

FINAL DRAFT

REPORT ON CLA INTERNAL FUNDING PROGRAMS SPONSORED BY THE EXECUTIVE VICE PRESIDENT FOR RESEARCH OFFICE 2011-2016

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Executive Summary

Purdue's College of Liberal Arts (CLA) is invested in the academic success of its faculty. Internal grant award support has the goal of enhancing faculty academic productivity and successful acquisition of external funding. Evaluating impacts of CLA internal awards on faculty productivity enables CLA administration to respond accordingly and better serve its faculty.

This report focuses on the findings of a statistical analysis of the impacts of internal funding opportunities by the College of Liberal Arts (CLA) on their faculty at Purdue University. Statistical analysis was conducted on a representative sample of CLA faculty members and their histories of grant applications and academic output. Data collection and analyses were driven by specific questions directed at discovering the relationships between CLA internal funding overall, EVPRP sponsored internal funding, faculty productivity and external awards. Below is a brief summary of the main findings. These findings are combined with qualitative research on grant impacts; those results and the integrated recommendations follow the statistical findings.

1) Does the presence of Internal Grants and faculty productivity affect the probability of obtaining External Grant Awards?

- a. Yes, internal grants positively affect the chances of faculty to obtain external funding. The estimated effect for EVPRP Grants indicates that on average, a faculty awarded one such grant has an increase of 1.63-1.92 times the probability of obtaining an external grant than individuals who did not obtain one. In other words, faculty awarded an internal grant on average increases their probability of obtaining an external grant by 63-92%.
- b. Faculty productivity plays a key role in the probability of CLA faculty to obtain an external grant award. For every unit increase in productivity increases there is a 9-10% increase in the probability of obtaining an external grant.

2) Do Internal and External Grants affect CLA faculty productivity?

- a. Yes. Overall, CLA faculty who receive CLA internal funding support benefit by increasing their average rate of annual academic productivity. This relationship varies across academic areas, ranging from a small negative relationship to an average 11% increase. External grants also have an average positive relationship with academic productivity. Faculty who received external grants were found to have a 44-52% increase in annual productivity than faculty with no external grants.

3) Does the amount of Internal Grants affect the amount of External Grants received? Does productivity?

- a. Yes. On average, large internal grant amounts (>5,000) are associated with larger external grants. There is some variation between CLA academic areas, however.
- b. On average, faculty with no internal grants, and productivity of 0, are expected to receive a maximum base of external funding of \$4,961.88 if in the Arts, \$16,263.95 if in the Humanities, and \$53,645.87 if in the Social Sciences. Adding the effects of CLA internal grant amounts and productivity modifies expected amount of external funding awards.

- c. On average, CLA funding modifies the expected amount of external funding positively— for every CLA dollar amount awarded, there is a positive increase in the amount of external funds received. This relationship has a compounding effect and varies by academic area. This variation ranges between a 1% decrease to a 50% increase, as shown by our examples. The latter 50% increase can be interpreted as follows: for every CLA-dollar received there is a 50-cent increase in external grant dollars. The relationship between Academic Productivity and External Funding follows a similar pattern.

Introduction

The Office of the Vice President for Research approved the Enhancing Humanities and the Arts Grants Program for College of Liberal Arts (CLA) faculty in 2010 and expanded internal grant support programs for CLA in 2013. The CLA Global Synergy Grants for Faculty and Students, supported by the Office of the President, was developed in 2011. These investments were designed to promote the highest-quality research by faculty in Purdue's College of Liberal Arts, and to advance the disciplines of the Humanities and the Arts and Social Sciences at Purdue.

EVPRR Funding Programs for faculty in the College of Liberal Arts are comprised of the following four internal grant opportunities: Enhancing Humanities, Research Initiative, Transdisciplinary, and Exploratory Social Science Grant Programs. The Enhancing Humanities Grant provides \$150K per year to fund approximately four to six projects annually (\$25K-\$75K each). The Exploratory Social Sciences Research Grant (\$50K per year), Transdisciplinary and Interdisciplinary Research Grants (\$50K per year) and the Research Initiative Grants (\$50 K per year) were initiated in 2013. In total, 142 applications were received from faculty for EVPRP grants that were awarded 2011-2016. 35% of CLA TT Faculty (n=101) applied for Internal Grants in CLA 2011-2016 (EVPRP or Global Synergy Grants) relative to approximately 284 TT Faculty in CLA during Spring 2016. A total of \$1,243,053.21 in EVPRP funding and \$279,943.18 in Global Synergy Funds have been awarded between 2011 and 2016. Summary information about the distribution of awards and award amounts by year, disciplinary area, department/school, and by rank can be found in the Appendix following this report.

Enhancing Humanities Grant (EHA) (2011-2016)

The Enhancing Humanities and Arts Program is the original and cornerstone program in the EVPRP funded initiative aimed to elevate the quality, innovativeness and impact of research in the Humanities and the Arts in the College of Liberal Arts. Since its establishment in 2011, the Enhancing Humanities Grant has received 85 applications from all ten departments and schools within the College of Liberal Arts. Between 2011 and 2016, 35.3% of all Enhancing Humanities grant applications were funded (funded =30, not funded =55). Faculty from eight departments/schools have successfully applied to the Enhancing Humanities program over the last six years.

The Exploratory Research in The Social Sciences (ERSS) (2014-2016)

With the goal of fostering innovation and excellence in the Social Sciences at Purdue, the Exploratory Research in the Social Sciences program provides \$50K of funding annually to stimulate innovative research efforts for collecting and analyzing pilot data necessary for preparing and submitting external proposals. The ERSS grants were first awarded in 2014 and 50% of the received applications over the last three years were successful (funded = 8, not funded = 8).

Research Initiative Small Grants Program (RIG) (2014-2015)

The Research Initiative Grant program was designed to support a wide range of small research needs of CLA faculty. Each award ranges from \$1,000-\$2,500. The Research Initiative Grants were first offered for 2014 and CLA received 29 applications in 2014 and 2015. All but four

were funded. The grant competition was not offered for 2016. CLA requested and received EVPRP approval to allocate this fund to support the Faculty Development Center Fellowships for 2016.

Transdisciplinary and Interdisciplinary Research Grant (TIG) (2014-2016)

This initiative represents an experimental approach designed to encourage transdisciplinary and Interdisciplinary activity between CLA faculty and those in other colleges, with an emphasis on CLA faculty leadership. This program as defined is fairly narrow and we have not reached a critical mass for these kinds of programs. The Transdisciplinary and Interdisciplinary Research Grants were first awarded in 2014 and two thirds of applications have been supported. The allocation for this program was up to \$50 K per year but not all funds have been used. Eight grants have been funded and four have been declined over the three years of this program.

The CLA-Global Synergy Program (2011-present) provides \$50K annually in internal grant funds to CLA faculty. Originally funded by the Office of the President, the program provides grants to foster international collaborations between Purdue faculty and those at other institutions around the world.

CLA Internal Grants Assessment Summer 2016

The office of the Associate Dean for Research in the College of Liberal Arts conducted an internal assessment of the impacts of the Internal Grants Programs. The goals for this project were two-fold: to produce a quantitative assessment on measurable outcomes of internal funding and also to seek qualitative data on the value and impact of internal grant support from the University. To these ends, a database was created of all the CLA faculty internal grant submissions for 2011-2016 programs and their outcome and data were gathered on subsequent internal and external grant activity and academic productivity in the years following an initial internal grant submission. Faculty who received internal funding were invited to participate in a series of online surveys on their perceptions of the value of internal funding.

This report focuses on the findings of a statistical analysis of the impacts of internal funding opportunities by the College of Liberal Arts (CLA) on their faculty at Purdue University, 2011-2016. Statistical analysis was conducted on a representative sample of CLA faculty members and their histories of grant applications and academic output. The investigation was conducted for CLA, by Erik Otárola-Castillo, faculty member in the Department of Anthropology. Data collection and the online surveys, coding and qualitative analysis were carried out by CLA staff members Madisson L. Whitman and Jennifer Sdunzik during Summer, 2016.

Purdue's CLA is invested in the academic success of its faculty. Faculty support through internal grant awards enhance their academic productivity and successful acquisition of external funding. Evaluating impacts of CLA internal awards on faculty productivity enables CLA administration to respond accordingly and better serve its faculty.

Materials and Methods

Observations

The association between the frequency of faculty external funding, faculty academic productivity, and CLA internal grants provides a measure of its impact on faculty success. This study evaluates the outcome of these associations using the following simple but hopefully clear observational measurements:

1. IG = Presence of internal grants related to EVPRP per year;
2. IGt = Presence of IG and Global Synergy grants per year;
3. EG = Presence of external grants per year;
4. TP = Total academic productivity.

Observations are retrospective ranging between 2011-2016. Data were obtained from CLA-submission and award records during that period, individual faculty curriculum vitae and grant documentation activity from sponsored programs. Faculty entered our sample at the time of their first internal CLA grant submission (IGt). Their IG (EVPRP grants), CLA-Global Synergy Grants, external grant (EG) submissions or awards or output previous to this date were not included in our sample. Following any internal grant submission, we began tracking and tallying their internal and external grant submissions and awards, scholarly and creative presentations, publications and other academic activities as listed on 2016 faculty vitae that had been submitted to the College. A Total Product Score (TP) was developed that includes the sum of publications (books, articles, edited volumes, software), presentations (conference and invited presentations) and creative works (including exhibitions, scripts, designs, juror, creative texts and scores).

We understand that these very diverse kinds of products are not equivalent in that they require different kinds of faculty effort. We simplified our measure of TP as a first step to determine whether there is an overall link between IG and EG and IG and productivity. We have provided a closer look at some of the individual kinds of products in some of the analyses and appendix tables. We anticipate future analyses will include a focus on assessing relative weight to these diverse kinds of products. More information on the products that were analyzed in this report can be found in the Appendix. External funding applications and awards were verified and added to the sheet based on records supplied by the Sponsored Programs Office in May, 2016. Faculty were listed by faculty rank as well as with their respective departments/schools and disciplines (Humanities, Social Science, Arts). Faculty names, departments, and disciplines received numerical IDs with identifying information removed and stored separately before the analysis was conducted.

These observations included 101 CLA faculty members, across 10 departments representing the Arts (13), Humanities (55), and Social Sciences (33). Faculty members who submitted their first IG or IGt proposal in 2016 were removed from our sample to be analyzed (n=16) because not enough time has lapsed for us to have adequate information about grant or productivity following the submissions. The following analyses were conducted on 88 CLA faculty members across 10 departments.

Data Analysis

These observations were treated and analyzed twofold:

1. As proportion and rate-data. This provides a single measure per individual. It is the average of all values of IG, IGt, EG, and TP across all years included in the sample.
2. As longitudinal-data. These data account for all values of IG, IGt, EG, and TP for by individuals for all years sampled.

Analyses of rate-data answer the following questions:

1. What is the proportion of faculty who either received EGs, IGs, IGts?
2. Given that at least an IG or IGt was awarded, what is the proportion of faculty that received an EG?
3. What is the average productivity of faculty who received:
 - a) at least 1 IG (or IGt) and at least 1 EG?
 - b) at least 1 IG (or IGT) and NO EGs?
 - c) No IG (or IGT) and at least 1 EG?
 - d) No IG (or IGT) and NO EGs?

Longitudinal analyses answer the following questions related to the impacts of IG:

On obtaining External Grants (EG)

1. Does the presence of IG affect the probability of obtaining EGs?
 - a) If so, what is the proportional effect of IG on the probability of obtaining EGs?
2. Does TP affect the probability of obtaining EGs?
 - a) If so, what is the proportional effect of TP on the probability of obtaining EGs?
3. Does academic area affect the probability of obtaining EGs?
 - a) If so, what is the proportional effect of AREA on the probability of obtaining EGs?

On faculty productivity (TP)

1. Does the presence of IG affect TP?
 - a) If so, what is the proportional effect of IG on TP?
2. Does EG affect TP?
 - a) If so, what is the proportional effect of EG on TP?

On the dollar amount of External Grants (EG)

1. Does the dollar amount of IGs affect the dollar amount of EG?
 - a) If so, what is the proportional effect of IG dollars on EG dollars?
2. Does productivity (TP) affect the amount of EG?
 - a) If so, what is the effect of TP on EG?
3. Does academic area affect the probability of obtaining EGs?
 - a) If so, what is the proportional effect of AREA on the dollar amount of EGs?

Statistical Methods

Proportions and Rates

These data provide simple but clear and powerful statistics about the relationships between IG, EG, and TP.

Longitudinal Data

To evaluate the effects of IG, TP, and AREA on the variation of individual faculty's probability of obtaining EG, this study constructed a Generalized Linear Mixed Model (GLMM). This procedure is appropriate in here because i) the response variable is not normally distributed, ii) there are multiple observation per individual faculty across time, therefore the data are not independent, iii) individuals' inter-annual trajectories might differ and random effects might be needed.

The response variable in this case is binary (1/0) representing whether individual faculty obtained an external grant for each year observed. These dependent data were modeled using a binomial probability distribution model with a logit link function (McCullagh and Nelder 2000). The following variables were used as explanatory factors (fixed and random effects): IG, TP, and AREA. The interaction effects between these factors were also explored. To account for "within-subject" correlations across time, the subject ID was used as a grouping variable.

Data across years are not equally represented for all sampled individuals. Therefore, temporal autocorrelation is potentially present and affecting GLMM parameter estimates (Hulbert 1984). To account for this potential lack of independence across time, this study modeled the data including an Autoregressive Moving Average (ARMA) correlation structure (Box, et al. 1994). Starting parameters (p & q) for the ARMA model were first estimated using the `auto.arima` function in the R package "forecast" (Hyndman and Khandakar 2008). Throughout the data-modeling process, model-selection is based on inferential tools drawn from the Information Theory (Burnham and Anderson 2002) and classical Hypothesis Testing. Akaike's information criterion (AIC) was used to compare models (Akaike 1974). Under this model selection criterion, the model with lowest AIC value is considered the best model, as long as its value is less than 2 (ΔAIC) from all other models' AIC values (Burnham and Anderson 2002). Model presented in the results section follows this criterion.

We acknowledge that although a *bona fide* effort was made, this analysis has limitations and these inferential methods are not infallible. For example, the sample of faculty chosen for analysis is faculty who submitted an EVPRP or Global Synergy internal grant. We are therefore excluding others who might have received funding through other internal funding opportunities. Additionally, as an observational study, random-group allocation to control independent variables was not achieved. Therefore, the variation observed in the independent variables might be caused by factors for which we did not account. We hope to improve on this in the future.

External grants, in amount of dollars (EG amount), as a response to IG, TP, and AREA was modeled using a similar procedure. EG amount is a continuous variable reflecting the amount of external grant dollars awarded to individual faculty across time. These data are usually right-skewed and therefore do not follow the "normal" probability model. These data were modeled using a Gamma distributed response using the log link (McCullagh and Nelder 2000). This procedure results in predictor variable coefficients reported in the exponential scale, having a compounding effect. AIC was also used for model selection.

Analyses of TP as a response to IG, EG, and AREA was modeled using a similar procedure. However, TP reflects the number of total products per year by individual faculty. It is therefore a

count and follows a different distribution than binary 1/0 data. TP was therefore modeled as a Poisson-distributed response using a log link (McCullagh and Nelder 2000). AIC was also used for model selection.

All analyses were conducted within the R statistical computing environment (R Development Core Team 2016), using the GLMMpql function of the MASS package (Venables, et al. 2002) and nlme package (Pinheiro, et al. 2016).

Results

Summary information about the CLA Internal and EVPRP Awards can be found in the Appendix. Results of the statistical analyses are presented here in two-sections. Section 1 presents all analyses related to EVPRP-only grant awards. Section 2 presents all analyses in the context of all CLA grants awards including EVPRP and Global Synergy grants.

Section 1. EVPRP Grants Only

Proportions and Rates

Table 1.1 shows the proportion of CLA faculty in our sample who were awarded at least one EVPRP internal grant (IG) and those who were awarded at least one external grant.

	n	Percentage (out of 85)
Faculty awarded at least 1 IG	43	56.8%
Faculty awarded at least 1 EG	25	34.1%

Rows in Table 1.2 show the frequency of faculty who were awarded at least one EVPRP IG and those who did not receive an IG. Similarly, the columns in this table show the frequency of faculty who were awarded EGs, and those who did not receive any EGs. EGs are further broken down to inspect whether 1) faculty did not receive EGs but made at least an EG application, and 2) whether faculty did not receive EGs because no EG applications were made. Proportions do not seem to be distributed differently than a randomized model ($X^2 = 3.65$, $P=0.15$, 10000 permutations).

	Awarded at least 1 EG	No EG Awards and at least 1 EG Application	No EG Awards and No EG Applications	Totals
Awarded at least 1 IG	16	9	18	43
Not Awarded IG	9	7	26	42
Totals	25	16	44	85

Table 1.3 shows annual productivity rates (number of production items per year), also classified by EVPRP IG and EG.

<i>Table 1.3. Mean annual productivity rate.</i>		
	Awarded at least 1 EG	Not Awarded EG
Awarded at least 1 EVRPP IG	4.21	3.52
Not Awarded IG	6.24	3.57

These are categorized by successful EVPRP IG and EG awards. Productivity ranking seems tied for lowest for faculty unsuccessful at securing EGs (3.52 & 3.57). Individuals who secured at least one EVPRP IG and at least one EG are more productive (4.21). Seemingly, the most productive faculty (6.24) are individuals who were awarded at least one EG, but no EVPRP IG, suggesting that there are selection effects. More information on comparisons of faculty productivity among Internal Grant recipients versus those without internal funding by research area can be found in the Appendix.

Longitudinal Data

Table 1.4 shows the results of the GLMM analysis of External Grants as a response to Academic Area, EVPRP Internal Grants, and Productivity.

Table 1.4. GLMM Model results for EG response (External Grants).			
Response	AIC	Observations	Individuals
External Grants	1531.77	304	101
<i>Factor</i>	<i>Effects¹</i>	<i>t-value</i>	<i>p-value²</i>
Overall Mean	0.02	-	-
EVPRP Grants	1.92	1.55	0.12
Productivity	1.09	2.91	< 0.005
¹ Effects of this model are interpreted as the <i>increase in probability</i> of obtaining an External Grant. ² Factor with p-values > 0.05 kept because removal worsens model fit (increases AIC).			

This model with an AIC value of 1531.77, is the linear model that best explains the data on hand. The interpretation of the effects is as an increase in the probability of securing an external grant (EG). Categorizing by Academic Area (Art, Humanities, and Social Science) had very little impact in the probability of obtaining an EG. Therefore, the intercept in this table is the overall mean probability of obtaining an external grant (across Art, Humanities, and Social Sciences).

Not accounting for the other variables, faculty in CLA have a 0.02 probability of obtaining an external grant. The variable EVPRP Grants is a categorical binary (1/0) variable representing whether individuals were awarded an internal grant (1) or were not awarded an internal grant (0) following application. The estimated effect for EVPRP Grants indicates that *on average*, a faculty awarded one such grant has 1.92-times the probability of obtaining an external grant than individuals who did not obtain an EVPRP IG. *In other words, on average, a faculty awarded an EVPRP IG increases their probability of obtaining an external grant by 92%.*

The continuous variable Productivity has an estimated effect of 1.09. This means that for *every unit that Productivity increases there is a 9% increase in the probability of obtaining an external grant.*

Table 1.5a provides results of the GLMM analysis of Productivity as a response to Academic Area, EVPRP Internal Grants, and External Grants.

Table 1.5a. GLMM Model results for TP response (productivity).			
Response	AIC	Observations	Individuals
Academic Productivity¹	753.13	304	101
Academic Area	Area Mean ² (intercept)	Effect of EVPRP IG	Effect of External Grants
Arts	4.42	1.01	1.44
Humanities	2.99	1.11	1.44
Social Sciences	5.15	0.63	1.44
¹ This is an interaction model. Slopes differ between Academic Areas – slopes are interpreted individually.			
² Effects of this model are interpreted as the ratios of the rates of annual productivity between factors and reference.			

This model with an AIC value of 753.13 is the linear model that best explains the data on hand. Effects of all explanatory variables included in this model should be interpreted as meaningful. This model includes an interaction term for Academic area and EVPRP IG. This means that the effects of IG differ by Academic Area. Results are presented as separate linear models.

Not accounting for the other variables, the intercept values model mean that faculty in Arts have an average annual rate of productivity of 4.42 academic outputs (total numbers of books, peer reviewed articles, conference presentations, creative exhibitions). Compared to the Arts, faculty in the Humanities have a lower rate of productivity than the Arts (HUM = 2.99). Average annual productivity in the Social Sciences was estimated at 5.15 products.

The EVPRP IG variable represents whether an individual was awarded an internal grant (1) or was not awarded an internal grant (0) following EVPRP-grant submission. The estimated effect should be interpreted as a ratio of the rate of annual productivity over their intercept value. For example, values > 1 signify a positive proportional effect over their intercept estimate, while values <1 mean that the effect was on average negative. This effect varies between Academic Areas. The Arts, for example, have an estimated effect of 1.01 in addition to their average. This means that faculty in the Arts who receive EVPRP IGs benefit from a 1% increase in their average annual academic productivity (4.42 x 1.01 = 4.48). *Faculty in the Humanities benefit from an 11% increase in their average annual productivity.* On the other hand, the Social Sciences seem to incur a negative effect of EVPRP IG (5.15 x 0.63 = 3.24; rounded values).

In general, the model shows that EVPRP IG seems beneficial to faculty in 2 of 3 academic areas sampled. The negative effect on the Social Sciences might be due to inadequate sampling, or not enough time represented in the sample to see publications from social scientists who received funds in 2014 or 2015 to start data collection for a new project, or additional variables for which we did not account. Negative relationships associated with the Social Sciences are intuitive in

the context of the length of grant opportunity availability. This is elaborated further in the *Time, IG Submission, and IG Success Rates* section (Table 2.8, Figures 2.2 and 2.3). Future analyses with longer term databases should reveal a more conclusive answer.

Future analyses with longer term databases should reveal a more conclusive answer.

External Grants: The best model fitted a common slope for external grants across all academic departments. *In summary, faculty who were successfully awarded external grants, were on average 44% more productive annually.*

Because “Total Academic Products” seemed too coarse of a measure, the effect of EVPRP IGs on the frequency of published articles and books between Academic Areas were also examined within the GLMM structure. Where appropriate, this was accomplished by including an interaction term involving EVPRP Grants and Academic Area (EVPRP x AREA). Results are highlighted by Table 1.5b through 1.5c.

Table 1.5b: GLMM: Number of Published Articles by Academic Area.			
Response	AIC	Observations	Individuals
Number of Articles	960.83	304	101
Academic Area ¹	Area Mean ² (intercept)	Effect of EVPRP IG	Effect of External Grants
Humanities	0.67	1.10	1.53
Social Sciences	1.26	0.71	1.53
¹ This is an interaction model. Slopes differ between Academic Areas – slopes are interpreted individually.			
² Effects of this model are interpreted as the ratios of the rates of annual productivity between factors and reference.			

The estimated effect in table 1.5b indicates that *on average, the Social Sciences have a higher average rate of annual production of published journal articles.* This is not surprising.

In addition, *faculty in the Humanities who receive an EVPRP IG have a 10% increase in the annual rate of article publications.* On the other hand, the estimated effect shown of EVPRP IG means that on average, individuals in the Social Sciences who receive an EVPRP grant have a decrease in the annual rate of journal article publications (from 1.26 articles per year, to .9 articles per year).

Individual faculty who were successfully awarded external grants, were on average 53% more productive in publishing articles annually.

Table 1.5c: GLMM: Number of Published Books by Academic Area.			
Response	AIC	Observations	Individuals
Number of Articles	1469.8	304	101
Academic Area ¹	Area Mean ² (intercept)	Effect of EVPRP IG	Effect of External Grants
Humanities	0.05	0.75	1.29
Social Science	0.03	0.75	1.29
¹ Slopes do not differ between Academic. ² Effects of this model are interpreted as the ratios of the rates of annual productivity between factors and reference.			

The estimated effect in Table 1.5c indicates that *on average, the Humanities have a slightly higher average rate of annual production of books*. This is also not surprising; it is uncertain, however, whether this reflects a true population difference not due to sampling. A common slope was fit because the interaction effect did not make a significant improvement to the model.

Faculty in the Social Sciences and Humanities who receive an EVPRP internal grant (IG) seem to incur a decrease in the annual rate of book publications. This negative effect might be due to inadequate sampling, or additional variables for which we did not account. Future analyses should reveal a more conclusive answer.

In addition, overall individual faculty who were successfully awarded external grants, were estimated on average as 29% more productive in publishing books annually.

Relationship between amounts of External Grants, EVPRP Grants, and Academic Productivity

Table 1.6 shows the average amount of external grants associated with the amount of EVPRP internal grants. Similar to the patterning in Table 1.6, *CLA Faculty in the Humanities and Social Sciences awarded internal funding >\$5,000, received larger amounts of external funding, on average.* Faculty associated with Arts on the other hand follow a reverse pattern, and receive less external funding when IGs > \$5,000.

Table 1.6. Average¹ EG Award Categorized by IG Award Amount and Academic Area

IG Award Amount	AREA	EVPRP Award	Average EG Award	Maximum EG Award
< \$5k	ART	Not Awarded	\$ 33,351	\$ 91,767
< \$5k	HUM	Not Awarded	\$ 3,794	\$ 35,539
< \$5k	SSC	Not Awarded	\$ 144,016	\$ 2, 109,881
< \$5k	ART	Awarded	-	-
< \$5k	HUM	Awarded	\$ 71,653	\$ 434,419
< \$5k	SSC	Awarded	\$ 10,000	\$ 20,000
> \$5k	ART	Awarded	\$ 1,670	\$ 6,680
> \$5k	HUM	Awarded	\$ 124,507	\$ 1, 288,350
> \$5k	SSC	Awarded	\$ 289,788	\$ 3, 079,844

¹Average is based on the total of each individual faculty.

Table 1.7 provides results of a GLMM analysis of the dollar amount of external funding awards as a response to Academic Area, EVPRP Grant Amount, and Productivity. Results illustrate relationships between the amount of external funding received by faculty, their EVPRP IG funding dollars and academic productivity. These relationships are also illustrated by Figure 1.1.

The intercept amount provides an average amount of EG grant funding in the absence of any EVPRP IG or Productivity (when EVPRP IG and Productivity = 0).

Table 1.7: External Award Amount by Academic Area.

Response	AIC	Observations	Individuals
EG Award Amount	160.95	304	101
Academic Area	Area Mean ² (intercept)	Effect of EVPRP IG Amount	Effect of Productivity
Art	\$4,961.88	0.99	1.41
Humanities	\$16,263.95	1.00004	1.01
Social Sciences	\$53,645.87	0.99	0.93

¹This is an interaction effects model. Effect of EVPRP IG Amount and Productivity differ between Academic Areas– slopes are interpreted individually.
²Effects of this model are interpreted as compounded rates that modify the intercept in a multiplicative model detailed as:
Expected EG \$ = Area \$ × EVPRP IG_{effect}^{Award \$} × Productivity_{effect}^{No. of Products}

For example, *on average*, faculty with no EVPRP IG, and Productivity of 0, are expected to receive external funding of \$4,961.88 if in the Arts, \$16,263.95 if in the Humanities, and \$53,645.87 if in the Social Sciences. Adding the estimated effects of EVPRP IG Amount and Productivity modifies the expected value of EG amount. This modification is different under every Academic Area.

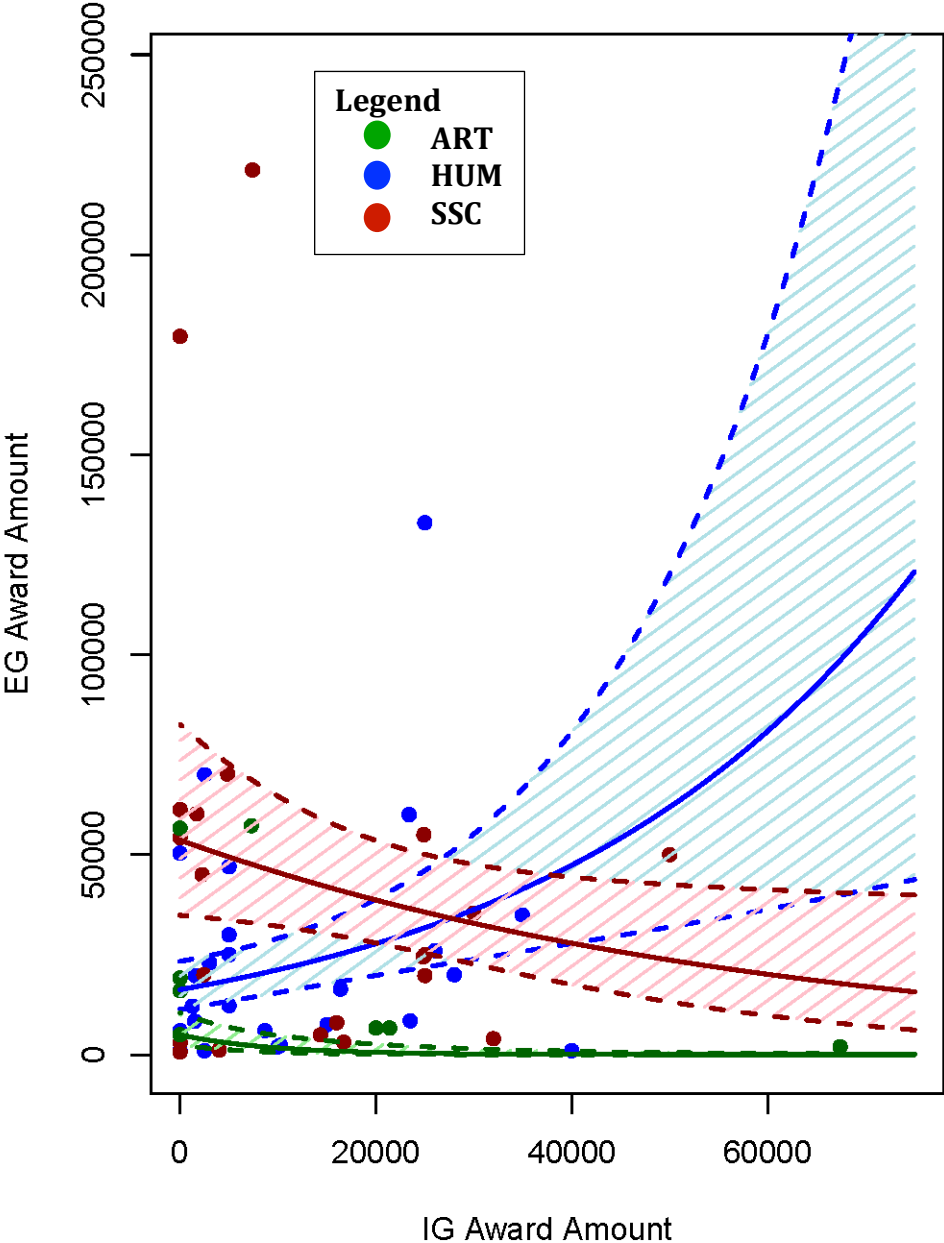


Figure 1.1. Plot of predicted values, standard error regions, and actual values by Academic Area detailed in the model on Table 14.

This was slightly more complicated during modeling because this model includes two necessary “interaction terms”: the first between EVPRP IG Amount and Academic Area; the second between Productivity and Academic Area. This means that *the relationship between EVPRP Funding Amount and External Funding Amounts differs between Academic Areas, and that Productivity and External Funding Amounts also differs between Academic Areas.*

For example, in the Arts, this model shows that the effect of EVPRP IG Amount and EG Amount is negative, at 0.99. This means that *on average, for every dollar in EVPRP IG received, faculty in the Arts receive a 1% compounded decrease in EGs.* This could be due to several reasons speculated on below. The estimate of EVPRP IG effect on faculty in the Humanities is seemingly small at 1.00004. After accounting for compounding, however, this means that: *A) after receiving \$1,000 in EVPRP IG, faculty in the Humanities receive an additional 4% in EG dollars; and B) for \$10,000 there is a 50% increase in the amount of EGs.* The model also shows that *the relationship between EVPRP IG dollars and EG dollars in the Social Sciences is negative, similar to the relationship described for the Arts. The Social Sciences, however, start at a higher average EG award amount.*

Faculty also affect the EG award amount through their productivity. The effect of productivity also varies by Academic Area. *For example, the effect of productivity in the Humanities is a positive compounded 41% rate for every product.* The Arts compounded effect was estimated at a positive 1%. On the other hand, the Social Sciences had a negative compounded effect (<1%).

Time, IG Submission, and IG Success Rates

CLA and EVPRP awards have been available to the arts and humanities since 2011 with submissions in 2010, and to the social sciences since 2014, with submissions in 2013. Table 1.8 shows the distribution of EVPRP internal grant submissions and awards by Academic Area and over time. These EVPRP data are representative across all CLA grants. Faculty in the Humanities have commendably capitalized on these funding opportunities since inception in 2011, and have continued doing so. These grants have only been available to the Social Sciences since 2014, and these faculty have been taking advantage of these opportunities as well.

Table 1.8. EVPRP Submissions and Awards between 2011-2016			
Year	Academic Area	EVPRP Submissions	EVPRP Awards
2010-2011	ART	4	0
2011-2012	ART	2	1
2012-2013	ART	1	0
2013-2014	ART	6	3
2014-2015	ART	3	2
2015-2016	ART	1	1
2010-2011	HUM	20	4
2011-2012	HUM	8	4
2012-2013	HUM	8	3
2013-2014	HUM	25	15
2014-2015	HUM	6	6
2015-2016	HUM	11	2
2010-2011	SSC	6	1
2011-2012	SSC	2	0
2012-2013	SSC	2	1
2013-2014	SSC	16	7
2014-2015	SSC	7	6
2015-2016	SSC	7	6

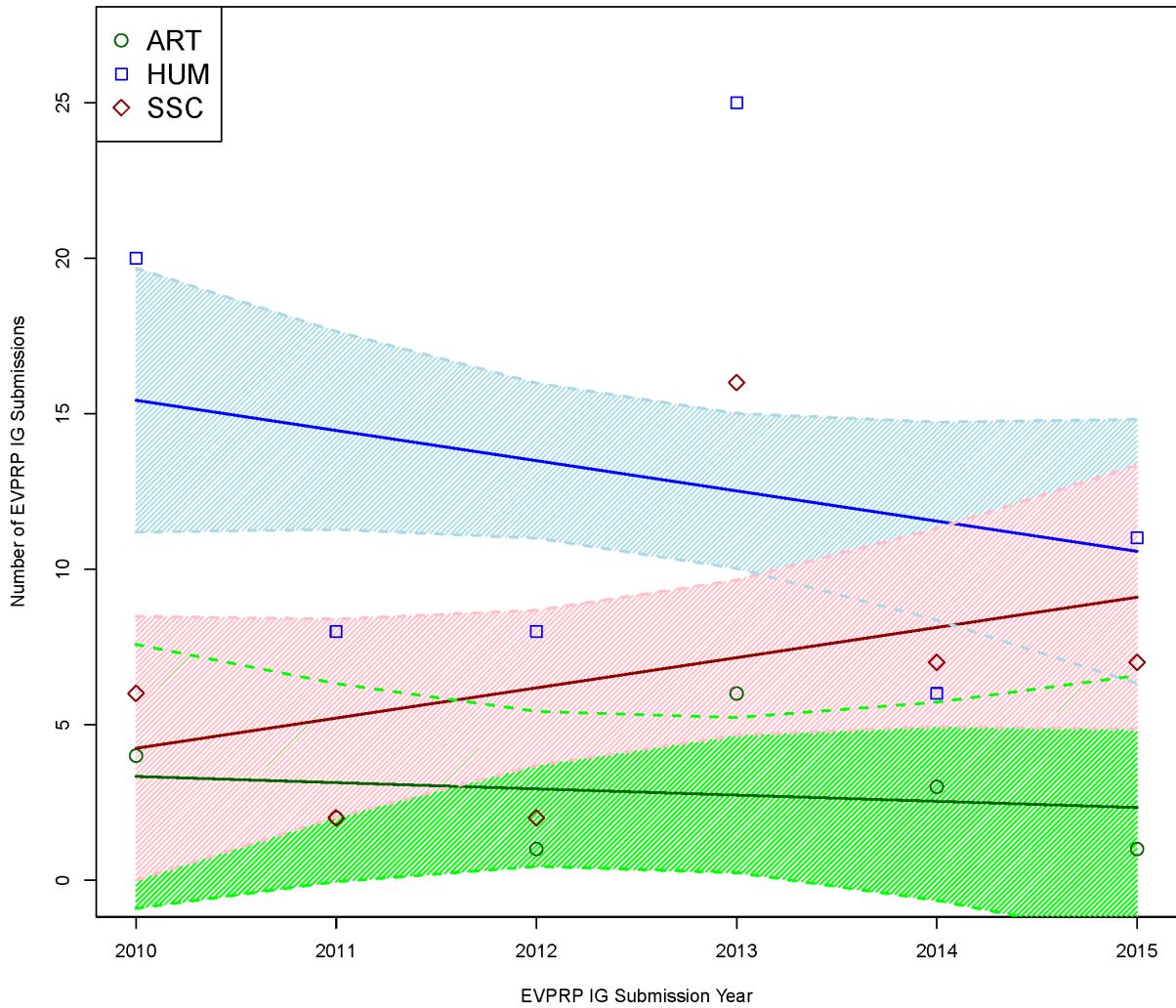


Figure 1.2. Plot of predicted values, standard error regions, and actual values of EVPRP grant submissions between 2010-2015 by Academic Area.

As Figure 1.2. indicates, although humanities’ submissions were high in 2010, these have decreased, and can be modeled as a linear trend. On the other hand, the social sciences have continuously increased their number of submissions between 2010 and 2015. If these trends continue, the number of Social Science submissions is likely to surpass that of the humanities.

Interestingly, Figure 1.3 shows the modeled and actual values of *EVPRP grant awards* between 2010-2015 (technically 2011-2016) by Academic Area.

The Humanities’ rate of grant awards seems to have steadily increased between 2010 and 2015. This is likely because their numbers of submissions have decreased. The rate of award success by the social sciences has continuously increased, also likely because their number of submissions has increased between 2010 and 2015. Although within the error margin, currently, if these trends continue, the number of Social Science awards is likely to surpass that of the humanities (this trend is based on the table above).

This phenomenon is likely the reason for the slightly non-positive relationship between EVPRP dollar amount and external grant dollars – the social science EVPRP IGs have probably not had enough time to show a direct effect at the moment.

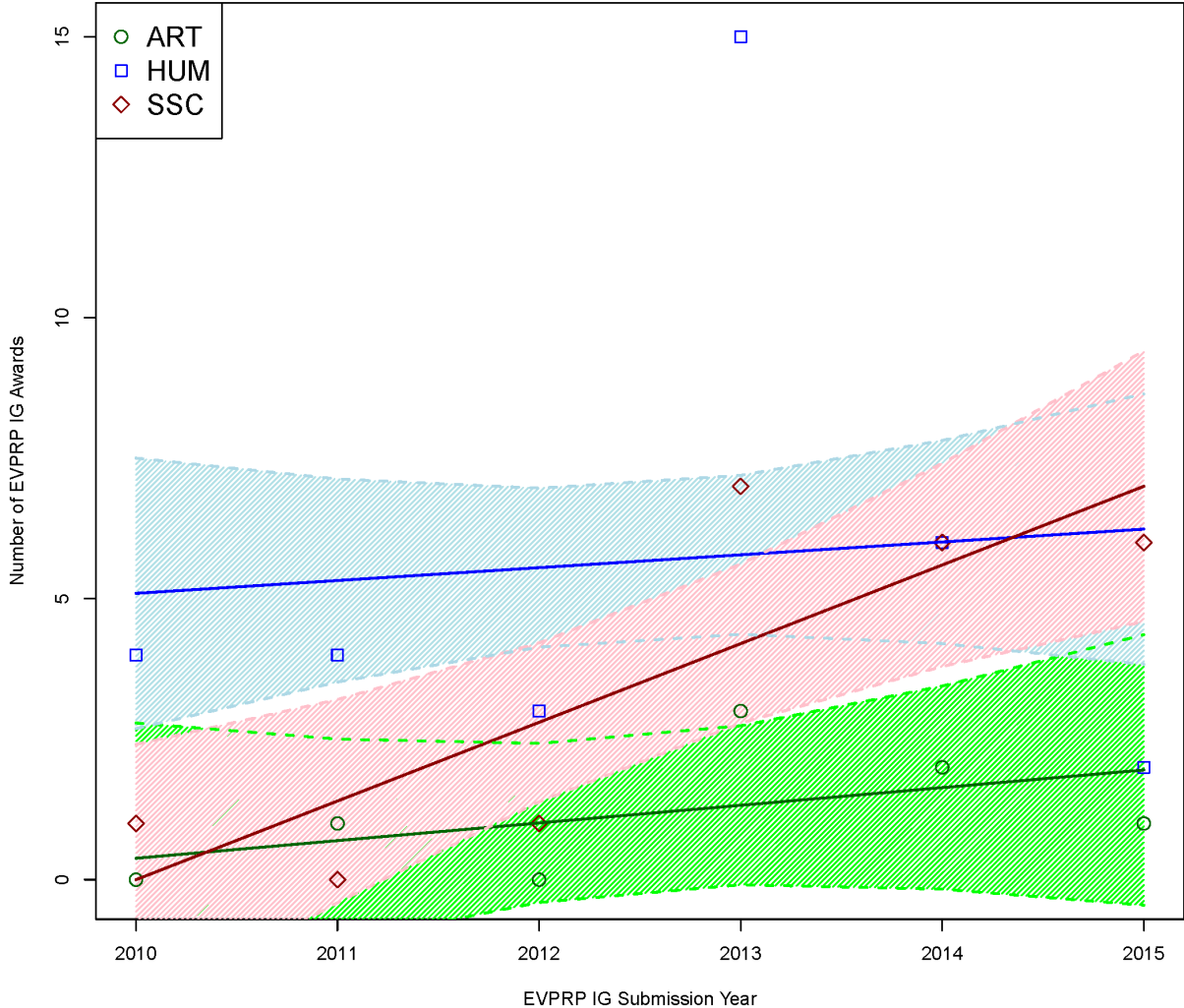


Figure 1.3. Plot of predicted values, standard error regions, and actual values of EVPRP grant awards between 2010-2015 by Academic Area.

Section 2. CLA Internal Grants EVPRP & Global Synergy IG)

Proportions and Rates

Table 2.1 shows the proportion of CLA faculty in our sample who were awarded at least one CLA internal grant (including EVPRP & Global Synergy) and those who were awarded at least one external-to Purdue grant.

	n	Percentage (out of 88)
Faculty awarded at least 1 IG	50	56.8%
Faculty awarded at least 1 EG	30	34.1%

Rows in Table 2.2 show the frequency of faculty who were awarded at least one CLA IG and those who did not receive an IG. Similarly, the columns in this table show the frequency of faculty who were awarded EGs, and those who did not receive any EGs. EGs are further broken down to inspect whether 1) faculty did not receive EGs but made at least an EG application, and 2) whether faculty did not receive EGs because no EG applications were made. *The frequency distribution of faculty awarded IGs and EGs is more extreme than expected under a model of complete random distribution ($X^2 = 5.63, P=0.05, 10,000$ permutations).*

This statistic highlights discrepancies in the frequency distributions shown on Table 2.2: 71% (22/31) of faculty who received CLA IGs and applied for EGs, were successful at securing at least one EG. In contrast 53% (8/15) of faculty who received CLA IGs and applied for EGs, were successful at securing at least one EG. *That is a 33% increase in the percentage of faculty who secured an EG.*

	Awarded at least 1 EG	No EG Awards and at least 1 EG Application	No EG Awards and No EG Applications	Totals
Awarded at least 1 IG	22	9	19	50
Not Awarded IG	8	7	23	38
Totals	30	16	42	88

This suggests that faculty who are awarded internal grants were more likely to receive external grant awards.

Table 2.3 shows annual productivity rates, also classified by CLA IG and EG.

	Awarded at least 1 EG	Not Awarded EG
Awarded at least 1 EVRPP IG	4.01	3.71
Not Awarded IG	6.53	3.20

Average annual productivity rates of CLA faculty that applied for CLA IG are shown on Table 2.3, categorized by successful CLA IG and EG awards. *Productivity ranking is lowest for faculty*

unsuccessful at securing CLA IGs and EGs (3.20). Faculty unsuccessful at receiving EGs but who did receive IGs seem more productive yielding 3.71 annual academic products, on average. Individuals who secured at least one CLA IG and at least one EG are even more productive (4.01). Seemingly, the most productive faculty (6.53) are individuals who were awarded at least one EG, but no CLA IG.

Longitudinal Data

Table 2.4 shows the results of the GLMM analysis of the probability of receiving External Grants as a response to Academic Area, CLA Internal Grants, and Productivity.

Table 2.4. GLMM Model results for EG response (External Grants).

Response	AIC	Observations	Individuals
External Grants	1701.89	304	101
Factor	Effects¹	t-value	p-value²
Academic Area	-	-	-
Art (Reference)	0.005	-	-
Humanities	6.00	1.39	0.16
Social Science	6.43	1.64	0.11
CLA Grants	1.63	1.99	0.047
Productivity	1.10	3.32	< 0.001
¹ Effects of this model are interpreted as the <i>increase in probability</i> of obtaining an External Grant. ² Factors with p-values < 0.05 kept because removal worsens model fit (increases AIC).			

This model with an AIC value of 1701.89, is the linear model that best explains the data on hand. Most explanatory variables are statistically significant (p-values <0.05). The interpretation of the effects is as a change in the probability of obtaining an EG. Faculty in different Academic Areas have differing probabilities of obtain an EG, when all other variables are held constant at 0. The Academic Area variable contains 3 levels: Art, Humanities, and Social Science. Estimated coefficients (the effects) are measured from the Arts as reference (the intercept).

Not accounting for other variables, faculty in the Arts have a 0.005 probability of obtaining an external grant. *Compared to faculty in the Arts, faculty in the Humanities have 6-times greater probability of obtaining an external grant. The Social Sciences have 6.43 times greater probability of obtaining an external grant, also compared to the Arts.* The binary (1/0) categorical variable CLA Grants represents whether individuals were awarded an internal grant (1) or were not awarded an internal grant (0) following application. The estimated effect **for CLA Grants indicates that individuals awarded one such grant have 1.64-times greater probability of obtaining an external grant than individuals who did not obtain a CLA IG.** The continuous variable Productivity has an estimated effect of 1.10. This means that for every unit **that Productivity increases there is a 10% increase in the probability of obtaining an external grant.**

Table 2.5a provides results of the GLMM analysis of Productivity as a response to Academic Area, CLA Internal Grants, and External Grants.

Table 2.5a. GLMM Model results for TP response (productivity).			
Response	AIC	Observations	Individuals
Productivity	847.79	304	101
Factor	Effects¹	t	p
Academic Area	-	-	-
Art (Reference)	4.35	-	-
Humanities ²	0.71	-1.42	0.16
Social Sciences	1.03	0.13	0.89
External Grants	1.52	2.89	0.004
CLA Grants ³	0.83	-1.39	0.16
¹ Effects of this model are interpreted as the ratios of the rates of annual productivity between factors and reference. ² Academic Area factor kept because p-value between HUM & SSC <0.05 ³ Internal Grants factor kept in model because removing it increases AIC and worsens model.			

This model with an AIC value of 847.79 is the linear model that best explains the data on hand. Two explanatory variables (Academic Area and External Grants) are overall statistically significant (p-values <0.05). The variable CLA Internal Grants has a p-value = 0.16.

Not accounting for the other variables, faculty in Arts have an average annual rate of productivity of 4.35 academic outputs (total numbers of books, peer reviewed articles, conference presentations, creative exhibitions). Compared to the Arts, faculty in the Humanities have a ratio to the Arts that is less than 1 (HUM/ART = 0.71). This means that the average annual rate of faculty productivity in HUM is 71% of the ART annual productivity rate (0.71 * 3.6 = 3.07). The Social Sciences-to-Arts rate is 1.03, meaning that Social Sciences annual productivity is slightly higher than the Arts by about 3%. The CLA Internal Grant variable represents whether an individual was awarded an internal grant (1) or was not awarded an internal grant (0) following internal grant submission. The estimated effect shown in the table is negative but not statistically significant.

In addition, faculty who were successfully awarded external grants, were on average 52% more productive annually.

The effect of CLA Grants on the frequency of published articles and books between Academic Areas were also examined within the GLMM structure. Where appropriate, this was accomplished by including an interaction term involving CLA Grants and Academic Area (CLA x AREA). Results are highlighted by Tables 2.5b through 2.5c.

Table 2.5b: GLMM: Number of Published Articles by Academic Area.			
Response	AIC	Observations	Individuals
Number of Articles	1038.765	304	101
Academic Area ¹	Area Mean ² (intercept)	Effect of CLA IG	Effect of External Grants
Humanities	0.70	1.10	1.56
Social Sciences	1.45	0.71	1.56
¹ This is an interaction model. Slopes differ between Academic Area – slopes are interpreted individually. ² Effects of this model are interpreted as the ratios of the rates of annual productivity between factors and reference.			

The estimated effect shown in the Table 2.5b indicates that on average, individuals in the Humanities who receive an CLA grant have a 10% increase in the annual rate of article publications. Furthermore, individual faculty who were successfully awarded external grants, were on average 56% more productive in publishing articles annually. Individuals in the Social Sciences who receive a CLA grant, although they begin with greater productivity (see intercept), have a decrease in the annual rate of article publications. Furthermore, individual faculty in either academic area who were successfully awarded external grants, were on average 56% more productive in publishing articles annually.

Table 2.5c: GLMM: Number of Published Books by Academic Area.			
Response	AIC	Observations	Individuals
Number of Articles	1612.48	304	101
Academic Area ¹	Area Mean ² (intercept)	Effect of CLA IG	Effect of External Grants
Humanities	0.06	0.57	1.15
Social Sciences	0.03	0.57	1.15
¹ Slopes do not differ between Academic Area. ² Effects of this model are interpreted as the ratios of the rates of annual productivity between factors and reference.			

The estimated effect shown in the Table 2.5c shows that on average, individuals in the Humanities and Social Sciences who receive an CLA grant seems to decrease their annual rate of book publications. On the other hand, individual faculty who were successfully awarded external grants, were on average 11% more productive in publishing books annually. Individual faculty

who were successfully awarded external grants, were on average 15% more productive in publishing books annually.

Relationship between amounts of External Grants, CLA Grants, and Academic Productivity

Table 2.6 shows the average amount of external grants associated with the amount of CLA internal grants. The patterning is identical to Table 1.6 (EVPRP IG-only), **CLA Faculty in the Humanities and Social Sciences awarded internal funding >\$5,000, received larger amounts of external funding, on average. Faculty associated with Arts on the other hand follow a reverse pattern, and receive less external funding when IGs > \$5,000.**

Table 2.7. Average EG Award Categorized by IG Award Amount and Academic Area

IG Award Amount	AREA	EVPRP Award	Average EG Award	Maximum EG Award
< \$5k	ART	Not Awarded	\$ 33,351	\$ 91,767
< \$5k	HUM	Not Awarded	\$ 3,794	\$ 35,539
< \$5k	SSC	Not Awarded	\$ 144,016	\$ 2, 109,881
< \$5k	ART	Awarded	-	-
< \$5k	HUM	Awarded	\$ 71,653	\$ 434,419
< \$5k	SSC	Awarded	\$ 10,000	\$ 20,000
> \$5k	ART	Awarded	\$ 1,670	\$ 6,680
> \$5k	HUM	Awarded	\$ 124,507	\$ 1, 288,350
> \$5k	SSC	Awarded	\$ 289,788	\$ 3, 079,844

Table 2.7 provides results of a GLMM analysis of the dollar amount of external funding awards as a response to Academic Area, CLA Grant Amount, and Productivity. Results illustrate relationships between the amount of external funding received by faculty, their CLA IG funding dollars and academic productivity. These relationships are also illustrated by Figure 2.1.

The intercept amount provides an average amount of EG grant funding in the absence of any CLA IG or Productivity (when CLA IG and Productivity = 0).

Table 2.8: External Award Amount by Academic Area.

Response	AIC	Observations	Individuals
EG Award Amount	201.92	304	101
Academic Area	Area Mean ² (intercept)	Effect of CLA IG Amount	Effect of Productivity
Art	\$4,044.64	0.99	1.52
Humanities	\$12,110.24	1.00002	1.04
Social Sciences	\$27,173.67	1.000001	0.98

¹This is an interaction effects model. Effect of CLA IG Amount and Productivity differ between Academic Area – slopes are interpreted individually.
²Effects of this model are interpreted as compounded rates that modify the intercept in a multiplicative model:

$${}^3\text{Expected EG \$} = \text{Area \$} \times \text{CLA IG}^{\text{Award \$}} \times \text{Productivity}^{\text{No. of Products}}$$

For example, *on average*, faculty with no CLA IG, and Productivity of 0, are expected to receive external funding of \$4,044.64 if in the Arts, \$12, 110.24 if in the Humanities, and \$27,173.67 if in the Social Sciences. Accounting for the estimated effects of CLA IG Amount and Productivity modifies the expected value of EG amount. This modification is different under every Academic Area.

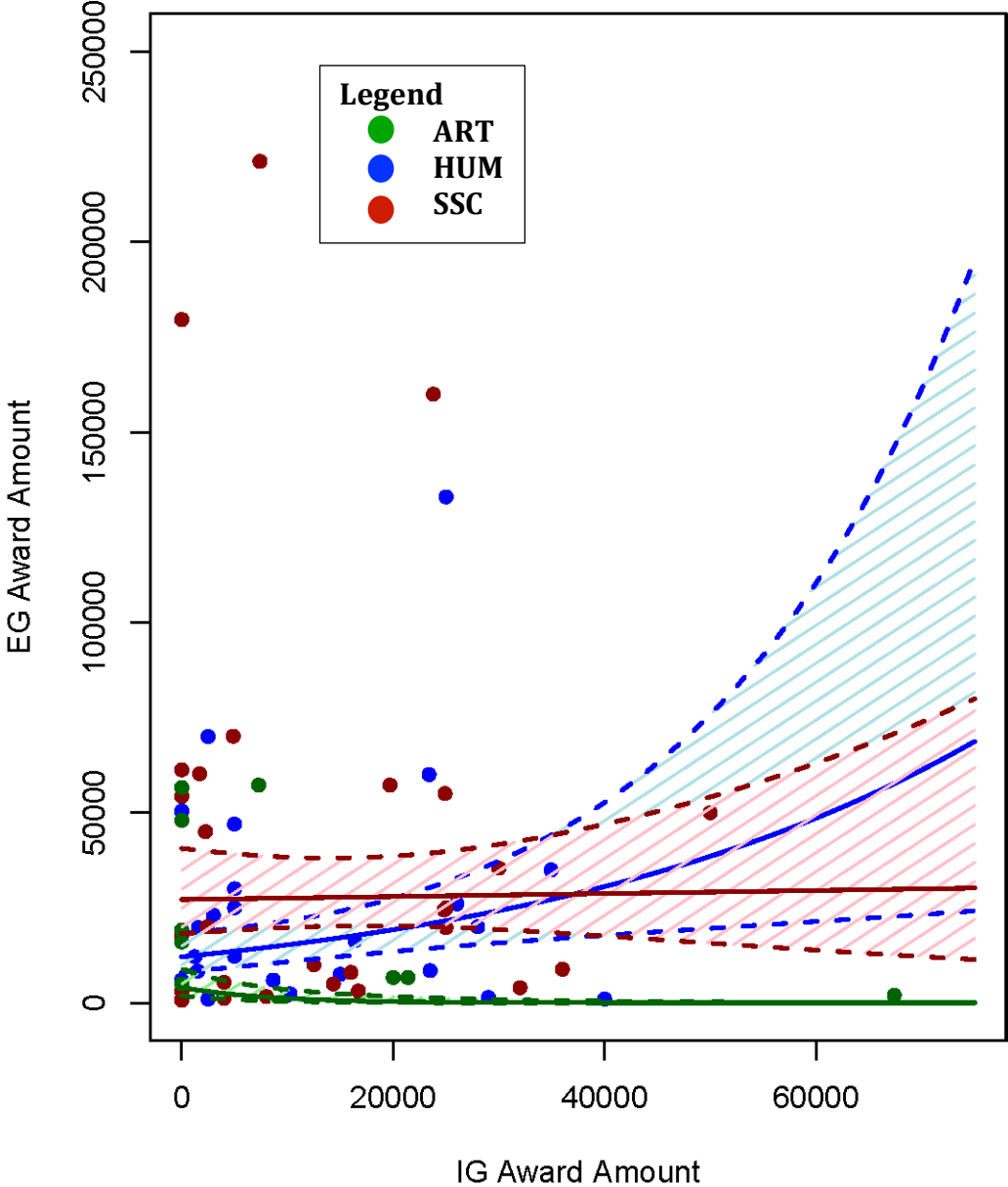


Figure 2.1. Plot of predicted values, standard error regions, and actual values by Academic Area detailed in the model on Table 2.8.

This was slightly more complicated because this model includes two necessary “interaction terms”: the first between CLA IG Amount and Academic Area; the second between Productivity and Academic Area. This means that *the relationship between CLA Funding Amount and External Funding Amounts differs between Academic Areas, and that Productivity and External Funding Amounts also differs between Academic Areas.*

For example, in the Arts, this model shows that the effect of CLA IG Amount and EG Amount is negative, at 0.99. This means that *on average*, for every dollar in CLA IG received, faculty in the Arts receive a 1% *compounded decrease* in EGs. For example, holding productivity at 0, the equation on Table 2.8 shows the relationship between CLA IG and EG. A CLA IG of \$1 results in:

$$\$4,044.64 \times 0.99^{\$1} \times 1.52^0 = \$4,004.19,$$

$$\text{Increasing the CLA IG amount to } \$10 \text{ results in } 1.52^0 = \$3,657.9$$

This effect is exponentially negative and is illustrated by Figure 2.1. The reason for this relationship might be due to several reasons speculated on below. The estimate of CLA IG effect on faculty in the Humanities is seemingly small at 1.00002. After accounting for compounding, however, this means that: A) after receiving \$1,000 in CLA IG, faculty in the Humanities receive an additional 2% in EG dollars; and B) for \$10,000 there is a 26% increase in the amount of EGs. The model also shows that the relationship between CLA IG dollars and EG dollars in the Social Sciences is very small after accounting for compounding. This means that: A) after receiving \$10,000 in CLA IG, faculty in the Social Sciences receive an additional 1.4% in EG dollars; and B) for \$100,000 there is a 15% increase in the amount of EGs. The Social Sciences, however, on average receive higher EG award amounts (the intercept).

Faculty also affect the EG award amount through their productivity. The effect of productivity also varies by Academic Area. For example, the effect of productivity in the Humanities is a positive compounded 52% rate for every product. The Arts compounded effect was estimated at a positive 4%. On the other hand, the Social Sciences had a negative compounded effect (<1%). However as shown in the EVPRP only analyses, more time will likely reverse this pattern.

Statistical Analysis-Conclusions

The internal grants assessment focused on a statistical analysis of the impacts of internal funding opportunities by the College of Liberal Arts (CLA) on their faculty at Purdue University.

Data collection and analyses were driven by specific questions directed at discovering the relationships between CLA internal funding, faculty productivity and external funding awards. Below is a brief summary of the main findings.

1) Does the presence of Internal Grants and faculty productivity affect the probability of obtaining External Grant Awards?

- a. Yes, internal grants positively affect the chances of faculty to obtain external funding. The estimated effect for EVPRP Grants indicates that on average, a faculty awarded one such grant has an increase of 1.63-1.92 times the probability of obtaining an external grant than individuals who did not obtain one. In other words, faculty awarded an internal grant on average increases her/his probability of obtaining an external grant by a range of 63-92%.
- b. Faculty productivity plays a key role in the probability of CLA faculty to obtain an external grant award. For every unit increase in productivity increases there is a 9-10% increase in the probability of obtaining an external grant.

2) Do Internal and External Grants affect CLA faculty productivity?

- a. Yes. Overall, CLA faculty who receive CLA internal funding support benefit by increasing their average rate of annual academic productivity. This relationship varies across academic areas, ranging between a small negative relationship to an average 11% increase. External grants also have an average positive relationship with academic productivity. Faculty who received external grants were found to have a 44-52% increase in annual productivity than faculty with no external grants.

3) Does the amount of Internal Grants affect the amount of External Grants received? Does productivity?

- a. Yes. On average, large internal grant amounts (>5,000) are associated with larger external grants. There is some variation between CLA academic areas, however.
- b. On average, faculty with no internal grants, and productivity of 0, are expected to receive a maximum base of external funding of \$4,961.88 if in the Arts, \$16,263.95 if in the Humanities, and \$53,645.87 if in the Social Sciences. Adding the effects of CLA internal grant amounts and productivity modifies the expected amount of external funding awards.
- c. On average, CLA funding modifies the expected amount of external funding positively—for every CLA dollar amount awarded, there is a positive increase in the amount of external funded received. This relationship varies by academic areas ranging between a 1% decrease to a 50% increase. The latter can be interpreted as: for every CLA-dollar received there is a 50% increase in external grant dollars. The relationship between Academic Productivity and External Funding follows a similar pattern.

Summary Faculty Perception Survey Results

We were also interested in learning about faculty values and the diversity of faculty perceptions of the impacts of the CLA/EVPRP internal grant funding they had received between 2011-2016. We conducted a Delphi evaluation (Delp, 1997) consisting of three online Qualtrics surveys with faculty recipients of internal grants in the summer 2016. Twenty-nine out of 51 faculty members who received the first survey participated and provided feedback on the impacts of the grants on their scholarship and careers. The open-ended qualitative responses from the first survey were coded using NVIVO software and condensed into key themes as they pertain to outcomes of internal funding, and faculty were subsequently surveyed again on the relative importance of these factors. Out of ten identified tangible outcomes identified by faculty in the first round of the survey (Collaborations, Conference Presentations, Events, External funding, Hiring Assistance, Invited Talks, Publications, Research Trips, Tool creation, Visibility in field), CLA faculty attributed the highest value to **publications** when indicating the importance of each individual outcome on a scale of 1 – Not at all important to 5 – Extremely important (n=15, mean 4.67), followed by “Visibility in the field” and “Collaborations” (mean for both 3.93). Faculty also identified 7 less tangible outcomes of internal funding: Creativity, Excitement for research, Faculty retention, Institutional support/value for research, Job satisfaction, Motivation, Time for research. Across ranks and disciplines the CLA Faculty overwhelmingly identified **institutional support and value for their research** as the most important outcome that is difficult to measure, with a mean of 4.8 on a scale of 1 – Not at all Important to 5 – Extremely important, followed by job satisfaction (mean 4.46) and time for research (4.43).

Discussion

Our combined analyses clearly demonstrate that internal grants programs in the College of Liberal Arts have had tangible beneficial impacts on faculty external grant awards and productivity. The programs provide critical seed money to launch new projects, further scholarly publications and other activities and establish feasibility of new research proposals to external funders. One recent winner of a large NEH grant commented, “I’m deeply grateful for the CLA (internal grant) support, without which this external grant would not have been possible”. Our online survey showed that of the less tangible benefits of the internal grants programs, faculty placed the most importance on institutional support and value for their research. It is hard to over stress the importance of this finding, especially in areas where visible supports, incentives and recognitions for faculty achievements have historically been scarce.

Our statistical analysis shows that the effects of the internal grants programs are stronger when all the CLA internal grant support is taken as a whole, as represented in our second set of analyses, which include the Global Synergy Grants as well as the internal grant programs funded by the EVPRP. The largest and longest term investment of the EVPRP programs has been targeted at the Humanities and Arts, with other programs coming on board later and with smaller award amounts. Including the Global Synergy Grants, that have been available during the entire time period represented in our study (2011-2016) and are open to faculty across disciplines, help strengthen our ability to draw conclusions about the impacts of internal funding on faculty productivity and external grant awards.

Our analysis indicated that our productivity measure of TP is lowest for faculty unsuccessful at securing either CLA IGs or EGs. If our sample included those faculty who had not submitted any kind of grant proposal during our study period we would expect to see even a stronger impact of the internal awards on external grant success. Some of the variation in productivity and external grant award activity between disciplinary areas reflects the shorter time period following the EVPRP programs that were attractive to Social Sciences faculty (ERSS and Transdisciplinary funds were only represented in our sample for 2014 and 2015, with little time represented after grant award to generate products or EG dollars. We can anticipate that if we follow faculty who have received funding from these programs over a longer time we will see more positive impacts and fewer differences between the disciplinary areas in impact of internal funding. We also note that our measure of TP is relatively crude. Additional analyses and ways of assessing productivity that allow weighting of the relative importance of various kinds of activities in our diverse disciplines would improve our understanding and analysis of the relationships between internal and external funding and faculty productivity.

Recommendations

This analysis leads us to request continuation of the EVPRP funding as the internal grant support is meaningful to our faculty, provides tangible benefits to scholarly activity in CLA and increases the likelihood that faculty will receive external grant awards. In order to improve the effectiveness of the internal support as seed money for external grant awards, we propose that we consolidate the funding into the two most in demand and effective programs, the Enhancing Humanities and Arts Award (EHA) and the Exploratory Research in the Social Sciences program (ERSS). Given our finding that bigger internal grants lead to bigger external grants we would like to be able to administer fewer and larger EVPRP funded awards. This consolidation should also improve efficiency in administering the programs across CLA, EVPRP and sponsored program offices. We hope this change will provide a boost to increase the potential for bigger impact of these programs in the Social Sciences where faculty tend to compete more often for external grant support.

We would like to accomplish this change by reallocating the other two EVPRP grants (RIG and TIG) to the EHA and ERSS programs. The new CLA administered ASPIRE program provides seed money for faculty research and support for conference presentations that had been provided by the EVPRP RIG fund. We propose to reallocate the \$50,000 allocation from the RIG to the ERSS Program. The Transdisciplinary Grant program (TIG) was the most experimental of the EVPRP funded programs and in the three years we have administered, we have not yet received a large number of proposals. We continue to share the commitment to the importance of promoting interdisciplinary activity between CLA and other Purdue colleges. As such, we propose to split the TIG allotment between the EHA and ERSS programs. This would begin to equalize the total internal funding available for faculty across the Humanities, Arts and Social Sciences and streamline the annual EVPRP funding to \$175,000 for the Enhancing Humanities and the Arts Program and \$150,000 for the Exploratory Research in the Social Sciences Program. We would discontinue the separate TIG competition but each of the two remaining program announcements would be revised to include new language that encourages and provides special consideration for proposals that have interdisciplinary and transdisciplinary components.

We plan to continue to track, monitor and assess the relationships between internal and external funding and a finessed measure of faculty productivity over time in order to continue to better promote high quality scholarship, grant seeking and the profile of Purdue Liberal Arts faculty. In order to increase faculty awareness of one of the main intents of the internal funds to promote EG activity, we propose new guidelines and criteria that internal grant applications and reports require faculty to more explicitly discuss external grant submission activity and grant-writing development that includes specific plans to use EVPRP, CLA or other supports and trainings available. In the future we plan to introduce stipulations on the funds that would require those who have previously received more than \$10,000 in internal funding to submit external grant or fellowship proposals of over \$50,000 before they would be considered eligible to apply for additional internal funding >\$5000.

References Cited

Akaike, Hirotugu

1974 A New Look at the Statistical Model Identification. *IEEE Transactions on Automatic Control* AC19(6):716-723.

Box, George E. P., Gwilym M. Jenkins and Gregory C. Reinsel

1994 *Time Series Analysis: Forecasting and Control*. 3rd ed. Prentice Hall, Englewood Cliffs, New Jersey.

Burnham, K. P. and D.R. Anderson

2002 *Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach, 2nd Ed.* Springer, New York.

Delp, Peter, et al.

1997. "Delphi." In *System Tools for Project Planning*. International Development Institute, Bloomington, IN.

Hulbert, Stuart H.

1984 Pseudoreplication and the Design of Ecological Field Experiments. *Ecological Monographs* 54(2):187-211.

Hyndman, R. J. and Y. Khandakar

2008 Automatic Time Series Forecasting: The Forecast Package for R. *Journal of Statistical Software* 27(3):1-22.

McCullagh, P. and John A. Nelder

2000 *Generalized Linear Models*. 2nd ed. Chapman & Hall/CRC, Boca Raton, FL.

Pinheiro, José, Douglas Bates, S. DebRoy, D. Sarkar and R Core Team

2016 nlme: Linear and Nonlinear Mixed Effects Models. R Package Version 3.1-127, [Http://Cran.R-Project.Org/Package=nlme](http://cran.r-project.org/package=nlme).

R Development Core Team

2016 R: A Language and Environment for Statistical Computing. Version 3.3.0. R Foundation for Statistical Computing, Vienna. Url [Http://Cran.R-Project.Org](http://cran.r-project.org). general editor.

Venables, W. N., Brian D. Ripley and W. N. Venables

2002 *Modern Applied Statistics with S*. 4th ed. Statistics and Computing. Springer, New York.

APPENDIX: Descriptive Data Tables

I. DESCRIPTIVE DATA ON EVPRP AND OTHER CLA INTERNAL FUNDING SUBMISSIONS AND AWARDS 2010-2016

TABLE 1: COLLEGE OF LIBERAL ARTS EVPRP AND OTHER INTERNAL FUNDING 2011-2016

CLA Internal Grant Award amounts per Funding Source by Year, 2011-2016							
	2011	2012	2013	2014	2015	2016	Grand Total
EVPRP funded	\$210,000.00	\$150,000.00	\$155,978.00	\$283,854.51	\$245,774.70	\$249,946.00	\$1,295,553.21
Global Synergy	\$25,550.00	\$48,816.68	\$50,000.00	\$48,516.14	\$57,160.36	\$49,900.00	\$279,943.18
Grand Total Awards	\$235,550.00	\$198,816.68	\$205,978.00	\$332,370.65	\$302,935.06	\$299,846.00	\$1,575,496.39

TABLE 2: EVPRP FUNDED GRANT AWARDS 2011-2016

PRP FUNDED GRANT AWARDS BY YEAR							
	2011	2012	2013	2014	2015	2016	Total
ancing Humanities	\$210,000	\$150,000	\$155,978	\$189,352.71	\$150,000	\$149,946	\$1,005,276.71
Exploratory Social Sciences				\$47,006.57	\$29,850.7	\$50,000	\$126,857.27
Research Initiative				\$38,717.23	\$15,924	\$50,000	\$104,641.23
Transdisciplinary				\$8,778	\$50,000	\$50,000	\$108,778
Grand Total	\$210,000	\$150,000	\$155,978	\$283,854.51	\$245,774.7	\$249,946	\$1,295,553.21

*Research Initiative Funds in 2016 were allocated to CLA Faculty Development Center Fellows

TABLE 3: EVPRP AWARDS RELATIVE TO SUBMISSIONS BY YEAR

EVPRP Awards Funded Relative to Total Numbers of Submissions by Year								
	2011	2012	2013	2014	2015	2016	Grand Total	Success Rate
Enhancing Humanities	5/34	5/14	5/11	7/13	3/4	5/9	30/85	35.3%
Exploratory Social Sciences				3/9	2/3	3/4	8/16	50%
Research Initiative				18/22	7/7		25/29	86.2%
Transdisciplinary				2/4	2/2	4/6	8/12	66.7%
Total Awards/Submissions	5/34	5/14	5/11	30/48	14/16	12/19	71/142	50%

TABLE 4: EVPRP GRANT AWARDS BY CLA UNIT BY YEAR

EVPRP Award Amount								Percent of Total
	2011	2012	2013	2014	2015	2016	Total	
ANTH				\$11,260.25	\$100,853.78	\$85,000.00	\$197,114.03	15.21
COMM	\$30,000.00			\$49,436.57	\$17,684.70		\$97,121.27	7.50
ENGL	\$50,000.00			\$77,584.27	\$59,614.17	\$45,000.00	\$232,198.44	17.92
HIST	\$40,000.00	\$40,000.00	\$0.00	\$10,000.00	\$45,122.05	\$34,946.00	\$170,068.05	13.13
PHIL		\$3,000.00	\$23,394.00				\$26,394.00	2.04
POL			\$74,856.00			\$25,000.00	\$99,856.00	7.71
SLC	\$90,000.00	\$80,000.00	\$57,728.00	\$102,413.38			\$330,141.38	25.48
SOC				\$1,700.00		\$41,000.00	\$42,700.00	3.30
VPA		\$27,000.00		\$31,460.04	\$22,500.00	\$19,000.00	\$99,960.04	7.72
Grand Total	\$210,000.00	\$150,000.00	\$155,978.00	\$283,854.51	\$245,774.70	\$249,946.00	\$1,295,553.21	100

TABLE 5: OVERALL EVPRP DISTRIBUTION BY DISCIPLINARY AREA

EVPRP submissions and awards distributed by Disciplinary Area:

	Awards/Submissions	Proportion of EVPRP Grants by Area	Award Success Rate by Area
Social Sciences	22/40	31%	55%
Humanities	42/83	59%	50.6%
Arts	7/19	9.9%	36.8%
Grand Total	71/142	100%	50%

Note: Faculty in Anthropology, Political Science, Communication, and Sociology are combined in Social Sciences according to Purdue University. English, Philosophy, History faculty as well as faculty from the School of Languages and Cultures are combined in Humanities.

TABLE 6: EVPRP AWARDS BY FACULTY RANK AND YEAR

EVPRP Awards Funded Relative to Submissions by Faculty Rank and Year								
	2011	2012	2013	2014	2015	2016	Grand Total	Success Rate
Assistant	3	2	1	8	4	6	24/41	58.54%
Associate	2	3	3	19	8	4	39/66	59.09%
Professor			1	3	2	2	8/34	23.53%
No. Awards/Submissions	4/31	5/12	5/11	29/47	14/16	12/19	71/142	50%

II. RELATIONSHIP BETWEEN INTERNAL GRANT FUNDING AND FACULTY PRODUCTIVITY

FACULTY PRODUCTIVITY MEASURES

We compared the productivity of faculty who received internal grant funding with those who applied for but did not receive any funding. Faculty who received at least one Internal Grant (IG) make up 56% of the total participant pool that applied to internal grants. We tallied productivity 2011-2016 using measures discernable from CLA faculty curriculum vitae for faculty received and those who applied for but did not receive any Internal Award Funding. Our total productivity score includes production of research articles and books, conference presentations and other creative works. Our measure is fairly crude. In the future we will seek additional ways of assessing productivity that would include attention to relative quality, time investment and value of each kind of product. In order to make a rough comparison of variation in the impacts of Internal Grants on productivity across the College of Liberal Arts, we calculated a relative productivity rate for faculty in respective areas by dividing the total amount of products by the number of TT faculty applicants in each of the representative departments/schools as of Spring 2016.

We are interested in understanding variation in trends amongst units with very different norms and modes of scholarship and creative activity within the College of Liberal Arts. Although individual scholars may break from others in their units, it is possible to group most faculty members in a unit as belonging to one of the broad disciplinary areas Social Sciences, Humanities or Arts. For this analysis we considered CLA faculty in Anthropology, Political Science, Communication, and Sociology as represented by the Social Sciences category. English, Philosophy, History and the School of Languages and Cultures are combined in the Humanities.

TABLE 7: PRODUCTIVITY MEASURES FOR FACULTY WITH INTERNAL GRANT FUNDING (IG) VS. FACULTY WITHOUT INTERNAL GRANT FUNDING.

Overall Productivity rate per faculty	Faculty with at least 1 IG			Faculty without IG		
	Social Sciences	Humanities	Arts	Social Sciences	Humanities	Arts
Articles	6.83	4.11	3	7.33	3.6	3.17
Books	0.06	0.41	0.2	1.58	0.4	0.17
Total Publications (includes books, edited volumes, software, translated works)	7.56	5.33	3.4	9.67	4.55	4.00
Total Presentations (includes domestic and international conferences, invited talks)	11.50	11.70	6.8	11.58	7.45	8.17
Total Creative Works (includes exhibitions, scripts, designs, etc.)	0.11	0.00	10.2	0.08	2.3	5.67

	Faculty with at least 1 IG			Faculty without IG		
Scholarly writing: Productivity rate per faculty	Social Sciences	Humanities	Arts	Social Sciences	Humanities	Arts
Articles	6.83	4.11	3	7.33	3.6	3.17
Books	0.06	0.41	0.2	1.58	0.4	0.17
Edited volumes	0.61	0.59	0.2	0.75	0.5	0.67
Software	0.00	0.15	0	0.00	0.05	0.00
Translated Works	0.06	0.07	0	0.00	0	0.00

Productivity Per Faculty by Product Type	Faculty with at least 1 IG			Faculty without at least 1 IG		
Presentations: rate per faculty	Social Sciences	Humanities	Arts	Social Sciences	Humanities	Arts
External Conferences	5.56	4.37	1.6	4.25	2.5	1.67
International Conferences	1.39	1.78	2	1.92	1.05	2.67
Invited Talks	2.56	2.74	1.6	3.17	2.55	0.83
Invited International Talks	2.00	2.81	1.6	2.25	1.35	3.00

Creative Works: rate per faculty	Social Sciences	Humanities	Arts	Social Sciences	Humanities	Arts
Exhibitions	0.11	0.00	9.4	0.08	0	3.00
Juror	0.00	0.00	0.8	0.00	0	0.00
Scripts	0.00	0.00	0	0.00	0	0.50
Director	0.00	0.00	0	0.00	0	1.00
Scores	0.00	0.00	0	0.00	0	0.50
Creative Texts	0.00	0.00	0	0.00	2.3	0.00
Designs	0.00	0.00	0	0.00	0	0.67

Note: IG includes EVPRP funded and non-EVPRP funded (Global Synergy) Grants