Academic Engagement, Commercialization, and Scholarship:
Empirical Evidence from Agricultural and Life Scientists at US Land Grant Universities

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1. Research Question

This article exploits rich and unique data to examine how academic engagement, commercialization, and scholarship are combined by agricultural and life science faculty at US land grant universities. Building on Perkmann et al. (2013), specifically their call for more representative and longitudinal evidence at the individual faculty level, we explore the prevalence, coincidence, temporal dynamics, and potential synergies or tradeoffs associated with academic engagement, commercialization, and traditional scholarly activities, such as publications, grants, and teaching. This article contributes to a vast body of literature that probes the ways in which evolving organizations, institutions and norms promoting university-industry relations shape faculty activities, attitudes, and research choice at research-oriented universities.

Perkmann et al (2013) focus on the two basic types of university-industry relations (UIR). One is academic engagement (AE) that they define as faculty participation in sponsored and collaborative research, contract research, consulting, and informal relationships with private firms and institutions. It is important to note that at US land grant universities, AE has a history dating back to the turn of the 20th century, stemming from their emphasis on agricultural and engineering sciences and working with farms and firms. Academic commercialization (AC) is the other, which they define as faculty participation in private intellectual property creation (via invention disclosures, patents, and licensing) and entrepreneurship (e.g., start-ups). This type of faculty involvement with industry is much more recent, and took off following the passage of the Bayh-Dole Act in 1981 (Henderson and Jaffee, 1998; Thursby and Thursby, 2011).

Perkmann et al (2013) reviews the state-of-knowledge about these two prevalent and somewhat contrasting types of UIR. Their meta-analysis/expert review probes the prevalence of AE and AC activities, mostly building on the recent flurry of research exploring how faculty engagement with university-industry relations affect the productivity of traditional academic scholarship (AS). One of their main findings is that the vast majority of recent research on UIR examines only the less common activity of AC and mostly overlooks AE, the more pervasive and potentially important one in terms of faculty participation and actual resource flows. They also find surprisingly little examination of the two activities side-by-side to ascertain their prevalence, coincidence, temporal dynamics, and synergies with one another and other scholarly activities (AS). We fill those two major empirical gaps by exploiting cross-sectional and panel survey data gathered in 2005 and 2015 from agricultural and life science faculty from all 52 of the original 1863 US land grant universities. This is exactly the type of data promoted in their conclusion to advance research on UIR and AS.

[1] The researchers who will be carrying out the project declare that they have no financial or other interests that might bear on the proposed work, and in particular that they have no financial ties to businesses in the agriculture industry.

This study addresses the following questions: What is the prevalence of AE and AC activities among agricultural and life science faculty at flagship public research universities across the United States? What are the characteristics and proximate determinants of participation in AE and AC? What role does UIR play in funding faculty research? How does the research and teaching output of faculty active in AE, AC, both or neither type of university-industry relationships compare? To what degree are there synergies across AE, AC, and AS activities? Finally, how do the activities and attitudes of land grant agricultural and life science faculty align with respect to issues related to research problem choice?

The salience of these questions is large given the considerable financial stress that most US land grant universities faced over the past three decades due to significant declines in state and federal financial support. At least partially in response to these financial pressures, most land grant institutions pursued academic commercialization as a potential mechanism to generate royalties and start-up revenue streams (Thursby and Thursby, 2011). This study also sheds light on the evolution of this strategy by examining detailed and representative survey data on the actual research activities and attitudes of agricultural and life science faculty at these institutions.

Much of the analysis involves cross-tabulations across categories of UIR activity and academic scholarship in order to provide a rich portrayal of the prevalence, coincidence, intensity, and productivity of faculty engagement in AE, AC, and AS. Reduced-form regressions using both linear and non-linear specifications help to identify factors shaping participation and productivity within and across these categories. Factor analysis highlights how attitudinal data align with AE, AC, and AS as well as with types of research funding pursued. Combined, these analyses identify key patterns of faculty activities and attitudes with respect to UIR and AS.

Data Description:

Similar to the 2005 survey (Barham et al. 2014), the 2015 sample frame includes all tenure-track faculty scientists in agricultural and life science departments at US land-grant universities. We culled faculty names from web directories to create the sample frame. We randomly selected a sample of 2,972 scientists who were sent a web-based survey with follow-up paper-mail reminders, following Dillman methods. We received 1,181 responses to at least one survey question, a response rate of 39.7%. Response rates vary somewhat by discipline, from a high of 42% among plant scientists to only 28% among agricultural engineering scientists. We are confident that our data do not exhibit serious response rate bias based on regressions by university on three characteristics of the universities: faculty size of the agricultural college, total university research funding, and total full-time university student enrollment. Other tests by discipline and gender similarly show insignificant coefficients.

Initial Findings:

- Stylized Fact 1 (Table 1 below): In 2015 academic engagement is four times more prevalent (75% versus 18%), and it plays a much more significant role in terms of generating research funding for agricultural and life science faculty labs than does academic commercialization (the ratio is 35:1 for faculty who do both);

- Stylized Fact 2 (Tables 1 and 2 below): On the extensive and intensive margins, AC activities of agricultural and life science faculty decreased notably over the past ten

years. In both 2005 and 2015 they generated a miniscule proportion (0 is the median and 1% is the mean) of research fund shares for labs;

- Stylized Fact 3: About 1 in 6 faculty in 2015 were active in both AE and AC, down from nearly 1 in 4 in 2005. Male, full professors are more likely to do both AE and AC than are other rank-gender cohorts. So are plant scientists relative to other fields.

- Stylized Fact 4 (Table 2): Faculty active in both AE and AC produce more articles, raise more research funding, and supervise more Ph.D. students. As in many other studies, the *prima facie* evidence supports synergies between active participation in university-industry relations and traditional academic scholarship.

- Stylized Fact 5: Faculty across all categories say that the most important factors shaping research direction/choice are intrinsic factors (such as enjoying the research, curiosity, and importance to society) rather than extrinsic commercial factors (such as potential marketability or likelihood to patent.

- Stylized Fact 6 (Figures 1 and 2): Despite the strong intrinsic science-driven overall approach, attitudes toward academic and commercial pursuits do differ across the faculty in some notable ways. Faculty with stronger academic scorings are more likely to do neither AE or AC, while faculty with stronger commercial scorings are more likely to do AE and AC. Figure 2 shows a similar funding source story.

Conclusion:

The results highlight that the longstanding public-science model of academic engagement and scholarship dominates the activities of agricultural and life science faculty at US land grant universities. Thirty-five years after the Bayh-Dole act, the expansion of UIR via academic commercialization has not made major inroads into scholar's activities, funding, or attitudes. Policy implications arise at university, state, and federal levels around the value of refocusing attention on the predominantly public nature of scholarly activities pursued by most faculty.

References:

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Table 1 - Prevalence of Faculty Participation in University-Industry Relations

Cross Section

	Mean 2005	Mean 2015	p.p. change
AE only	54.72%	58.99%	4.27
AE/AC	22.29%	15.75%	-6.54
AC only	3.41%	2.38%	-1.03
Neither	19.58%	22.88%	3.30
AE	77.22%	74.78%	-2.44
AC	25.73%	18.13%	-7.60

Panel

	Mean 2005	Mean 2015	p.p. change
AE	60.80%	53.69%	-7.11
AE/AC	20.40%	22.54%	2.14
AC	2.40%	2.87%	0.47
Neither	16.40%	20.90%	4.50

Cross Section

Table 2 - Scholarly Output Across UIR Types (2005)

	AE	AE/AC	AC	Neither
Scholarly articles (5 yrs)	11.31	16.42	12.91	10.39
PhD students	1.42	1.74	1.69	1.61
Masters students	3.25	2.79	1.94	3.04
Collaborations Industry	1.05	1.63	0	0
Invention disclosures	0	1.73	1.21	0
Patents (5 yrs)	0	1.08	0.64	0
Patent royalties (% over $3000)	0	4127	0	0

Table 2- Scholarly Output Across UIR Types (2015)

	AE	AE/AC	AC	Neither
Scholarly articles (5 yrs)	14.12	23.48	19.81	14.38
PhD students	1.67	2.71	1.87	1.62
Masters students	2.79	2.43	1.43	1.89
Collaborations Industry	1.15	1.93	0	0
Invention disclosures	0	2.32	1	0
Patents (5 yrs)	0	1.19	0.36	0
Patent royalties (% over $3000)	0	1081	0	0

Figure 1 – Proportion of UIR Category versus Academic or Commercial Factor Score (quintile)

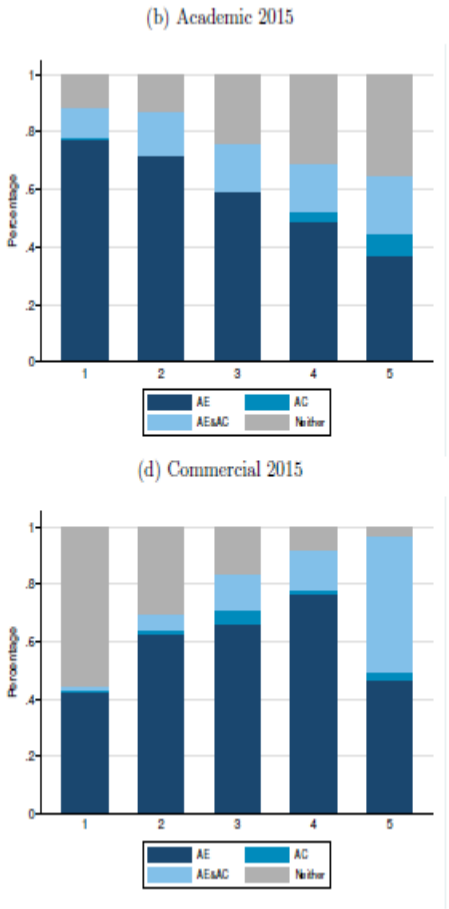


Figure 2 (for our purposes here) – Share of Federal or Private Funding by Academic or Commercial Factor Score (quintile)

