In the Department of Resource Economics, we have chosen the structures and contents of our graduate programs to reflect what we believe is important for graduate education in an applied economics field. Decisions about the structures of the programs are made by the graduate faculty of the department. These structures include all requirements for completion of the degrees and indicate the department's organization of content. Content includes the types of knowledge that we strive to impart to the students and the types of skills that we hope to enhance through our programs. However, the exact content of each graduate course is at the discretion of the individual faculty member.

The survey questionnaire was designed to elicit graduates' perceptions of the importance that is placed by the department on different components of the programs and the importance that graduates feel *should be* placed on different components based on their experiences following graduation. These responses will be used to provide an indication of the relevance of graduate training in the Department of Resource Economics.

### Structure

The structure of our programs is taken to mean the different components of the graduate curriculum. Requirements for both the M.S. and Ph.D. degrees, as discussed above, can be summarized by the following seven categories:

- *Microeconomic theory core courses*: two courses are required for the M.S. degree; four courses are required for the Ph.D. degree.
- *Econometric and quantitative methods core courses*: two courses are required for the M.S. degree (one mathematical methods/programming, one econometrics); three courses are required for the Ph.D. degree (one mathematical methods/programming, two econometrics).
- *Qualifying and comprehensive examinations*: qualifying examinations in microeconomic theory and quantitative methods are required for the M.S. and Ph.D. degrees; a written comprehensive exam in the candidate's field is required for the Ph.D. degree.
- *Department field courses*: during the period 1977–96 the department offered fields in three areas: agricultural production economics, marketing/industrial organization of the food system, and natural resource and environmental economics.
- *Elective courses*: additional courses in economics, statistics, business, political science, etc., have been used to fulfill electives.
- *Thesis or dissertation research*.
- *Departmental seminars*.

Graduates were asked to rate the importance of each component of the department's graduate curriculum using a modified Likert scale of 1–5. Three of the five values were labeled as follows: 1 = very important; 3 = somewhat important; and 5 = not important. Respondents were asked to rate the importance from two standpoints: (1) their perception of the importance placed by the department on each component; and (2) the importance of each component to their jobs or positions. Examples of these two types of survey questions are presented in figure 1. Question 1 in figure 1 asks the graduates to rate the importance they feel the department placed on microeconomic theory in their graduate programs (M.S. or Ph.D.). The graduates' perceptions of the importance placed on each component by the department will be used as an assessment of how important each component *is* to the curriculum. The department's faculty were asked to respond to the same questions, and the graduate responses can be compared with faculty responses.

<b><u>Importance Is:</u></b>					
1. Please circle the number you feel best represents the importance <i>the Department placed</i> on each of the following components in your Resource Economics degree program.					
	Very Important		Somewhat Important		Not Important
<i>Microeconomic Theory Core Courses</i>	1	2	3	4	5
<b><u>Importance Should Be:</u></b>					
2. Please circle the number you feel best represents how important each of the components is for your job or position.					
	Very Important		Somewhat Important		Not Important
<i>Microeconomic Theory Core Courses</i>	1	2	3	4	5

**Figure 1. Examples of Survey Questions Using a Modified Likert Scale.**

The second set of questions on the importance of curriculum components to individuals' jobs will be used to indicate what graduates feel the importance *should be* for the different components of the graduate curriculum. Question 2 in figure 1 provides an example for microeconomic theory. This second set of responses will provide an assessment of how important the curriculum is to the kinds of positions our graduates take upon completion of their degrees. Indicators of the relevance of the graduate curriculum in resource economics can be obtained from the numeric responses to these questions. If we are seeking a straightforward yes/no answer to our question about the relevancy of graduate training, we can proceed as follows. If a component of the graduate curriculum receives a numeric value less than or equal to three (somewhat important), then we can conclude that the individual finds this component to be important (relevant) to his/her career. If a component receives a score greater than three, we can conclude that component is not relevant to the individual's career. Of course, degrees of importance are indicated by the numeric responses. The smaller the numeric value assigned to a curriculum component, the more important/relevant that component is to graduates' jobs.

Another relative measure of the department's emphasis on curriculum importance can be developed by comparing the importance graduates feel is placed on components of the curriculum by the department with the importance they feel *should be* placed on components of the curriculum. Subtracting the importance to the individual's job from the importance the department places on each component results in a difference variable. If the difference variable has a positive value, individuals con-

sider that component of the graduate curriculum to be relatively more important to their jobs than it is in the department's graduate curriculum. If the variable has a negative value, then individuals perceive that the importance to the department of that component is greater than the importance to their jobs. Statistical tests of differences between means for the various components will be used to indicate whether the importance the department places on a curriculum component is statistically different from the importance to individuals' jobs.

Graduates were also asked to rank-order the seven curriculum components, once again in terms of (1) the importance the department places on each and (2) how they felt the components should be ranked based on their experience after graduation. The component the graduate feels is most important from the department's perspective would receive a rank of 1 and the component he/she feels is least important from the department's perspective would receive a rank of 7. Similarly, the component the graduate feels is most important to his/her job would receive a rank of 1, and the component least important to the job would receive a rank of 7. These rankings can also be compared to determine whether there is agreement between the department's emphasis and the importance to the graduate's current job or position. Hansen (1991) conducted this form of analysis and found differences between what graduates perceived *was* important in Ph.D. programs and what graduates felt *should be* important.

#### *Content*

Each graduate was also asked to evaluate the content of his/her graduate program using the same

process described above. Following Hansen (1991), content was separated into two broad divisions: *areas of knowledge* and *skills*. The intent was to reflect what the graduate students learned while completing their degrees and what skills were enhanced by the degree programs.

Students acquire knowledge while completing their degree requirements through their courses, research, and thesis work. Six areas of knowledge were included on the survey questionnaire:

- *Economic theory*: assumptions and theories of economic behavior.
- *Econometrics*: statistical theories for economics, properties of models, distribution theory.
- *Economic institutions and history*: different forms of economic associations, historical economic forces.
- *Economic literature*: recent and/or comprehensive histories of economic ideas and approaches.
- *Economic applications and policy issues*: current topics of concern to business, government, and society.
- *Empirical economics*: testing of implications of theoretical models, estimating of behavioral responses, practical analysis of data, experience with economic data.

In addition to assimilating knowledge, graduate students develop and enhance their skills in applying this knowledge. These skills are important to a graduate's effectiveness and success in the job market. Hansen (1991) classified skills important to graduates into the following seven categories:

- *Critical judgment*: analyzing ideas, reviewing literature, formulating pertinent comments.
- *Analytics*: understanding and solving problems, making and analyzing logical arguments.
- *Application*: seeing practical implications of abstract ideas, analyzing real-world policies and processes.
- *Mathematics*: constructing and analyzing proofs, manipulating mathematical abstractions.
- *Computation*: effectively and quickly finding and manipulating relevant data sources, translating statistical theory into programs.
- *Communication*: speaking and writing effectively with proper style, quickly understanding spoken and written ideas of others.
- *Creativity*: conceiving interesting research questions, finding new ways of analyzing topics.

The formats of the questions for areas of knowl-

edge and skills were identical to those described above and illustrated in figure 1 for graduate curriculum components. Graduates provided their perceptions of the importance to the department for each area of knowledge and skill using the same modified Likert scale. They then provided an assessment of the importance of each area of knowledge and skill to their current jobs. Values of three or less can again be interpreted as indicating relevance; the range of numeric values indicates degrees of importance or relevance. Difference variables will be calculated to indicate relative importance for the different areas of knowledge and skills. Finally, the rank orderings for areas of knowledge and skills will be provided.

As noted above, opinions about the proper mix of theory, econometrics, mathematics, and other areas of knowledge and skills vary across students, graduates, and faculty. Faculty were asked to respond to the same questions on curriculum and content. The following two faculty responses represent fairly divergent opinions about the proper mix of curriculum and content for the graduate programs in resource economics. The first response suggests emphasis on current developments in microeconomic theory and methods:

There should be much more emphasis on economic theory and quantitative methods that have become prominent during the last five years. Less time should be spent covering and applying traditional methods.

More emphasis on theory and methods is important for students completing a Ph.D. degree and for M.S. students who are applying to Ph.D. programs. However, students completing the M.S. as a terminal degree may not be well served by focusing on these areas. The second, nearly polar opinion suggests an emphasis that may be more appropriate for students seeking a terminal M.S. degree:

I am concerned that we have missed a turn in our graduate training. As we continue to race down the road of more math and more elegant theory, we might have overshot the optimal amount. We have had great success supplying Ph.D. programs with well-trained M.S. students and they have greatly benefited from the training we give our students. But will these programs continue to take as many students in the future? It appears to me that Ph.D. students are finding jobs scarce in traditional academic and government areas. Hence, business jobs are becoming important, but these jobs require different training. Many still need solid mathematical training (e.g., finance) but not the latest in economic theory.

We might consider these as two alternate hypotheses about the appropriate format of graduate pro-

grams in resource economics as we review the survey results in the sections that follow.

### Graduate Survey Results

The questionnaire was sent to all graduates from the period 1977–96 for whom addresses were available from the Development Office at the University of Massachusetts. In total, 105 survey questionnaires were mailed; 8 were returned because of incorrect addresses. Fifty completed questionnaires were returned, for a response rate of 51.5%. Of them, 49 responses were used in the analysis below. Of the 49 respondents, about 63% graduated during the period 1986–96. Thus, the responses and the results reported here are mainly indicative of recent graduates' experiences and opinions.

Table 1 shows descriptive statistics for the 49 survey respondents. The respondents are broken into three cohorts: M.S. graduates who are currently in Ph.D. programs; M.S. graduates who are currently employed; and graduates who have attained the Ph.D. degree. The delineation creates two distinctions: level of education and employment. Because of the small sample size for the group that obtained the Ph.D. degree, there was no further delineation of the department's Ph.D. graduates from those who obtained the Ph.D. elsewhere.

All but two respondents were currently employed. Most M.S. degree recipients found jobs in the private sector, and salaries for M.S. degree holders exceeded salaries of Ph.D. degree holders. Moreover, mean salaries reported do not include variable bonuses reported by a number of M.S. graduates. Graduates typically found employment immediately upon graduation or spent little time searching. Sixty-four percent of the M.S. graduates

found employment immediately following graduation. Those who did require time to find a job did so quickly; on average, 0.22 years (about 2.6 months) were spent seeking employment. The maximum reported time seeking employment was one year. Graduates with Ph.D. degrees were more likely to find employment immediately upon graduation; in fact, 93% did so. Ph.D. recipients were also more likely to have jobs closely related to their degrees, as would be expected, whereas only 54% of M.S. graduates had jobs closely related to their degrees. This figure may, however, understate the percentage of M.S. graduates employed in jobs related to their degrees. For example, one individual, whose M.S. field was natural resources and the environment, did not perceive his/her job as a rate analyst and electricity demand forecaster to be closely related to his/her degree. It is possible that others interpreted the question in a narrow sense as well. A number of M.S. graduates also moved into management positions in corporations after initial positions as economists or analysts.

### Structure

Structures of the department's graduate programs were reviewed above, and seven components were identified for the M.S. and Ph.D. curricula. Respondents provided assessments of the importance they felt the department places on various components of their graduate curricula ("Importance *Is*") and their assessment of how important they felt each component is to their job or position ("Importance *Should Be*"). Results are presented in table 2 for the three cohorts described above. As discussed above, if a component receives a rating of three or less on average, we will conclude that the component is relevant to individuals' careers.

**Table 1. Descriptive Statistics for Graduate Survey Respondents**

Variable	All Respondents (n = 49)	M.S. Graduates Currently Ph.D. Students (n = 7)	M.S. Graduates Currently Employed (n = 28)	Ph.D. Graduates Currently Employed (n = 14)
Age	38.49 (8.01)	30.29 (2.69)	39.18 (8.74)	41.21 (5.42)
Currently employed (Yes = 1)	0.96 (0.20)	1.00 (0.00)	0.93 (0.26)	1.00 (0.00)
Annual salary (\$)	56,327.37 (44,558.12)	14,650.00 (2,737.70)	63,615.71 (45,530.75)	62,107.69 (44,289.77)
Immediate employment (Yes = 1)	0.78 (0.42)	1.00 (0.00)	0.64 (0.49)	0.93 (0.27)
Time seeking employment (years)	0.16 (0.35)	0.00 (0.00)	0.22 (0.35)	0.13 (0.40)
Job related to degree (Yes = 1)	0.66 (0.48)	0.86 (0.38)	0.54 (0.51)	0.79 (0.43)
Years of experience	8.55 (6.35)	0.00 (0.00)	9.47 (6.51)	7.45 (5.81)

Numbers in parentheses are standard deviations.

Table 2. Importance That *Is* Placed on Curriculum Components and Importance That *Should Be* Placed on Components

Curriculum Component	Faculty (n = 11)			M.S. Graduates Currently Students (n = 7)			M.S. Graduates Currently Employed (n = 28)			Ph.D. Graduates Currently Employed (n = 14)		
	Importance <i>I<sub>s</sub></i>	Importance <i>I<sub>s</sub></i>	Importance <i>Should Be</i>	Difference	Importance <i>I<sub>s</sub></i>	Importance <i>Should Be</i>	Difference	Importance <i>I<sub>s</sub></i>	Importance <i>Should Be</i>	Difference	Importance <i>I<sub>s</sub></i>	Importance <i>Should Be</i>
Microeconomic theory core courses	1.27	1.14	1.71	-0.57 (-1.92)*	1.21	2.61	-1.39 (-5.49)*	1.21	1.89	-0.68 (-1.80)*		
Econometric and quantitative methods core courses	1.18	1.00	1.29	-0.29 (-1.55)	1.14	2.29	-1.14 (-4.77)*	1.21	1.81	-0.59 (-2.09)*		
Qualifying examinations	1.64	2.14	2.86	-0.71 (-1.99*)	1.85	3.70	-1.85 (-7.28)*	1.93	3.65	-1.73 (-4.38)*		
Department field courses	1.73	2.29	2.14	0.14 (0.31)	2.46	2.52	-0.05 (0.18)	2.31	2.04	0.27 (0.77)		
Elective Courses	3.00	3.43	2.57	0.86 (2.52)*	3.32	2.04	1.30 (5.75)*	3.57	2.19	1.27 (3.61)*		
Thesis or dissertation research	1.18	1.43	1.43	0.00 (0.00)	1.64	2.85	-1.22 (-4.96)*	1.93	2.19	-0.19 (-0.46)		
Departmental seminars	4.09	3.29	2.71	0.57 (1.33)	3.34	3.81	-0.50 (-2.40)*	3.64	3.88	-0.27 (-0.86)		

Numbers under the columns labeled "Importance *Is*" and "Importance *Should Be*" are mean ratings. Numbers in parentheses are t-statistics for the differences between means.

\*Indicates the value is statistically different from zero at the 5% level of significance (one-tail test).



There is strong agreement about the importance the department places on various components of the graduate curriculum (columns labeled "Importance Is") among all three cohorts and the department faculty. If rankings of the department's emphasis were created using these results, the rankings for all three cohorts and the department faculty would be similar. The graduates are fairly perceptive about the department's emphasis. The graduates consider the econometric and quantitative methods component to be most important to the department on average, with Microeconomic Theory a close second. Thesis or dissertation research and qualifying examinations are also rated as important to the department by the graduates and are ranked third and fourth in importance, respectively. The department faculty feel that thesis and dissertation research is one of the two most important components of the graduate curriculum. The fifth most important component to the department according to the graduates' assessments are the department field courses. The final two components, elective courses and departmental seminars, are in the somewhat important range or near the not important range on average for all three cohorts.

The columns labeled "Should Be" indicate the relevance of the graduate curriculum to the individuals' current jobs. M.S. graduates currently in Ph.D. programs found all components of the graduate curriculum to be important to their current positions (all were research assistants or teaching assistants); all components received numeric values of less than three. Those graduates who were employed found all components except qualifying examinations and departmental seminars to be important or relevant to their current jobs. While Ph.D. graduates found econometric and quantitative methods and microeconomic theory to be the most important curriculum components, M.S. graduates who were employed found that elective courses were most important. In fact, a number of written responses by employed M.S. graduates urged that the department encourage students to supplement their graduate curriculum with elective courses in business, such as finance and management.

Differences between the importance graduates felt the department placed on curriculum components and the importance to their current jobs or positions provide an indication of the relevance of the department's emphasis in the graduate curriculum. Statistically significant differences were found for microeconomic theory, qualifying examinations, and elective courses for the first cohort, M.S. graduates currently pursuing Ph.D. de-

grees. Despite the fact that this cohort indicated that microeconomic theory was important to their current positions, the respondents felt that the department placed too much importance on microeconomic theory and the qualifying examinations. They felt that too little importance was placed on elective courses. The results may reflect the fact that two of the seven students in this cohort are pursuing Ph.D. degrees in fields other than economics or resource economics.

Results were quite different for M.S. graduates who are currently employed. The differences between the importance placed by the department on curriculum and the importance to the graduates' current jobs were statistically different from zero for all components except department field courses. The graduates felt that too much importance was placed on microeconomic theory, econometrics and quantitative methods, qualifying examinations, thesis and dissertation research, and seminars. The graduates felt that more importance should be placed on elective courses. Graduates of Ph.D. programs also felt that the department's emphasis on microeconomic theory, econometrics and quantitative methods, and qualifying exams was too strong. They also felt that the emphasis on elective courses should be increased.

The results confirm what some faculty have perceived about the department's curriculum. The required M.S. courses in microeconomic theory and econometrics and quantitative methods are very rigorous. While they are most appropriate for students continuing on to Ph.D. programs, they apparently exceed what is important for employment. The results also suggest that more importance could be placed on elective courses in the graduate program.

One final aspect of the department's graduate training that was not considered part of the graduate curriculum warrants discussion. As mentioned above, the department utilizes nearly all first-year graduate students as teaching assistants. Most of the students provide assistance in large introductory courses in statistics. Their duties include assisting with grading, maintaining office hours, and leading discussion sections. Several graduates provided written comments that lauded their experience as teaching assistants. M.S. students currently in Ph.D. programs found the experience valuable training for teaching duties in their Ph.D. programs. M.S. and Ph.D. graduates currently employed found the experience valuable in private business for presentations and, as expected, in academic teaching positions. It was gratifying to find that M.S. experience as a teaching assistant was of value in the private business world, a feature

graduates probably do not emphasize enough when seeking employment.

### Content

The content of the graduate program was divided into two broad categories, areas of knowledge and skills. Respondents were asked to rate the importance that the department placed on six areas of knowledge and seven skills that are taught in graduate education.

Table 3 presents summary statistics for individuals' assessments of the importance that the department places on different areas of knowledge and individuals' assessments of importance to their jobs. The three cohorts generally agreed about the importance that the department placed on the six areas of knowledge; these results are generally consistent with faculty perceptions. Econometrics was rated as most important to the department and economic institutions and history as least important. (The faculty believe economic theory is most important.) If these responses were used to rank-order the areas of knowledge, the rankings of what the department considers important would be consistent across the three cohorts.

Economic theory, econometrics, applications and policy issues, and empirical economics were rated better than somewhat important for all three cohorts (numeric values were less than three). Economic literature was also rated as important by current Ph.D. students and Ph.D. graduates who are employed. Despite the apparent importance of these areas of knowledge, M.S. graduates who are currently employed felt the department should place less importance on economic theory, econometrics, and empirical economics, as indicated by statistically significant differences between the means for "Importance Is" and "Importance Should Be." This cohort felt that more importance should be placed on applications and policy issues.

Those graduates who were currently in Ph.D. programs or had already obtained the Ph.D. degree generally agreed with the department's emphasis. Graduates currently in Ph.D. programs did feel that more importance should be placed on economic literature, as indicated by the difference between the two measures of importance. Ph.D. graduates who were employed felt that the level of importance placed on Econometrics by the department was too high.

Table 4 presents mean responses to questions on the importance placed on skills by the department and the importance of skills to graduates' jobs. All skills were rated as important to the department (columns labeled "Importance Is") and to the

graduates' jobs (columns labeled "Importance Should Be"). However, the numerical scores reflecting the importance that the department places on these seven skills were generally greater than two. This result suggests that while graduates perceive that these skills are important to the department, none is perceived as being *very important* to the department. This perception is in contrast to the importance of these skills to graduates' jobs. The cohort currently in Ph.D. programs rated all skills at values of less than two, except mathematics. Both M.S. graduates currently employed and Ph.D. graduates currently employed rated all skills except mathematics and computation at two or less, emphasizing the importance of skills in their jobs. In fact, the mean numeric value for communication was rated *very important* (value of 1.07) by these two cohorts.

Statistical tests underscore the differences between the importance placed by the department on skills and the importance of skills to the graduates' jobs. All graduates agreed that critical judgment, communication, and creativity were more important to their jobs than they were to the department in its graduate programs. M.S. graduates currently employed also felt that application was more important to their jobs than it was in the department's graduate program. However, M.S. graduates currently employed felt that mathematics and computation were less important to their jobs than they were in the department's graduate programs.

### Rankings of Curriculum and Content

Graduates were also asked to provide rank orderings for the curriculum components and the elements of content. Tables 5 and 6 present the mean rank orderings that resulted. A number of respondents found that providing rankings was difficult. A common response was: "It is difficult to assign a ranking of 6 or 7 to something I feel is important." Thus, a number of individuals did not complete the rank orderings, a situation that is reflected in the reduced number of observations. The rank orderings for curriculum components (table 5) show general agreement between the importance that graduates perceived was placed by the department and the importance that they felt should be placed on different components. However, the larger magnitudes for some components reflect greater variability in rankings by respondents. Similar results were found for areas of knowledge (table 6).

The results for skills in table 6 are interesting. Recall from above that communication was rated as *very important* by nearly all respondents. How-

Table 3. Importance That Is Placed on Areas of Knowledge and Importance That Should Be Placed on Areas of Knowledge

Area of Knowledge	M.S. Graduates Currently Employed (n = 28)			Ph.D. Graduates Currently Employed (n = 14)		
	Importance		Difference	Importance		Difference
	Is	Should Be		Is	Should Be	
Economic theory	1.27	1.57	0.14 (0.31)	1.50	2.14	-0.64 (-2.54)*
Econometrics	1.45	1.43	-0.29 (-1.00)	1.25	2.57	-1.32 (-4.94)*
Institutions and history	4.00	3.29	0.57 (1.33)	3.86	3.54	0.32 (1.27)
Economic literature	3.18	1.71	1.14 (4.38)*	3.46	3.21	0.25 (0.84)
Applications and policy issues	2.45	2.14	-0.14 (-0.55)	2.54	1.93	0.61 (2.08)*
Empirical economics	1.64	1.29	0.43 (1.16)	1.59	2.07	-0.48 (-2.16)*

Numbers under the columns labeled "Importance Is" and "Importance Should Be" are mean ratings. Numbers in parentheses are t-statistics for the differences between means.  
\*Indicates the value is statistically different from zero at the 5% level of significance (one-tail test).

Table 4. Importance That Is Placed on Skills and Importance That Should Be Placed on Skills

Skill	M.S. Graduates Currently Employed (n = 28)			Ph.D. Graduates Currently Employed (n = 14)		
	Importance		Difference	Importance		Difference
	Is	Should Be		Is	Should Be	
Critical judgment	2.50	1.43	1.43 (3.87)*	2.18	1.39	0.79 (4.35)*
Analytics	2.00	1.57	0.43 (1.00)	1.68	1.57	0.11 (0.55)
Application	2.20	1.86	0.29 (0.79)	2.21	1.71	0.50 (1.93)*
Mathematics	2.10	2.71	0.00 (0.00)	1.86	3.57	-1.71 (-7.89)*
Computation	2.00	2.29	0.71 (1.70)	2.04	2.57	-0.54 (-1.75)*
Communication	2.70	2.43	0.86 (2.12)*	2.54	1.07	1.46 (7.48)*
Creativity	3.10	2.29	0.71 (1.98)*	2.93	2.00	0.93 (3.48)*

Numbers under the columns labeled "Importance Is" and "Importance Should Be" are mean ratings. Numbers in parentheses are t-statistics for the differences between means.  
\*Indicates the value is statistically different from zero at the 5% level of significance (one-tail test).

**Table 5. Rank Orderings of Importance That *Is* Placed on Curriculum Components and Importance That *Should Be* Placed on Components**

Curriculum Component	M.S. Graduates Currently Ph.D. Students (n = 6)		M.S. Graduates Currently Employed (n = 22)		Ph.D. Graduates Currently Employed (n = 5)	
	Importance <i>Is</i>	Importance <i>Should Be</i>	Importance <i>Is</i>	Importance <i>Should Be</i>	Importance <i>Is</i>	Importance <i>Should Be</i>
Microeconomic theory core courses	1.50	1.33	1.65	2.22	1.63	2.00
Econometric and quantitative methods core courses	1.67	2.33	1.52	2.17	1.63	2.50
Qualifying examinations	4.17	5.67	3.61	5.26	3.63	5.13
Department field courses	3.67	3.00	4.43	3.48	3.75	3.63
Elective Courses	6.00	5.67	5.87	4.09	6.00	4.00
Thesis dissertation research	3.67	3.33	3.74	3.74	3.38	3.00
Departmental seminars	6.83	6.00	6.65	6.17	6.75	5.63

Numbers are the mean rank orderings.

ever, when providing a ranking of what the importance *should be* in the department's graduate programs, communication does not occupy the top spot. Instead, communication ranks last for those currently in Ph.D. programs, fourth for M.S. graduates currently employed, and second for Ph.D. graduates currently employed. These results may reflect the opinion by graduates that the development of skills may not be the most important responsibility of the graduate programs in resource economics.

### Summary and Conclusions

There are many ways that we might consider the relevance of graduate education in agricultural and resource economics. In this paper, the relevance of graduate training was considered for the graduate programs in the Department of Resource Economics at the University of Massachusetts. Through a survey of graduates, the importance of the department's programs to the jobs of graduates was evaluated.

**Table 6. Rank Orderings of Importance That *Is* Placed on Areas of Knowledge and Skills and Importance That *Should Be* Placed on Areas of Knowledge and Skills**

	M.S. Graduates Currently Ph.D. Students (n = 6)		M.S. Graduates Currently Employed (n = 23)		Ph.D. Graduates Currently Employed (n = 5)	
	Importance <i>Is</i>	Importance <i>Should Be</i>	Importance <i>Is</i>	Importance <i>Should Be</i>	Importance <i>Is</i>	Importance <i>Should Be</i>
Area of Knowledge						
Economic theory	2.33	2.50	1.95	2.04	1.60	1.80
Econometrics	1.83	2.33	1.52	2.70	1.80	2.80
Economic institutions and history	6.00	5.67	5.65	5.17	5.80	5.60
Economic literature	4.50	4.67	5.08	4.78	4.00	4.40
Economic applications and policy issues	3.67	3.17	3.78	3.30	3.20	2.80
Empirical economics	2.83	2.00	2.57	2.30	3.75	3.00
Skill						
Critical judgment	4.17	4.00	3.64	2.91	2.00	4.00
Analytics	2.00	2.00	1.77	1.91	2.20	2.20
Application	3.00	3.00	3.32	2.23	3.20	4.20
Mathematics	3.33	5.17	2.82	6.14	2.60	5.20
Computation	4.67	5.00	4.05	4.77	3.40	5.80
Communication	5.50	5.33	5.55	3.27	5.80	3.20
Creativity	4.83	3.50	6.18	4.73	6.40	4.80

Numbers are the mean rank orderings.

An immediate conclusion from surveying the department's graduates is that graduate education in resource economics is certainly relevant. The department does an exceptional job at preparing M.S. students for Ph.D. programs in economics and agricultural and resource economics. However, even M.S. graduates who go on to Ph.D. programs find that the applied content of the programs could be increased. The following written response from a graduate currently in a Ph.D. program confirms the survey results:

I am grateful for the degree to which the microeconomic theory courses were taught. After that good background, I was in good stead to take on the Ph.D. microeconomic core courses in my new program. The same can be said about the quantitative methods core courses. With regard to the Department field courses, if they require some reshaping, I think a move to make them more applied can go a long way.

Another graduate wrote:

The Department did a fine job preparing me to continue at the Ph.D. level here at UC Davis. I felt coming into the Ph.D. program that I had a distinct advantage in microeconomic theory, econometrics/statistics, and how to conduct research. I received excellent mentoring in my thesis research from the professors on my committee and found that all of the professors in the Department were not only accessible, but interested in helping as well. One area that I believe many programs could benefit from spending more time on is that of private sector employment preparation. . . . This is by no means a shortcoming of the UMass program, but rather an area of focus where most academic agricultural and resource economics department[s] could spend more effort.

Other graduates currently in Ph.D. programs wrote similar comments. The kinds of courses taught at UMass provide excellent preparation for further study, especially in microeconomics, econometrics, and quantitative methods.

Components of the department's graduate curriculum were also rated better than *somewhat important* by those who are employed, with the exceptions of qualifying exams and departmental seminars. Graduates who are employed felt the department placed too much importance on microeconomic theory, econometrics and quantitative methods, and qualifying exams. These graduates also felt too little importance was placed on elective courses. Again, written comments confirm the survey results. For example, one graduate wrote:

Many careers in the private sector have less need for advanced micro courses, multi-market equilibrium, etc. And while I have longed for an opportunity to evaluate a bordered Hessian in real life, alas, none have arisen. . . . I do value my grounding in quantita-

tive methods and think the Department did an excellent job . . . I would steer the choice of outside electives to the School of Management for a more marketable balance in course work.

Another wrote:

An economics graduate has to work harder to land a job in many industries than an MBA does. The irony is that most economics graduates are better real world problem solvers than MBAs. Even though we don't like to think we compete with MBAs, the fact is that we do. I would advise new graduates to develop a marketing strategy that leverages their training in economics, but that gives them a unique advantage over MBA training.

It is interesting that both groups of graduates from the department's M.S. program agree on the need for additional applied content in the program and that both suggest the need to consider the types of analyses and problems addressed by economists in the business world. These comments are consistent with those of the faculty member who suggested that the department's emphasis on theory has gone too far and that we may not prepare students for jobs in the business world. The department does an excellent job of training students to go on to Ph.D. programs, but these skills may not be exactly what students interested in terminal M.S. degrees need for private employment. While the faculty agree, on average, with the assessment that the department places too much emphasis on microeconomic theory and econometrics and quantitative methods, the faculty did not agree with increasing the importance on Elective Courses. It is difficult to encourage students to look elsewhere to satisfy degree requirements when we have seen recent decreases in numbers of applicants to the department's graduate programs and when university pressure on class size has increased.

The survey results for areas of knowledge follow those of the graduate curriculum quite closely. The graduate curriculum reflects many of these areas of knowledge, as would be expected. Again, the survey results support the importance or relevance of areas of knowledge to the graduates' jobs, with two exceptions: economic institutions and history and economic literature. It again appears that the cohort of graduates currently in Ph.D. programs identified most closely with the importance placed by the department on areas of knowledge. M.S. students who are employed found that too much importance is placed on economic theory, econometrics, and empirical economics. Both M.S. and Ph.D. graduates who are employed felt that too little importance is placed on applications and policy issues. Interestingly, the depart-

ment faculty, on average, agree with these assessments.

The skills enumerated in the survey were all important to the graduates. All were rated quite highly in importance, except mathematics! The faculty agreed, on average, rating skills high in importance but with mathematics receiving the lowest rating. Graduates felt that the importance placed on communication, creativity, critical judgment, and application should be increased; the department faculty agreed with this assessment also.

We might draw distinctly different conclusions from the results presented above. Those fond of theory and methods can find support in the finding that these components of our curriculum are indeed relevant to our graduates as a whole. Alternatively, we might view the results as a mandate to reduce the theoretical, mathematical, and empirical content of our curriculum, replacing it instead with applied elements focusing on policy and application. A healthy dose of applied business topics might be thrown in to bolster the curriculum. My preference falls in the middle. We focus on teaching a strong base of microeconomic theory, econometrics, and quantitative methods because that is where our strengths lie. We are trained in those areas, and those are the areas in which we are most adept at imparting knowledge to others. Robert Solow provided a candid explanation for the focus in graduate education:

I suspect that the reason we emphasize theory and econometrics and focus on developing our students' analytical and mathematical skills is because that is what we know how to do reasonably well. If I knew how to teach creativity and critical judgement, I guess I would do it. I know how to recognize them all right, and can even offer examples. But, that is far from being able to teach them. (1990, p. 449)

We must realize that the curriculum in resource economics at UMass serves both M.S. students who may move on to Ph.D. programs and those for whom the M.S. is a terminal degree. This causes some problems, as the needs of these two cohorts are somewhat different. However, the results suggest that while there are things we can do to improve the relevance of our curriculum, wholesale changes are not required. Additional applications can be included in microeconomic theory courses, making better use of our applied journals in teach-

ing. Applications utilizing econometric and quantitative methods are of obvious value to any econometrics course. In many cases, the applied content of courses can be improved with little disruption of the course format.

In general, asking graduates from the department's programs their opinions was a gratifying experience. Most graduates expressed appreciation to the department faculty, emphasizing the importance of their devotion to teaching and to the students. Many found the sense of community that exists between students and faculty extremely important during a challenging graduate program. For example, one student who was quite dissatisfied with the strong neoclassical focus of the program had this to say:

I found the graduate program in Resource Economics to be fully committed to quantitative methods and a particular branch of economic theory, namely a neo-classical Euro-centric tradition . . . I found the Department's claim to "science" pretentious and its quantitative methods occupying a place of fourth—after the well known trilogy of 'lies, damned lies, and statistics.' . . . Despite all this, I have a genuine affection for the faculty, students and staff of the Department. Those personal relationships have sustained me more than any of the Department's academics.

When we ask how relevant our graduate training is, we need to remind ourselves that through our graduate programs we have the opportunity to affect our students in many ways.

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