

THE IMPACT OF ECONOMIC CONDITIONS IN AGRICULTURE ON STUDENT ENROLLMENTS

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ABSTRACT

Results of correlation and regression analyses suggest that freshmen enrollments in some agricultural disciplines are significantly impacted by changes in financial conditions in agriculture. The existence of programs which are complementary with respect to enrollment patterns due to changes in agricultural income help dampen the effects of swings in income.

Declining enrollments in agricultural related curricula have been a continuing concern of administrators and faculty in U.S. colleges of agriculture. Continuing declines can cause budgets to decline, weaken resident instruction programs, and have serious implications for quality and status considerations. In addition, fewer students enrolled in college of agriculture curricula could cause a decline in the availability of trained agriculturalists, and perhaps faculty, to properly train future students. One factor which may have impacted student enrollments in colleges of agriculture, as well as enrollments in selected curricula within colleges of agriculture, has been the recent financial stress facing the agricultural industry. Testing this hypothesis is the basic purpose of this paper.

The specific objectives of the paper are to analyze the effect of variations in income in the agricultural sector on freshmen enrollments (1) in the College of Agriculture at the University of Wyoming and (2) in specific curricula within the College. The specific curricula that will be examined are agricultural business management, farm and ranch management, animal science and range management. Freshmen enrollments were used, rather than total enrollments, since these data should reflect enrollment patterns for the entire four-year undergraduate program period.

Data and Procedures

Freshmen enrollments in the College of Agriculture and in the agribusiness management, farm and ranch management, animal science and range management curricula are depicted in Figures 1 through 3. These data were provided by the College's Director of Resident Instruction. During the period 1970-1988, College of Agriculture freshmen enrollment reached a peak in 1980 (168 students) and declined to a low of 79 students in 1986. Subsequently, freshmen enrollments in the College increased in both 1987 and 1988.

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Freshmen enrollments in the agribusiness management curriculum show substantial variation, ranging from four students in 1976 to 25 in 1980 and 1982. Over the period of analysis, farm and ranch freshmen enrollment was highest in 1976 (24 students) and has trended downward to a low of one student in 1988.

During the period of analysis, freshmen enrollments in animal science ranged from five in 1985 to 24 in 1970. Since 1985, enrollments in the animal science curriculum have rebounded slightly, reaching 17 students in 1988. Freshmen enrollments in range management, during the period 1970-1988 ranged from four in 1972 to 22 in 1981.

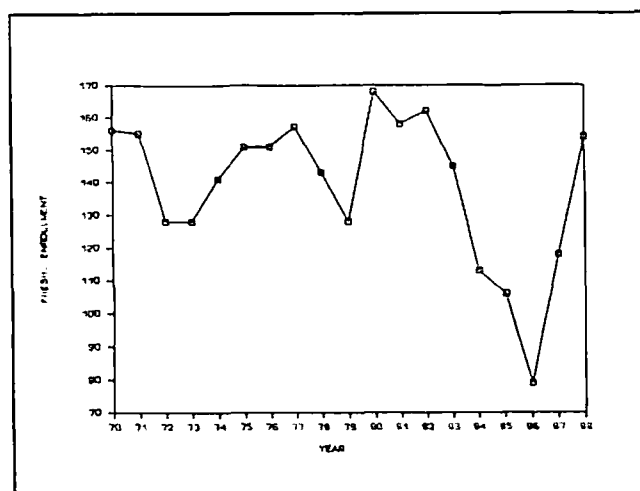


Figure 1. Freshmen Enrollment, College of Agriculture, University of Wyoming, 1970-1988.

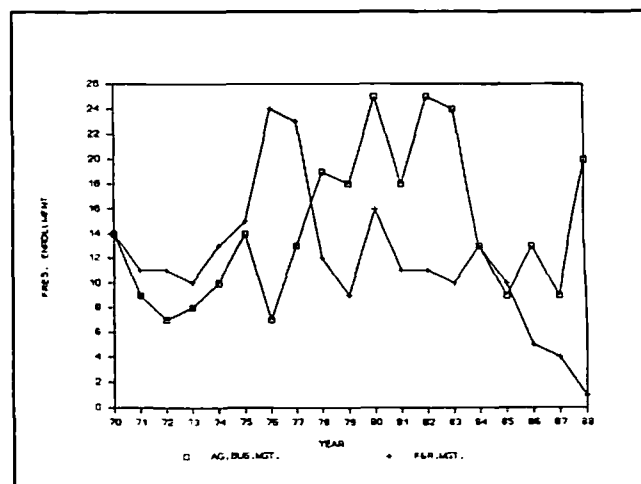


Figure 2. Freshmen Enrollments in Agricultural Business Management and Farm and Ranch Management, University of Wyoming, 1970-1988.

For the period 1970-1987, deflated (deflated using the GNP implicit price deflator) Wyoming net farm/ranch income ranged from \$42.9 million in 1983 to \$130.8 million in 1973 (Wyoming Agricultural Statistics). The mean deflated net farm/ranch income is \$25.5 million, with a standard deviation of \$45.8 million. Thus, variation in income is quite substantial. The lagged four-year moving average of deflated Wyoming net farm/ranch income is presented in Figure 4.¹

Given the variation in income, it is probable, particularly with the very low levels of income which existed during the period of analysis, that the decision made by freshmen to enter a College of Agriculture curriculum could be affected. In particular, there are two reasons why enrollments could be affected. First, low farm incomes may be seen as a signal of limited opportunity -- especially for those students who plan to enter production-level agriculture. Second, low farm income may affect the financial ability of students from farm and ranch families to be able to afford a college education. To the extent the College of Agriculture, in comparison to other colleges, is more likely to draw from this particular pool, enrollments in the College could be impacted significantly.

The potential sensitivity of enrollments and choice of major to changes in Wyoming's agricultural income would

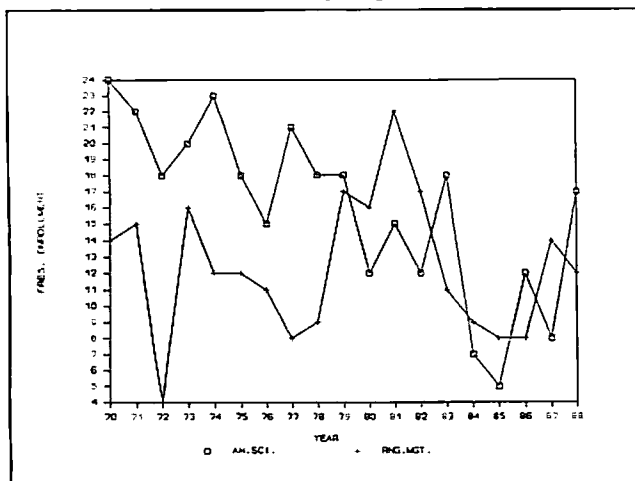


Figure 3. Freshmen Enrollments in Animal Science and Range Management, University of Wyoming, 1970-1988.

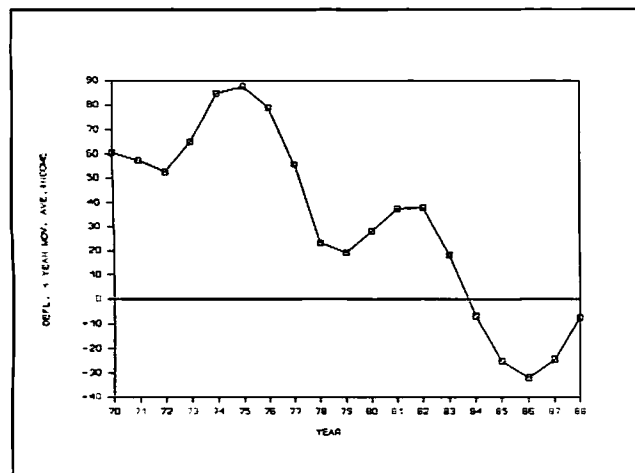


Figure 4. Deflated Four Year Moving Average Wyoming Net/Farm-Ranch Income, 1970-1988.

likely be influenced by where the students come from and/or where they tend to reside after graduation. For example, if all students in the analysis were from outside Wyoming and/or if all of the students planned to seek careers somewhere other than Wyoming, then Wyoming net farm income may not be the most appropriate independent variable. Instead, national net farm income may be more appropriate. However, such dynamics do not appear to be at work. Specifically, 77 percent of the undergraduate majors in the College of Agriculture at the University of Wyoming in 1986 were Wyoming residents (unpublished data from the College's Director of Resident Instruction). Additionally, a 1986 survey of all alumni from the Department of Agricultural Economics (undergraduate plus graduate student alumni) indicates that 58 percent of the Department's alumni were still residing in Wyoming (Purdy).

As noted above, it could be hypothesized that enrollments in certain types of majors are potentially affected to a greater degree by changing economic conditions in the farm/ranch sector, i.e. those particular majors having a higher proportion of students intending to pursue farm/ranch employment upon graduation. To estimate the extent of difference among curricula (regarding intentions to seek farming/ranching careers), data concerning "major" and "career plans" were summarized from records of students enrolled in two selected courses (Ag Econ 460 - Farm and Ranch Records; and Ag Econ 461 - Farm and Ranch Management) at the University of Wyoming over a 12-year period (1977-1989). The summary is from students in these two classes who were majoring in the four different curricula under analysis: farm and ranch management, agricultural business, animal science and range management. Ag Econ 460 and 461 are required for farm and ranch management majors, and Ag Econ 461 is also required for range management students. Conversely, agricultural business and animal science majors have typically selected these courses for elective requirements.

For each of these majors, student responses regarding future career plans were categorized between those who appeared to be certain about seeking farm/ranch types of careers, versus those who were either undecided or definitely not interested. As summarized below, the proportion of students having definite plans to seek farming/ranching careers appears to vary widely by curriculum.

	Farm & Ranch Management	Agricultural Business	Animal Science	Range Management
Student respondents	138	193	116	89
Number (%) of students with definite plans to pursue farm/ranch types of careers	106 (77%)	43 (22%)	62 (54%)	10 (11%)

Not surprisingly, a high percentage of students majoring in farm and ranch management have corresponding career interests. In addition, a significant percentage of animal science majors appear to have aspirations for farm/ranch

¹ The four-year moving average is calculated using lagged net farm/ranch income, i.e., deflated income lagged one year + ... + deflated income lagged four years, all divided by four. This is essentially a lagged moving average of income.

Table 1. Simple Correlation Coefficients Between Freshmen Enrollments in the College of Agriculture, Agribusiness Management, Farm and Ranch Management, Animal Science and Range Management and Deflated Income Measures, University of Wyoming, 1970-1988.*

Deflated Wyoming Net Farm/Ranch Income	College of Ag.	Ag. Bus. Mgt.	F&R Mgt.	Animal Sci.	Range Mgt.
Current	0.036	-0.380	-0.020	0.551*	0.088
1 Year Lag	0.385	-0.199	0.120	0.658*	0.360
2 Year Lag	0.610*	-0.103	0.456*	0.597*	0.279
3 Year Lag	0.590*	-0.217	0.741*	0.566*	0.108
4 Year Lag	0.433*	-0.193	0.808*	0.567*	-0.191
Lagged 4-Yr Moving Average	0.616*	-0.216	0.645*	0.745*	0.170

* An asterisk (*) represents correlation coefficients which are significantly different from zero at $\alpha = 0.10$.

types of careers, although this proportion may be unrepresentative of all animal science majors because the animal science students in Ag. Econ. 460 and 461 apparently have at least a passing interest in farming and ranching in having taken these courses on an elective basis. Conversely, relatively low proportions of agricultural business and range management majors are not particularly surprising, since their curricula are designed primarily for non-farm/ranch types of careers. To the extent that farm and ranch management and animal science majors appear to have more students directly linked to farming and ranching, it is possible that they and other majors with similar student profiles may find their enrollments to be more sensitive to changes in expected agricultural income over time.

To further test the relationship between enrollments and the financial condition in agriculture, simple correlation coefficients relating lagged deflated Wyoming net farm/ranch income and a lagged four-year moving average of income with freshmen enrollment data are calculated and reported. To determine the magnitude of a change in deflated net farm/ranch income on freshmen enrollment in the College of Agriculture as well as each of four separate curricula, a single variable regression equation is estimated. Lagged and moving average income data are used rather than current year data as they should better reflect the financial circumstances which existed when the decision regarding a major was made by potential students. This is partially confirmed by the correlation coefficients in Table 1.

Results

The results of a correlation and regression analyses are reported below for a selected 19-year period (1970-1988).

Correlation Analysis

Correlation coefficients are reported in Table 1. Statistically significant relationships exist between lagged deflated income and freshmen enrollments in the College of Agriculture, farm and ranch management and animal science. Correlation coefficients of 0.616, 0.645 and 0.745 are exhibited between the lagged four-year moving average of deflated income and freshmen enrollments in the College of Agriculture, farm and ranch management and animal science, respectively. Thus, reasonably strong positive linear relationships exist between Wyoming net farm and ranch income and freshmen enrollments in these selected agricultural curricula, as well as in the College of Agriculture.

Freshmen enrollment in the College of Agriculture is most strongly correlated with a two-year lag in deflated Wyoming net farm/ranch income, ($r = 0.610$). For animal science enrollments, the strongest linear relationship is also with the lagged four-year moving average ($r = 0.745$). Freshman enrollment in the farm and ranch management curriculum is most strongly correlated with a four-year lag in deflated Wyoming income ($r = 0.808$).

The correlation coefficients relating net farm/ranch income and freshmen enrollments in agribusiness management and range management are relatively small, and not significant, suggesting that there is not a strong linear relationship between income and enrollment in these curricula. It is interesting to note that the relationship between enrollment in agribusiness management and income is consistently negative, although not significant. That is, if income goes up (down) enrollment in this curriculum declines (increases). In this respect, the farm and ranch and agribusiness curricula (program areas within the Department of Agricultural Economics), complement each other and may not compete for students. Given the data relating curricula and career intentions of students, these relationships may be expected.

In summary, freshmen enrollments in some programs in the College of Agriculture at the University of Wyoming can be expected to be impacted by changes in the financial condition in the state's agricultural industry. This is particularly evident in programs which are more directly related to production agriculture, such as farm and ranch management and animal science. On the other hand, enrollments in agribusiness management and range management curricula are not significantly influenced by changes in financial conditions in agriculture.

Regression Analysis

To obtain estimates of the magnitude of the effect of changes in deflated net farm/ranch income on freshmen enrollments, a regression analysis was conducted. Estimated regression coefficients and summary statistics for deflated income lagged two, three and four years and a lagged four-year moving average are reported in Table 2. Of course, the relationships and the overall explanatory power of the regression results are identical to the findings from the simple correlation analysis.

As gleaned from the correlation analysis, freshmen enrollments in the College of Agriculture and in the farm and

ranch management and animal science curriculum are directly and significantly related to lagged Wyoming net farm/ranch income. Freshmen enrollment in the agribusiness management curricula is negatively, although not significantly, related to lagged income. Additionally, enrollment in range management is not significantly related to financial conditions in agriculture.

Results of the regression analysis were extended further to estimate the percent impact on freshmen enrollment of a 10 percent change in the lagged Wyoming net farm/ranch income (Table 3). Results of this analysis indicate that a 10 percent increase in deflated net farm income will be accompanied by a 1-3 percent increase in future freshmen enrollment in farm and ranch management. Future freshmen enrollment in animal science would be expected to increase by 1-2 percent, given the same level of increase in deflated net farm income. Future college-wide freshmen enrollment would also be expected to increase, but the percentage magnitude of the increase could be expected to be much smaller.

Summary and Conclusions

The purpose of this paper was to analyze the effects of financial conditions in the agricultural sector on freshmen enrollments in the College of Agriculture and four selected agricultural related disciplines. Majors within the College of Agriculture which have a high proportion of students intend-

ing to pursue farm/ranch employment after graduation might be expected to be most affected by changing economic conditions in the agricultural production sector.

Results of correlation and regression analyses suggest that freshmen enrollments in some agricultural related programs are impacted by changes in the financial condition in agriculture, as measured by lagged deflated net farm/ranch income. As a result, enrollments in the College of Agriculture as a whole are also affected. Some of the effects in total College enrollment are abated due to the presence of programs which are either not affected by income in agriculture or may, in fact, exhibit enrollment patterns counter to financial conditions in agriculture.

Enrollments in curricula which are more directly related to production agriculture, such as farm and ranch management and animal science, are most affected by changes in income in the farm/ranch sector. Conversely, enrollments in agribusiness management and range management are not significantly influenced by changes in economic conditions in agriculture. In fact, enrollments in agribusiness management, although not significant, are inversely related to income from agriculture.

The results of this study suggest that programs which are complementary with respect to enrollment patterns due to changes in farm/ranch income help dampen the overall effects of large swings in farm and ranch income levels. While this is a fairly intuitive conclusion, it has likely not

Table 2. Coefficient Estimates and Summary Statistics, Regression Analysis Relating Freshmen Enrollment and Deflated Lagged Net Farm/Ranch Income (\$M).

Variable	Estimated Coefficients and Summary Statistics				
	College of Ag.	Agribus. Mgt.	Farm and Ranch Mgt.	Animal Science	Range Mgt.
Intercept	130.121 (25.529)*	14.732 (8.338)	10.120 (7.261)	13.88 (11.324)	11.607 (10.020)
Income lagged 2 years	0.303 (3.174)	-0.014 (-0.429)	0.055 (2.114)	0.070 (3.067)	0.026 (1.198)
R ²	0.372	0.011	0.208	0.356	0.078
Intercept	129.416 (24.041)	15.291 (8.509)	8.804 (8.081)	13.76 (10.540)	412.037 (9.686)
Income lagged 3 years	0.288 (3.012)	-0.029 (-0.918)	0.088 (4.554)	0.066 (2.828)	0.010 (0.451)
R ²	0.348	0.047	0.550	0.320	0.012
Intercept	130.482 (20.449)	15.342 (7.956)	7.953 (7.792)	13.356 (9.582)	13.059 (9.968)
Income lagged 4 years	0.224 (2.037)	-0.027 (-0.812)	0.099 (5.659)	0.068 (2.840)	-0.918 (-0.805)
R ²	0.196	0.037	0.653	0.322	0.037
Intercept	127.023 (22.554)	15.477 (8.028)	8.684 (6.527)	12.602 (10.764)	11.748 (8.890)
Lagged 4 year Moving average	0.372 (3.226)	-0.036 (-0.914)	0.095 (3.481)	0.104 (4.334)	0.019 (0.712)
R ²	0.380	0.047	0.416	0.525	0.029

* t-statistic reported in parentheses.

Table 3. Percent Impact of a 10 Percent Change in Deflated Wyoming Net Farm/Ranch Income on Freshman Enrollment at Mean Values, 1970-1988.

	Percent Change in Freshmen Enrollments from a 10 Percent Change in:			
	Income Lagged 2 Years	Income Lagged 3 Years	Lagged Moving 4 Years	Av. Income
College of Ag. Agribusiness	0.64	0.69	0.61	0.86
F&R Mgt.	1.38	2.50	3.22	2.61
Animal Sci	1.29	1.38	1.63	2.11
Range Mgt.	—	—	—	—

* Percent impact was not calculated in cases where the regression coefficient was not significantly different from zero at $\alpha = 0.10$.

been explicitly recognized. This information can be important in planning new programs and recruitment strategies in Colleges of Agriculture.

With respect to the analysis in this study, some caution needs to be exercised in drawing conclusions from the single variable analysis. Certainly, additional variables (other than income from agriculture) including employment potential after graduation, the amount of information available to the student at the time a decision is made regarding a major, the influence of parents and peers, etc. are important in the decision-making framework. In addition, the downward trend in income over the period of analysis in this study may be picking up the influence of other trend-related factors such as overall appeal of a particular subject area. An example of this might be biotechnology and the effects of interest in this topic on student enrollments in a biochemistry program. Nevertheless, it is reasonable to suggest, as supported by the results of this study, that income in production agriculture may be an important factor in deciding whether or not to attend college; and is almost certain to be an important factor in a student's choice of a particular major.

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A NATIONAL ASSESSMENT

Faculty Development Needs in Colleges of Agriculture

Coby Bunch Simerly

This article presents the findings of a national survey which tapped the perceptions and views of agricultural faculty regarding their needs in five areas: (1) faculty development programs, (2) faculty responsibilities, (3) teaching, (4) faculty support, and (5) academic-private sector relationships. The study reveals that a majority of the faculty are interested in faculty development programs and in gaining new knowledge and skills which will enable them to be more effective in their teaching, research, and public service roles. The investigators recommend a number of steps for creating an environment which promotes and supports continued growth and development of agricultural faculty.

Through their educational and research programs, colleges of agriculture have strong traditional ties with food and fiber producers and agribusiness. Never before in our history have these relationships been more important. United States agriculture today faces the challenges of participating in a world-wide, competitive, high-technology food system. Significant scientific and technological advances enable us to make a major impact on world agriculture. Therefore, it is imperative that the educational and research programs in our colleges of agriculture stay at the forefront of this science and technology.

Faculty members are an essential resource component of the agricultural education system. Their teaching, research, and continuing education activities generate and transfer new technology, develop additional human resources, and thereby increase the value and human assets of U.S. agriculture. Faculty must be scientifically and technologically current, highly effective and productive, and innovative in their teaching and research if we are to remain competitive and continue our role as world leader in agriculture.

The need for greater attention to faculty development, renewal and redirection in teaching and research is clearly evident. Recognizing the significance of these issues to the future of agriculture, the United States Department of Agriculture Higher Education Programs made funds available for a comprehensive research project to investigate faculty development initiatives for instructional enhancements involving industry and education. As a result, a research

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