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The Productivity Effects of Extension Appointments in Land Grant Colleges

By

Jeremy D. Foltz and Bradford L. Barham

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Jeremy D. Foltz and Bradford L. Barham[1]

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Abstract:
A key piece in understanding the link between the extension and research missions of Land Grant universities is to understand the role of faculty with (and without) extension appointments within agricultural colleges. This article provides a comparative empirical portrayal of the primary activities of agricultural college faculty, and demonstrates the basic vitality of extension professors within the Land Grant system. Professors with smaller extension appointments are heavily engaged in the major research efforts of their universities at even greater levels of production than professors without extension responsibilities. Professors with heavy levels of extension appointments experience increasing tradeoffs between core extension activities and research outputs and graduate training. Professors with no extension appointments engage substantively in extension activities and frequently have links to core extension clientele.

[1] The authors are associate professor and professor of Agricultural & Applied Economics at the University of Wisconsin-Madison. This project was supported by the National Research Initiative of the Cooperative State Research, Education and Extension Service, USDA, Grant # 2004-35400-14937, and a Hatch grant through the University of Wisconsin. The authors would like to thank participants at the NC-1034 meeting in Washington DC, the INSITE conference at UW-Madison for comments and Jessica Goldberger, Mark Cooper, and Benjamin Schwab for work with the data.

The Productivity Effects of Extension Appointments in Land Grant Colleges

Over the past several decades, much attention has been paid to reconsidering the role and function of Cooperative Extension in land grant universities (Hoag, 2005; Ilvento, 1997; National Research Council, 1995; Peters, 1995; and Wolf and Zilberman, 2001). Budgetary pressures, an expanding scope of thematic activities, a decline in the relative importance of agriculture, growing private extension services, and demands for better integration of research and extension have received considerable attention in the literature. While many changes in organizational form and direction have been discussed, relatively little attention has been paid to the actual work of "state specialists" – that is, faculty with extension appointments – in the Land Grant system. State specialists are the intellectual cutting edge of the Cooperative Extension system (Woeste, Waddill, and Arrington, 2005; Radhakrishna, 2001), and who they are, how they perform in both research and extension, and how they compare to non-extension faculty is a key piece of information in analyzing the organizational structure of Cooperative Extension.

Faculty with extension appointments make up approximately one-quarter of the total faculty in agricultural colleges. In principle, they are more connected to farmers and the stakeholders of the college than other research and teaching faculty members. These stronger connections come both from their more explicitly applied orientations and more frequent contacts and work with stakeholders that are part and parcel of their appointment. Yet, while they fulfill this vital link, one hears the impression that professors with extension appointments may be divorced from their respective disciplines, less productive in non-extension activities than their colleagues, and in some

places increasingly marginalized players in agricultural colleges, especially where life science research, teaching, and commercialization activities have ascended.

Are extension professors actually different from other professors in terms of who they are or what they produce? Do extension professors have different productivity levels in research and teaching activities than their non-extension colleagues? What are the tradeoffs associated with various research, teaching, and extension activities, and how do they vary by the degree or extent of extension appointment? Answers to these questions helps to shine light on the actual and potential role for extension professors within agricultural colleges, and may help to inform broader discussions regarding the role and function of extension activities.

Using unique survey data collected in 2005 from a random sample of 1,000 agricultural college faculty members at all 1862 US Land Grant universities, this article addresses some basic empirical questions concerning faculty with extension appointments. The data include a mix of faculty with a wide range of extension appointments and a majority without any formal extension appointment, which permits a comparison in terms of demographic origins, appointment rank, grantsmanship, and productivity in research, teaching, and extension activities.

Overall, the evidence suggests that differences between extension professors and others in agricultural colleges may be much smaller than commonly perceived in agricultural college circles. We show that the average faculty member with an extension appointment has about the same productivity level as non-extension faculty across the full range of academic activities, while at the same time the average faculty member with no extension appointment engages in a substantive amount of extension activity. We also

find considerable heterogeneity among extension personnel with, in particular, a non-linear effect of the percentage of extension time in a faculty's appointment on most output variables. The non-linear effect suggests that for the output measures at hand faculty with moderate amounts of extension responsibilities tend to be more productive than those with no extension responsibilities as well as those with very heavy extension responsibilities. The work concludes with a discussion of the implications of our findings for faculty appointments and the role of state specialists in Cooperative Extension.

Literature on Extension:

A relatively large literature on the extension system explores how it can best deliver its message to the public, how to measure the effects of that message, and how to preserve the system in the face of mounting social, intellectual, and budgetary challenges. To our knowledge, no literature directly examines the academic productivity of extension faculty at land grant universities.

One major line of economic research on extension studies the efficiency and quality of extension services. This literature explores how extension services respond to the demand for information that comes from their clientele (see e.g., Dinar, 1986, 1989; Frisvold et al. 2001). Most of the analysis is done at a state or country level using a supply and demand framework to understand the factors influencing the "market" for extension services. Here extension demand is in part viewed as an endogenous

outgrowth of the supply of information whereby regular information provision produces a constituency to demand more information of that particular type.[2]

A second line of economic research explores the impacts of extension activities on the productivity of agriculture (see e.g., Shimmelpfennig et al., 2006; Huffman and Evenson, 2003). These works have either imputed the effects of extension through measures of spillovers from agricultural research or used direct measures of extension expenditure. Typically, estimates of technical and allocative efficiency are derived through some type of frontier production or cost function analysis, with a special focus on how estimates vary with different levels of extension spending. These studies generally find high returns to extension funding, providing supportive evidence that extension activities are an important conduit for research to the agricultural production in a state. This is where state specialists fit into the system.[3] Despite broad evidence of the importance of this overall system, little is known about how best to organize the creation and dissemination of information, or particularly about how faculty outputs vary across different extension appointments.

While these first two lines of economic research provide supporting evidence on the broad effectiveness of extension services from Land Grant universities, including their attention to constituency demands, a parallel literature has worried explicitly about the efficacy and long-term viability of the public extension system. Recent examples include McDowell (2003) who analyzes how the "engaged" public university can recover

[2] A parallel literature, but beyond the scope of this work, primarily concerned extension activities in developing countries has investigated the efficiency and efficacy of different methods of extending information to key clientele.

[3] Different university and extension systems use different names for university faculty with extension appointments. In this work we use two terms: "faculty with extension appointments" and "state specialists".

public support. Both Hoag (2005) and Adelaja (2003) provide some economic principles that could be used to help preserve the extension system in the face of declining public (especially federal) support. In the general literature, a number of commentators describe how best to create the "engaged university" or to promote faculty doing engaged scholarship (see e.g., Irwin et al. 2004; Davis et al. 2007). While related to issues of the extension system, this literature also envisions the university professor engaging beyond the Cooperative Extension system and building stronger links with the public.

Within the agricultural economics field, the closest line of discourse to the analysis we pursue below comes from a now nearly 20 year-old debate between a number of leading agricultural economists about the role of extension appointments within a department.[4] A piece written by Shuh in *Choices* (1986) ignited this debate with subsequent responses by Bromley (1986) and Smith (1986). Much of the debate centered on whether departments and extension personnel in particular should engage deeply with disciplinary advances or focus primarily on more applied issues that come to them from their state constituents. Beattie and Watts (1989) responded to this debate by setting forth the principles for an effective extension program that did both, responding to disciplinary innovations while pursuing a sufficiently applied agenda to be valuable to constituent's issues. In the intervening 20 years, that split seems to have resulted in some some agricultural economics departments following a primarily disciplinary path, with others pursing a more applied and commodity focused path. The evidence presented below is weakly suggestive of the potential at the agricultural college level of the integrated path argued for by Beattie and Watts.

[4] Note that we are here concerned with extension appointments in the agricultural college as a whole rather than simply in agricultural economics departments. But we have not located a parallel literature in any of these other fields.

At the heart of this debate is the issue of trade-offs versus synergies between producing research outputs (disciplinary work) and extension outputs. This framing is similar to the question raised in Foltz, Barham and Kim, (2007) about synergies and tradeoffs between research products that are public goods (e.g., articles) and those that are commercial goods (e.g., patents). If there are synergies between research and extension outputs, as suggested by Beattie and Watts, then faculty who integrate research and extension could be more productive than those that specialize. If the tradeoffs are strong with more specialized faculty doing the individual activities more productively, then there could be an argument for specialization in which extension (or research) professors should be wholly focused on extension (or research) outputs. This article provides some evidence on those tradeoffs and or synergies between extension and research outputs, but only at the level of individual faculty members, not at the department, college, or Cooperative Extension system level. Nonetheless, the evidence is broadly suggestive of synergies over specialization.

Data Description

We derived the sampling population for this study from online faculty listings (accessed during September-October 2004) of full, associate, and assistant professors in departments typically associated with colleges of agriculture at the "1862" land-grant universities.[5] Our sampling frame included approximately 12,000 professors in the traditional crop and animal production sciences, environmental and natural resource sciences, agricultural social sciences, food and nutritional sciences, basic biological

[5] Because our sampling frame only contains members of the faculty ranks we are not measuring any of the extension work being done by academic staff. This is not intended to deny their importance in disseminating extension work, but the focus here is on faculty outputs.

sciences (e.g., biochemistry, genetics, molecular biology), and agricultural engineering at 53 universities. During February-April 2005, we sent an introductory letter and a series of four emails to a random sample of 1,963 individuals. The emails included instructions for participating in a survey entitled "Modern Agricultural Science in Transition: A Survey of U.S. Land-Grant Agricultural and Life Scientists." This web-based survey was designed as a replication and extension of the surveys used by Busch and Lacy (1983) and Buttel (2001; also see Goldberger 2001; Goldberger and Buttel 2001; Buttel and Goldberger 2002).

We excluded 181 individuals from the sample due to exit from research, death, retirement, unknown addresses, USDA-ARS employment, and non-agricultural departmental affiliations (e.g., family studies, human development, marine science). With a corrected sample of 1,782 agricultural scientists and 1,027 completed surveys, we obtained a 57.6 percent response rate. Because of the high quality sampling frame and a response rate of nearly 60 percent, we are confident that the sample of agricultural scientists is representative of the total population of professorial-rank individuals engaged in active research and extension in agricultural colleges in US land-grant universities.

Measuring Professor Output

The objective here is to examine the scholarly activities of extension professors through a comparative analysis of agricultural college professors with appointments that range from 0 to 100% extension. While the typical research and teaching appointment has standard measurements of output: journal articles, teaching evaluations, students advised and PhD's produced, the standards of measurement for evaluating extension output are

arguably less clear. Our approach here is to provide information on each of the various outputs that professors might produce, their relative production levels, and tradeoffs or synergies that might appear between them. For the most part we can only measure quantities of output rather than the actual quality of that output. It is often the case that quantity and quality go hand in hand, but there are obviously circumstances and certain types of outputs in which there may be real tradeoffs in quantity and quality. We try not to put values on one output over the other, but leave it to the reader to choose which outputs they might think are most important.

The measures of output we use are journal articles, extension bulletins, presentations to extension audiences, presentations to academic audiences, and masters and PhD students produced.[6] We must emphasize that the measures we present here are only some portion of all the output of a faculty member. This is especially true of extension outputs, which could be expanded to include a variety of forms of software/data services, consultation, collaboration, and leadership activities beyond those captured by bulletins and presentations. We investigate these measures across the different levels of extension appointments, which for most of the analysis we divide into the following categories: 0, 0-10%, 10-20%, 20-40%, 40-60%, 60-75%, 75-100%.

Overall, 29% of the sample of agricultural college professors has a formal extension appointment. Table 1 shows a relatively uniform distribution of appointments by extension percentage, with a little under 50% of the extension faculty with extension appointments under 40%, another 34% in the 40-75% appointment range, and 18% in the

[6] We do not explicitly measure teaching output except in the form of graduate students, because it is in most cases prescribed by contract. That is most professors teach the number of classes or credit hours they are required to teach, with the major differentials being the hard to measure quality differences in those contact hours with undergraduates.

75-100% range. While we use the extension percentage as a determinant of professorial output, it is worth acknowledging that it could be endogenous to those outputs in the later stages of a faculty member's career. It could be that as professors produce more extension outputs their extension appointments expand, or visa-versa with research outputs. This is more likely to be the case among associate and full professors who may have requested or accepted changes in their appointments for a variety of reasons.

Table 1
Extension appointment percentages in the sample

Extension Percentage of formal appointment	Number of respondents	% of total sample	Percent of Extension personnel
zero	616	71.0%	
0<x<=10	60	6.9%	23.8%
10<x<=20	30	3.5%	11.9%
20<x<=40	34	3.9%	13.5%
40<x<=60	38	4.4%	15.1%
60<x<=75	46	5.3%	18.3%
75<x<=100	44	5.1%	17.5%
Total	868	100%	29.0%

The complete appointment division is offered in Table 2 again by Extension categories. Notice first that the alternative majority time allocation for extension faculty is research rather than teaching or administration. For example those with 60-75% extension appointments average a remainder 27% research, 9% teaching, and 6% administration in their appointments, while those with extension appointments less than 40% have at least a 10% higher research appointment than teaching appointment in all categories. As the extension percentage gets lower, more of it is replaced with teaching responsibilities, such that a 30% extension appointment on average would have ~40%

research and ~30% teaching responsibilities. Perhaps equally important to note is that average administrative appointments are highest for the zero and 0-10% extension categories (7% and 8.5% respectively), but lowest for those with the highest levels of extension appointments.

Table 2
Research, Teaching, Administration and Extension[7]

Extension Percentage of formal appointment	Research %	Teaching %	Administration %	Extension %
zero	56.4	35.2	7.2	0.0
0<x<=10	48.1	33.8	8.5	8.0
10<x<=20	42.4	32.4	6.8	17.8
20<x<=40	37.8	28.5	2.9	30.8
40<x<=60	27.1	15.5	3.4	53.4
60<x<=75	22.8	4.2	0.1	72.6
75<x<=100	4.1	4.2	0.0	91.7
Total	48.9	30.7	6.2	13.1

Demographics of Extension Faculty

We start with a general description of faculty with any level of extension appointment and compare them to their non-extension colleagues. We find no major gender differences between extension and non-extension professors, with women representing 19% of non-extension professors and 20% of extension professors. For all except the highest category of extension appointment, women represent at least 20% of the faculty. It is the case, however, that women represent only 11% of professors with a 75-100% appointment. Chart 1 shows the division of professors by rank between the different

[7] Numbers do not add up to 100% due to rounding and because we dropped a fifth category "service and other" which made up less than 1% of people's formal appointment.

extension categories. Overall there are more of both assistant and associate professors in the extension ranks. This is especially pronounced for those with extension appointments above 40%, while the numbers for those under 40% look similar to the non-extension professors. This suggests that new extension professors are more likely to enter with extension appointments above 40%, although this effect is somewhat reversed for the 75-100% category.

Chart 1: Rank by appointment category

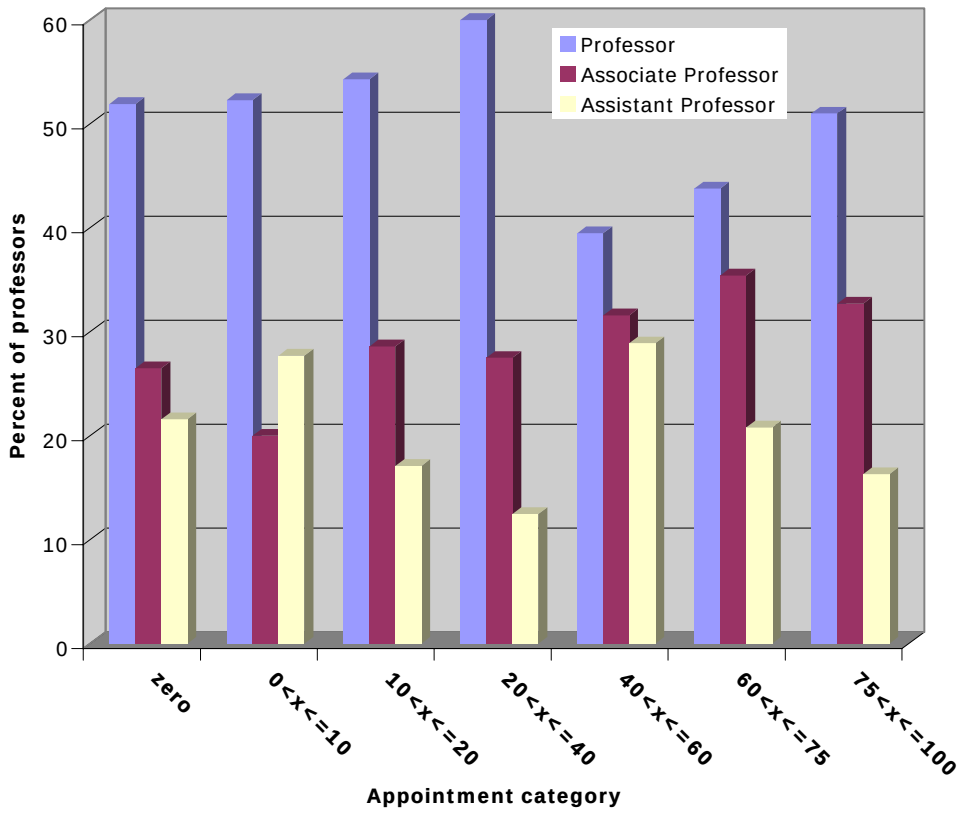
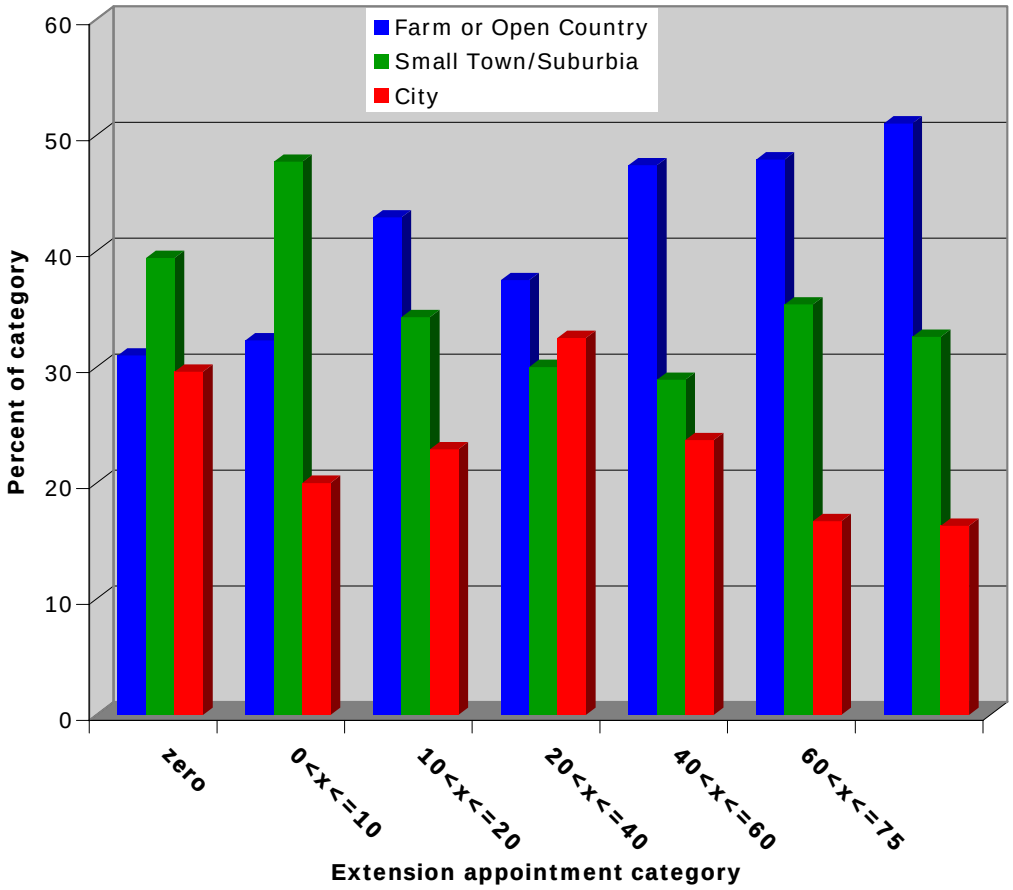


Chart 2: Farm Origins



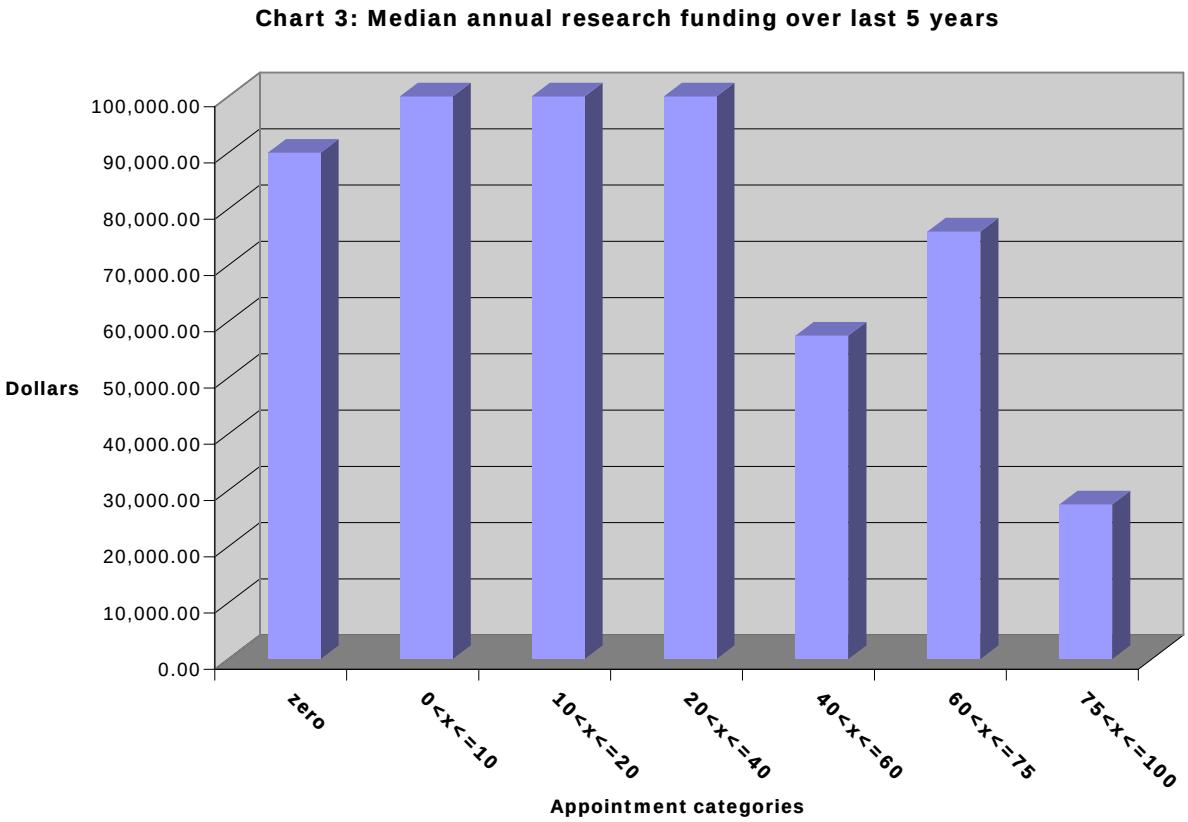
Given that extension positions typically require more engagement with the farm community, one might expect that the extension professoriate would draw much more heavily from those who had grown up on farms than the general agricultural college faculty members. Chart 2 shows where a professor lived when they were 16 years old. It demonstrates that extension personnel are indeed more likely to have grown up on a farm or in open country than non-extension professors, but the differences are not as overwhelming as one might expect. More than half of the extension personnel come from urban or suburban/small town origins.

Research, Extension, and Student Production

The demographic information suggests only minor differences between extension professors and those without extension appointments. Presumably, the biggest difference that would be likely to have an effect on their academic productivity is the type of appointment itself, with higher levels of research type outputs (articles and graduate students) among those with zero or low extension appointments and higher levels of extension outputs among those with high extension appointments.

We start with research funding, a critical input to academic production (research, extension, and graduate student training) and an increasingly key source of funding for universities in general. Overall median dollars of annual research funding are not significantly different between those with extension appointments and those without (A non-parametric K-sample test of equality of the medians cannot reject the null of equal medians: $\chi^2(1) = 3.12$ p-value 0.07).[8] The data presented in Chart 3 show the largest gaps between different types of extension appointments rather than between those with and without extension appointments. Specifically, a major drop-off in median levels of research funding occurs between those with a 40% or less extension appointment and those above 40%, suggesting a critical threshold. Also, note that extension professors with a less than 40% extension appointment bring in a bit more research funding than faculty without extension appointments, which suggests comparable levels of research engagement.

[8] Note that mean research dollars are highly skewed by a couple of multi-million dollar labs, so we instead work with medians.



In terms of funding sources, extension and non-extension professors were equally likely to receive federal research funding, with 91% and 93% respecitively receiving some federal money (t-test of difference = 1.24).[9] As suggested by the overall research dollars, this demonstrates the continued engagement of extension professors in overall research mission of a major research university. Extension professors were, however, significantly more likely to receive both commodity group (46% versus 28%, t-test of difference = 5.57) and private industry funding (60% versus 43%, t-test of difference = 4.40). Surprisingly it is not the case that extension professors either receive more money or receive a higher percentage or their funding from either commodity or industry

[9] There is also no significant difference in receiving federal competitive funding between extension and non-extension personnel (t-stat 0.88).

sources.[10] In terms of how funding changes across extension appointments, the percentage of faculty with industry funding rises in a nearly linear fashion from 44% for those with a 1%-10% appointment, to 60% at a 40% -60% appointment, to 73% for those with a 75%-100% appointment. The percentage of faculty with commodity funding also rises in a nearly linear fashion from 21% for those with a 1%-10% appointment, to 51% at a 40% -60% appointment, to 68% for those with a 75%-100% appointment. We thus see evidence of a higher engagement with the commercial world for those with extension appointments and one that rises with the percent of their appointment. This is likely an outcome of the greater integration with applied issues and stakeholders that extension professors have.

In the production of written research output there are significant differences between extension and non-extension professors. In our sample the average extension professor produced 10.2 journal articles in the previous 5 years, which is significantly lower than those without extension appointments who averaged 13.0 (t-test of difference = 3.17). In the production of extension bulletins extension professors averaged 15.0, which is significantly higher than the production for non-extension professors who averaged 5.4 total in the previous 5 years (t-test of difference = 8.43).

Chart 4a and 4b shows the mean and median journal article and extension bulletin production from the last five years for agricultural professors according to the level of their extension appointment. In general, mean article production declines for increasing levels of extension appointments while extension bulletins increase. However, journal article production is fairly steady up to a 40% extension appointment, with the 20-40%

[10] Average industry research dollars are $12,294 for non-extension and $11,921 for extension (t-stat = 0.13), while commodity funding is $6,217 for non-extension and $8,741 for extension professors (t-stat = 1.58).

appointments having the highest mean (that category had the highest median, 11, also). Extension bulletins show an opposite pattern in which extension appointments above 20% have much higher production, but with little actual increases in bulletin production for extension appointments above the 20-40% category. Also, professors with no extension appointments still produce on average of one extension bulletin each year, or about one-third the levels of those with extension appointments.

There is a slightly different story suggested by Chart 4b, which depicts the median journal article and extension bulletin production levels. In this case, the typical professor with an extension appointment at the 40-60% level shows a commensurate increase in median bulletin production to the significant drop-off in journal article production. In other words, for the median professor, there is less evidence of a threshold effect as there is in the mean production levels. The other important contrast between these two charts is the significant average differences in the mean versus median production levels especially among the 20-40% extension category for both journal articles and extension bulletins, where the mean is close to 20 of each for the 5-year period and the median is 10 and 6, respectively. This suggests that there is a "sweet-spot" in the appointment category for a certain cohort of faculty who produce a lot of written research of both types.

Chart 4b: Median Journal article and Bulletins

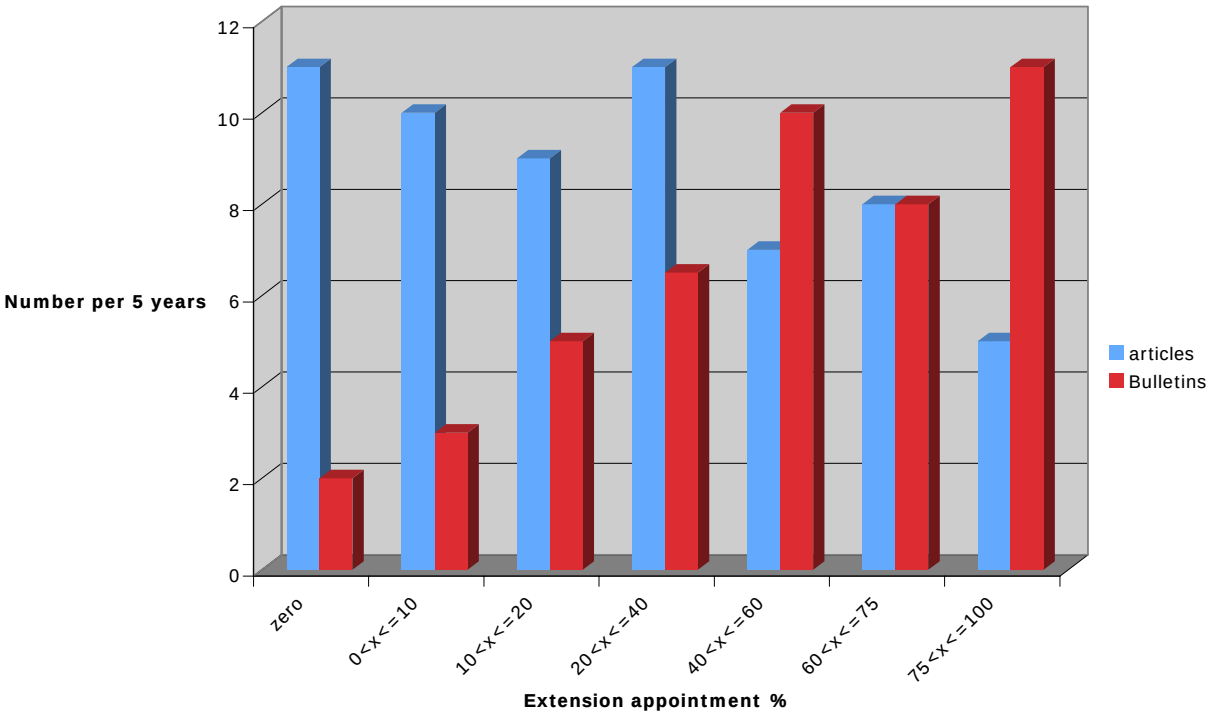
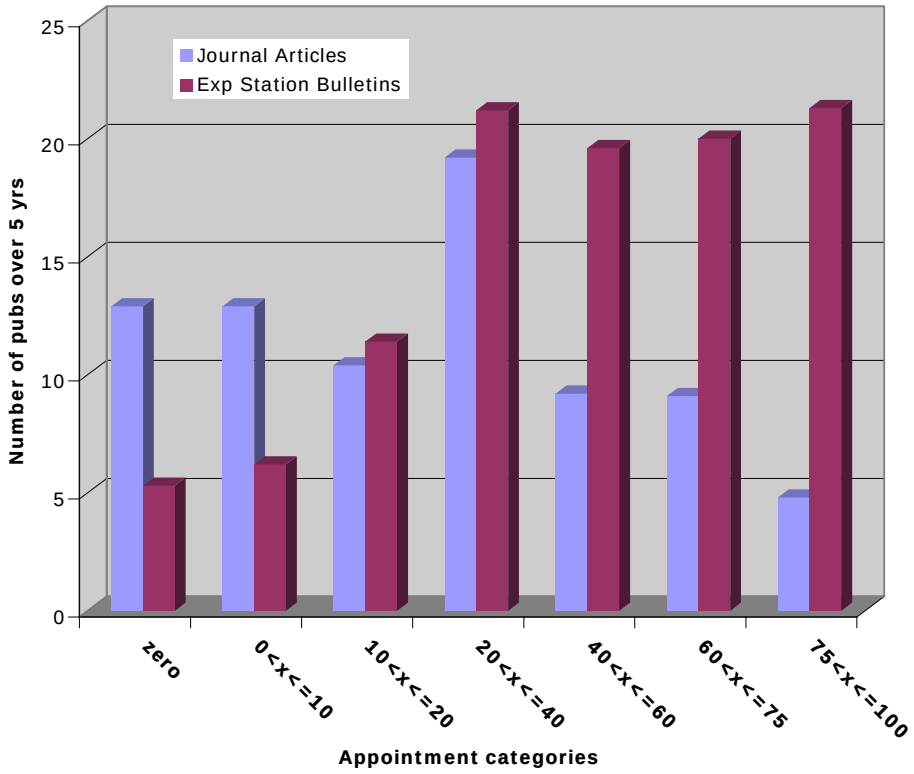
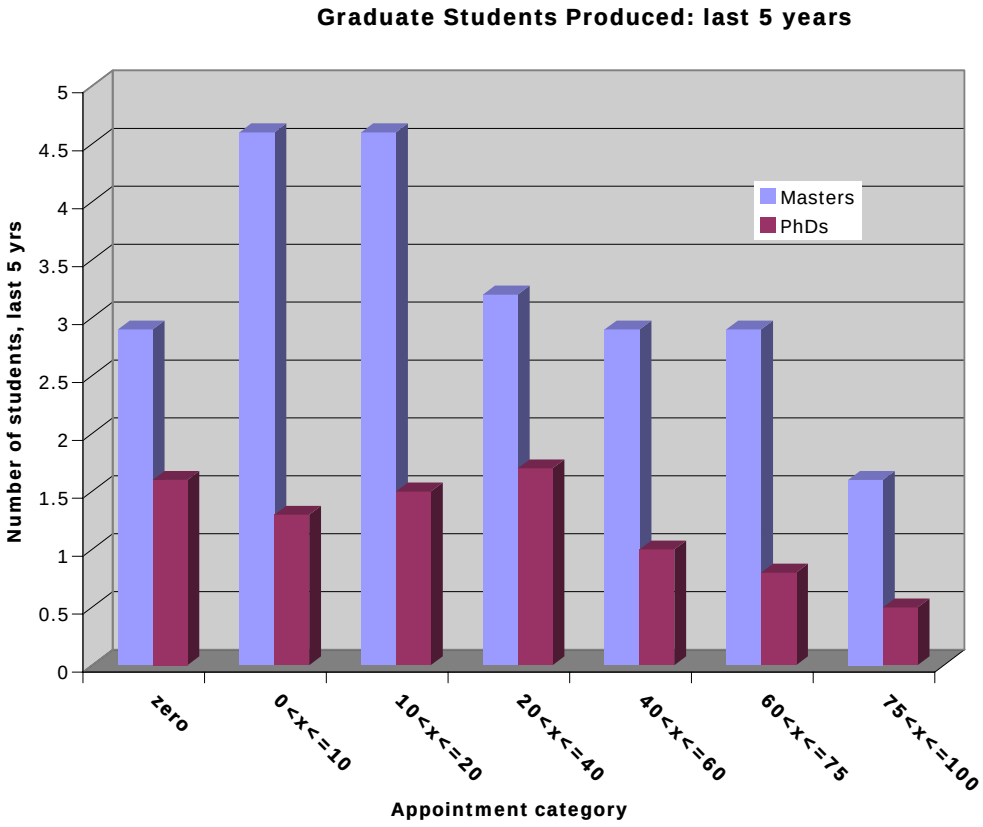


Chart 4a: Articles and Bulletins



Another method of measuring faculty output is in terms of student production. Since most undergraduate teaching is specified by the university, and rarely is an explicit choice of faculty members we choose to measure graduate student output. We measure it in two forms: terminal master's and PhD students produced in a 5-year period. Overall extension professors produced 3.2 Masters and 1.1 PhD students while non-extension produced 2.8 Masters and 1.5 PhD students. While the Masters student numbers are not statistically different (t-test = 1.63), the PhD student production is 40% higher for non-extension professors and is a statistically significant difference (t-test = 3.4).

Chart 5 shows graduate student production by extension appointment category. Extension personnel show more Masters' students on average than non-extension faculty, driven primarily by those with low extension appointments (below 40%). Overall, Masters' student production is equal or higher than non-extension personnel for all extension appointments except the 75-100% category. In contrast, extension professors produce fewer PhD students, with the drop-off being greatest among those with greater than a 40% extension appointment. The drop-off is quite steep above a 40% extension appointment with the highest extension category having a rate of PhD student production 75% lower than that of the 20-40% category or that of the non-extension professor.



Determinants of Research and Extension Production

In order to fully test the effects of extension appointments on research and extension outputs we need to control for other intervening variables. In particular, some of the differences we see may be due to differences by field, experience, and/or the amount of research funding that the professor has at his or her disposal. We therefore turn to a regression analysis to describe the determinants of article and bulletin production.

In this case we are interested in estimating a production function for the two key outputs: journal articles and extension bulletins.[11] The production of these two outputs is potentially correlated in that there may be tradeoffs between putting effort into the two

[11] We specify a primal formulation in preference over the dual because costs for these activities are difficult to specify exactly at the university professor level. See Foltz, Barham, and Kim, 2007 for an application of cost functions in research production at the university level.

outputs or there may be synergies between them in which the same idea can produce two outputs. We therefore estimate them as a seemingly unrelated regression (SUR), which allows for a potential correlation between the error terms in the equations. The correlation coefficient provides us with some estimate of the existence of synergies or tradeoffs between the two outputs.

For simplicity we specify a semi-linear production function for each output of the following form:

$$y_j = \alpha_{oj} + \beta_{1j}\ln(\exp erience) + \beta_{2j}\ln(research\_funds) + \beta_{3j}(extension\%) + \beta_{4j}discipline + \varepsilon_j$$

where y_j measures the two different outputs (*j = 1,2 = journal articles, extension bulletins)* and the ε_j are potentially correlated with each other. We chose the log specification for experience and research funding to accommodate potential non-linearity in the effects of funding and experience.[12] We divide the agricultural college into seven broad disciplines: (1) social sciences, (2) agricultural engineering, (3) animal sciences, (4) plant sciences, (5) biological sciences (biochem, genetics, microbiology, etc.), (6) environmental sciences, (7) food and nutritional sciences. The discipline variables measure effects relative to the plant sciences, which is the omitted category.

Table 3 below shows the estimation of the SUR model for journal publications and bulletins. The models show very different effects of the percentage extension appointment on the production of the two outputs. Extension appointments lower the production of journal articles, such that a 50% appointment would imply a 33% decline

[12] Quadratic specifications produce similar results, but the overall fit of the model is better with the log specification. Note that we are measuring research funding concurrently to the article/bulletin production, which could lead to some endogeneity issues. We have tested models that measure journal article production for the 2 years after the grant funding is received and found similar results. Unfortunately we do not have measures of bulletin production to match, so cannot estimate the full sequential model.

in publications. In contrast for extension bulletins a 50% appointment would imply an extra 10 bulletins over a five-year period. These results are suggestive of there being trade-offs rather than synergies between the two publication types. We find, however, no evidence of correlations between the errors of the two equations suggesting that they are independent production processes.

Among other variables, research funding is a major contributor to the production of both journal articles and bulletins. On the bulletin side this suggests that grant money is still an important input in what is essentially an extension output. The models show some differences with experience having a positive significant effect on journal articles and no effect on bulletin publication. We find some differences in article outputs by disciplines with social, biological, and environmental sciences having lower production levels than plant sciences. In terms of extension bulletins only biological and nutritional sciences have significantly different production levels from the base case in plant sciences.

Table 3
Journal and Bulletin Publication Production: Seemingly unrelated regression

	Journal publications	Standard error		Bulletins	Standard error	
Ln(yrs since PhD)	1.37	0.51	***	0.31	0.80	
Ln(research expenditure)	2.59	0.26	***	2.11	0.41	***
Extension appointment percentage	-0.07	0.01	***	0.20	0.02	***
Disciplines						
Social Sciences	-3.41	1.08	***	2.17	1.70	
Ag. Engineering	-1.15	1.44		-1.86	2.26	
Animal Sciences	1.87	1.14		2.91	1.79	
Biological Sci	-3.54	1.22	***	-6.99	1.92	***
Environment Sci	-1.95	0.99	**	-2.67	1.55	*
Food & Nutri Sci	1.89	1.25		-5.99	1.96	***
Constant	-0.78	1.92		-3.08	3.03	
R^2	0.197			0.179		
Cross Equation Correlation	0.0454					
Breusch-Pagan test of independence:	$\chi^2(1) = 1.61$	Pr = 0.21				

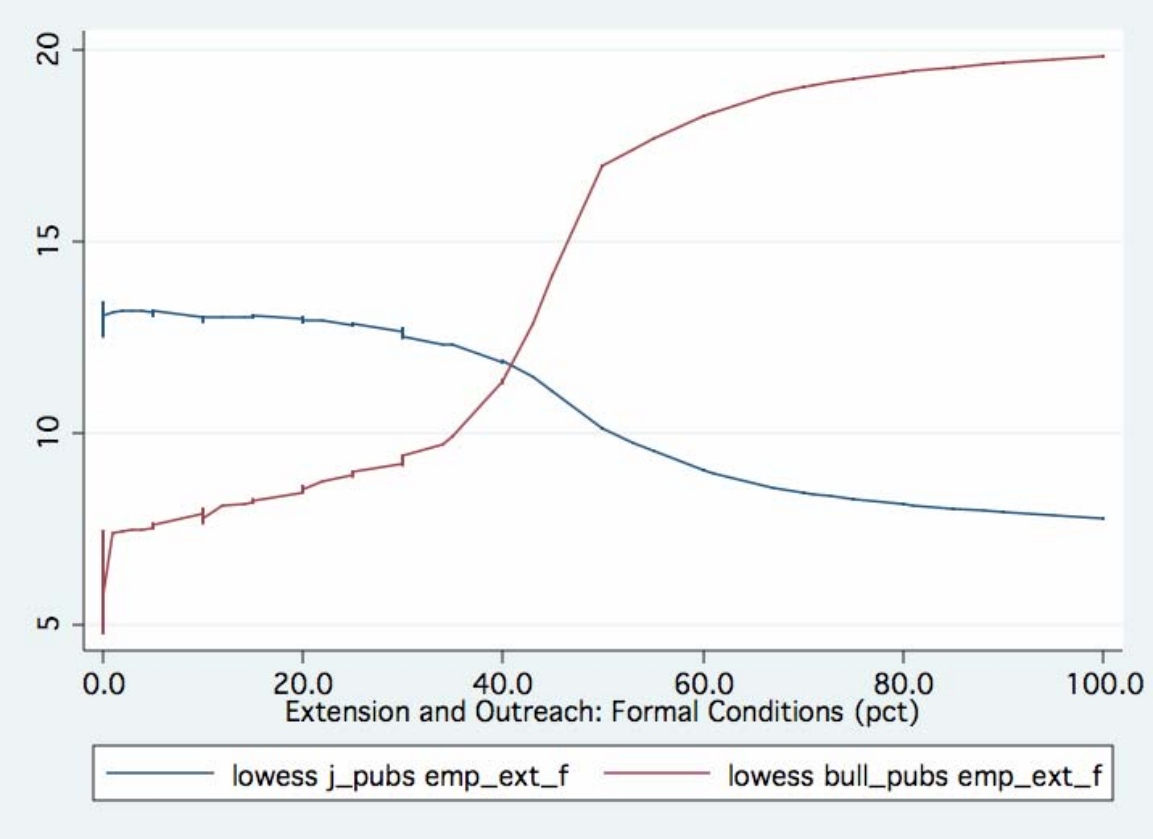
*, **, *** denote respectively significance at the 10%, 5%, and 1% levels

In order to see the potential tradeoffs or synergies between journal publications and bulletins we also estimate a non-parametric Lowess smoothed surface for them shown below in chart 6.[13] It does demonstrate the corresponding tradeoffs between the two publication types. While the tradeoffs are everywhere they get more severe after a 50% extension appointment, such that increments to the percent time on extension produce bulletins at a decreasing rate and "cost" articles at an increasing rate. These results reinforce the earlier charts, which suggest a more severe drop off in research production at the high end of the extension appointments. It is also worth reiterating that

[13] A Lowess smoother provides a local non-parametric representation of the data. The Lowess smoothing was performed in STATA 10 using the mean smoothing and the default level bandwidth of 0.8.

at both extremes faculty are producing outputs beyond their formally allocated effort percentages. Faculty with no extension appointment account for an average of 1 extension bulletin per year at the same time those with no research appointments account for 1.4 journal articles per year.

Chart 6: Lowess smoothed graphs

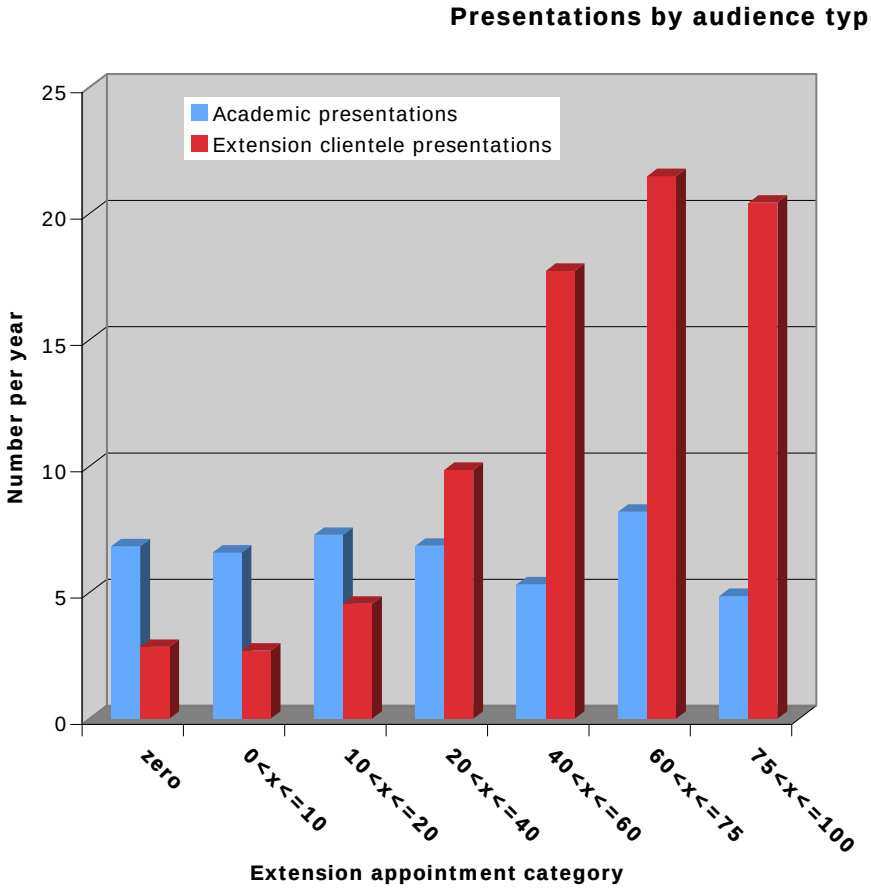


Clientele work

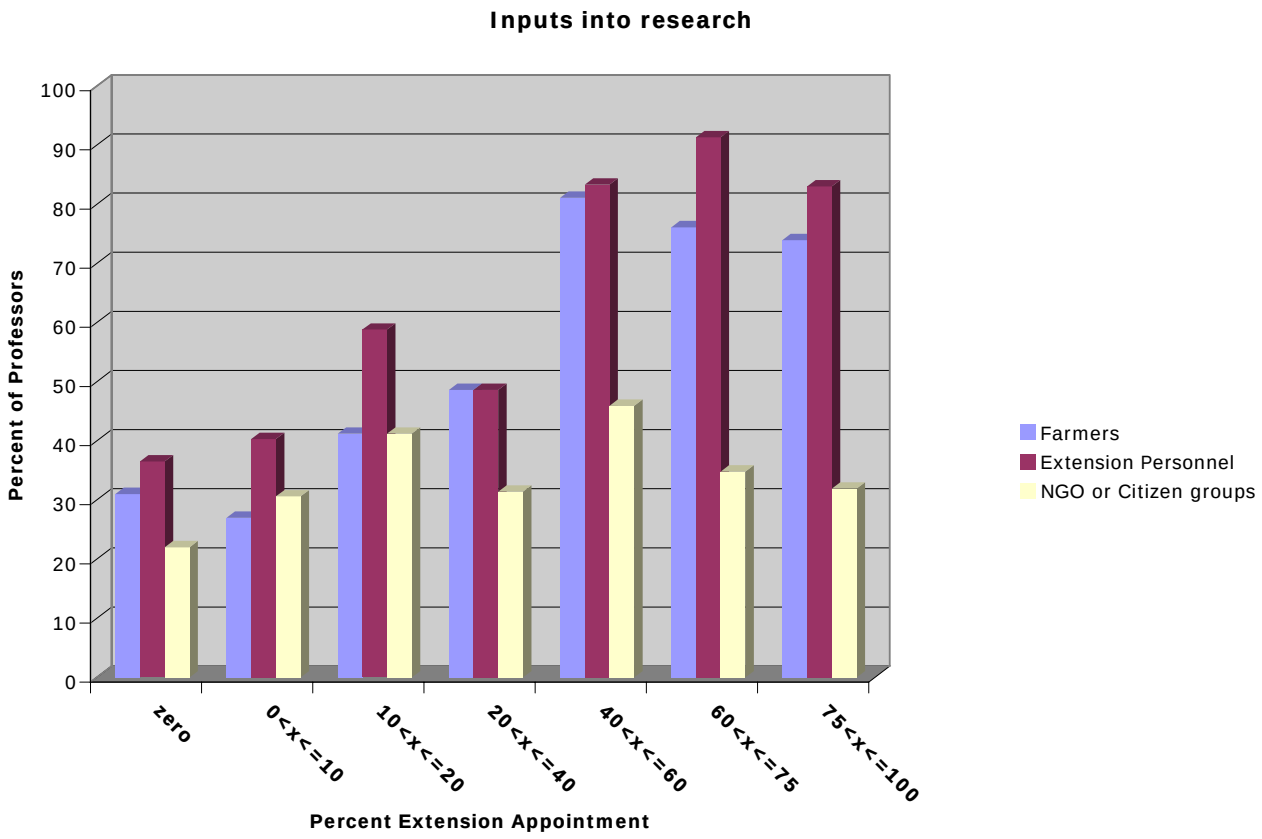
In addition to standard research outputs such as journal articles and students, extension personnel are most often expected to interact on a regular basis with farmers, extension agents, non-governmental groups, and government agencies. This interaction ideally is a two way information flow in which these outsiders receive information from the Land Grant university personnel at the same time they provide information that can be a key

input into the research process. It is this latter interaction that can make the applied research done by extension personnel relate more closely to real world problems and potentially increase the quality of that research.

Chart 6 below shows the output direction of the information flows demonstrating how many times professors, by extension appointment category, have presented to various groups during the year 2005. In this case extension clientele includes farmers, extension agents, non-governmental and community groups, and government agencies; while academic presentations include seminars at their own university, other universities, and academic conferences. Extension professors presented much more frequently to extension clientele, with the highest levels being for those with appointments greater than 40%. At the same time academic presentations were overall slightly higher for non-extension professors, but the differences are not as great and unlike other research outputs presented above such as journal articles there is not the steep drop-off at high levels of extension appointments. Again, faculty with zero extension appointments had small but significant numbers of extension presentations.



In terms of farmers and extension agents as sources of information there is a strong pattern with respect to extension appointments as shown in chart 7. Those with higher appointments are much more likely to use farmers, extension agents, and non-governmental groups to help them identify an important research problem. Above a 40% appointment more than three-quarters of the professors used farmers and extension personnel as inputs into their choices of research problems. At the same time, those without extension appointments also used information from farmers and extension personnel as inputs in the research process, with nearly one-third of the professors using each of those sources of inspiration.



Conclusions

The results presented here show the vitality of extension professors within the Land Grant system. Those with extension appointments are heavily engaged in the major research efforts of their respective universities at sometimes even greater levels of production than those without extension responsibilities. Our data show extension professors receiving federal grants at the same levels as their non-extension colleagues at

the same time those colleagues are engaging significantly in the kind of work thought to be reserved for extension personnel. The results suggest that there are strong overlaps and commonalities between research and extension and that overall the debate between them is probably overblown.

There is some modest evidence in the data for synergies between the two types of outputs. Those with low extension appointments seem to be able to produce research outputs at about the same rate as those without, and they are able to also produce extension outputs in the form of bulletins and clientele meetings. On the other hand, there do seem to be some strong tradeoffs at the upper end of the extension appointment percentages. The evidence suggests that increasing an extension appointment above 50% increases extension bulletin production and clientele visits, but that comes at the expense of research output at an increasing rate with bulletins being substituted at a decreasing rate.

Given the vitality of extension professors in producing research outputs and the reasonably high levels of extension output by non-extension personnel, one can pull out a number of implications for university administrators. Perhaps most obvious is that efforts to segregate extension work or professors from the rest of the agricultural college faculty are likely to be counter productive. Such a segregation could produce less work from each of the types of professors, with potential losses in extension output from the majority of faculty who have zero budget extension appointments but in fact are engaged in extension activity and losses in research output from extension professors.

In terms of hiring practices the results here suggest that deans of extension and agricultural colleges will want to carefully consider the potential implications of

differential appointment percentages. The highest levels of extension appointments (greater than 60%) provide strong extension incentives but clearly are costly in terms of research and teaching output. This strong incentive may be important to get faculty to reach certain clientele, but appears to carry a high cost to research. Meanwhile, extension appointments in the 30% range seem to produce faculty members who are quite productive in both research and extension. If these results apply to a wider range of outputs (and in terms of quality), then agricultural colleges may be able to get higher research and extension productivity by spreading smaller extension appointments across more professors rather than by concentrating larger appointments on fewer professors.

While these results provide a start on analyzing the roles of extension professors we have clearly not measured all the output of extension professionals, nor have we explored fully the behavioral determinants. A fuller accounting of extension output might also need to include some measure of the responsiveness of extension work to local demands for information as well as the leadership displayed on important issues. Such a quality measure might come to some different conclusions especially with respect to the productivity of high percentage extension appointments. For example, it may be that while the current measures show little difference in bulletin production and clientele visits between a 60% and 100% appointment, measures that include responsiveness to clientele or quality of information might show a different result. We hope that our work will be a start that stimulates future investigation into measuring these outcomes.

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