Fundability and success

This analysis summarises what we know about some of the factors that might affect fundability and success in ESRC peer review.

We are sharing it externally to invite comment, discussion and further analysis. Our aim is to use its conclusions to help us to work effectively with Research Organisations on future demand management and research strategy.

If you have any questions or comments about this analysis please contact the head of ESRC's Insights team, alex.hulkes@esrc.ac.uk, or telephone 01793 413039.

Key findings

Research quality, as indicated by performance in the most recent REF exercise, influences the fundability of proposals.

There is probably some slight association between application volume and fundability. Rather than more frequent applicants being more successful, it seems likely that more successful ROs apply more frequently.

Scale of research effort is probably not associated with an RO's ability to generate fundable proposals.

Per-capita rates of proposal submission probably do not vary meaningfully across ROs.

Factors influencing fundability

While there is no straightforward and meaningful association between overall success rates and the number of proposals submitted to ESRC[1] there is an association between the fundability rate (the proportion of all proposals received that is fundable) and volume (Figure 1):

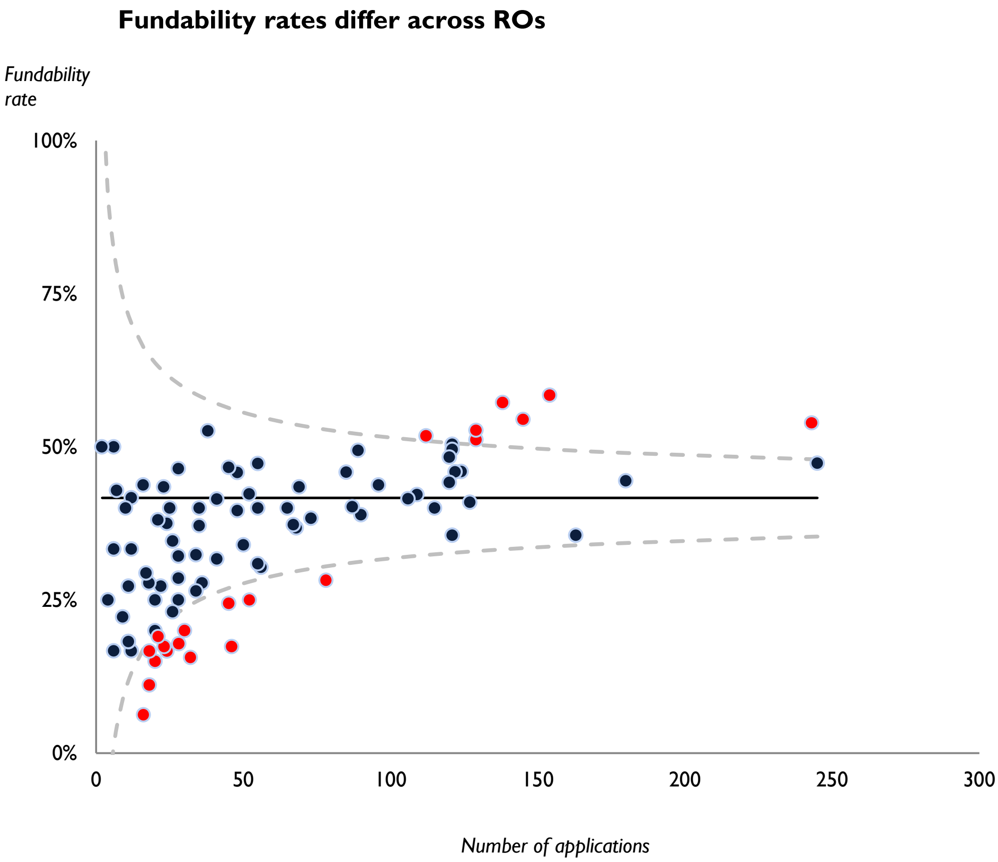

Figure 1: funnel plot of fundability rates for 96 ROs with non-zero success rates relating to decisions made in financial years 2013/2014 to 2015/2016. Dashed lines are roughly 95% control limits, with red data points being outside the limit.

In figure 1 too many data points sit outside the control limits for the underlying hypothesis – that all ROs in the data set have the same underlying success rate – to be valid. There is clearly something influencing fundability systematically, and it's something to do with proposal volume.

[1] See http://www.esrc.ac.uk/files/about-us/performance-information/application-and-success-rate-analysis/ (PDF)

Figure 2 shows a plot of $\log_{10}$ of the odds of funding[2] for the same data.

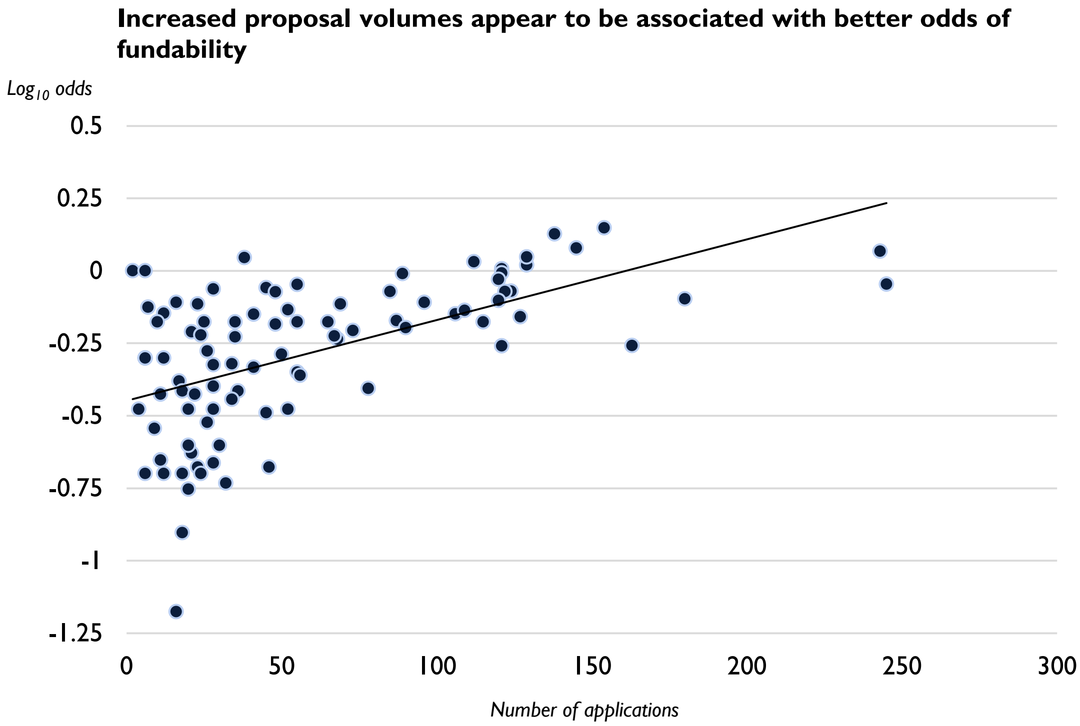

Figure 2: $\log_{10}$ (odds of fundability) *vs* number of applications for 96 ROs with non-zero success rates relating to decisions made in financial years 2013/2014 to 2015/2016. Log odds of 0 indicate equal chances of success and failure, i.e. a 50% success rate.

The relationship between the log odds of fundability and the number of proposals submitted is reasonably strong ($R^2 = .32$) though of course Figure 2 does not tell us which way the relationship works or whether the number of proposals itself, rather than another factor, is the source of the systematic variation.

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[2] A simple linear regression is not appropriate here as the dependent variable is a proportion. The odds of fundability are ${p_{fundable}}/{1 - p_{fundable}}$ or alternatively ${n_{fundable}}/{n_{unfundable}}$ for each RO, and taking the log of the odds linearises the relationship. The use of the odds ratio loses the simplicity of the direct interpretation of the fundability rate but the pattern seen in Figure 1 is still evident in Figure 2.

A multiple linear regression (see the annex), based again on log odds of fundability as the outcome measure but incorporating two further characteristics of each RO, helps to clarify the situation. The explanatory variables used in this regression are:

- **Quality** – the average proportion of outputs that were graded as 4* in REF2014 for relevant Units of Assessment acting as a proxy measure of quality
- **Scale** – the number of research active FTE in relevant REF Units of Assessment acting as a proxy measure of the size of the social science research effort in each RO
- **Application volume** – as before

Further details of the analysis are in the annex, but based on data from 96 ROs with non-zero success rates over Financial Years 2013/2014 to 2015/2016 it seems that:

- **Quality** is very likely positively associated with fundability rates. Holding other factors constant, the higher the proportion of 4* research outputs, the better the odds that an RO's proposals will be fundable.
- **Scale** is probably not related to fundability rates. Holding other factors constant, the number of FTEs returned in REF does not affect the odds of fundability.
- **Application volume** may be positively associated with fundability rates. Holding other factors constant, the number of proposals submitted may have a slight positive association with an RO's odds of fundability, but the relationship is weak.

The relationship suggested by Figure 2, between fundability and volume, is a bit misleading, as can be seen in Figure 3:

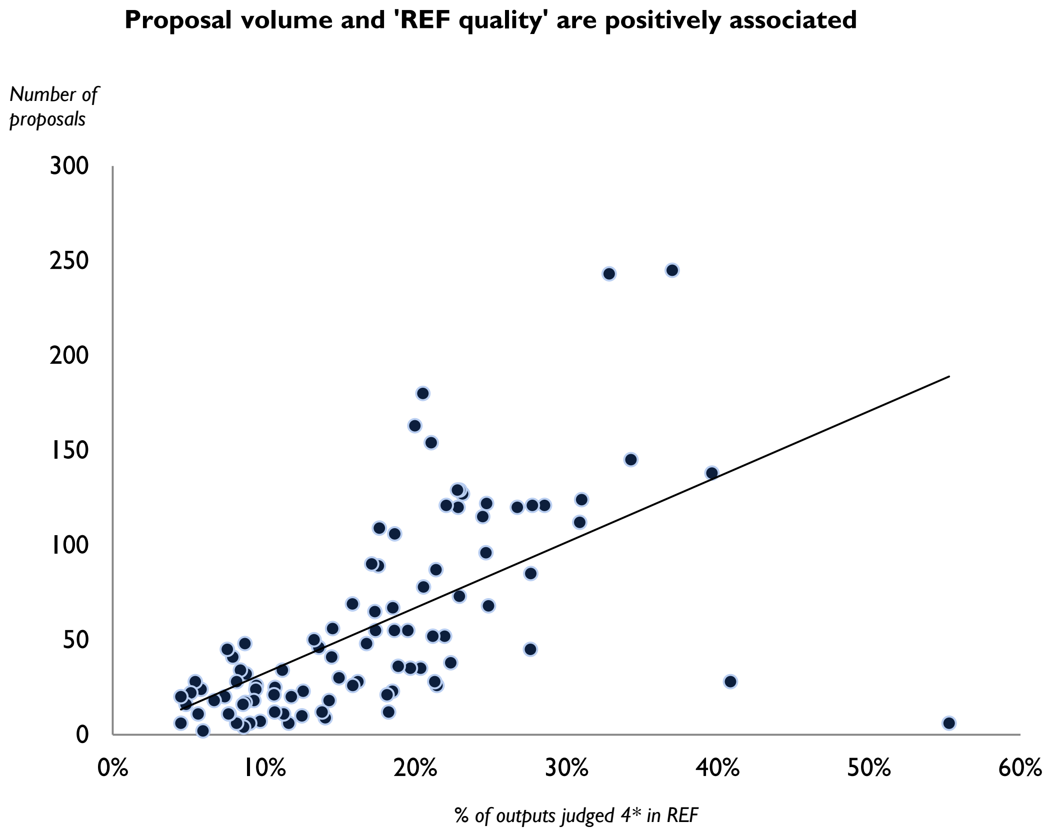

Figure 3: Number of proposals *vs* REF quality outcome for 96 ROs with non-zero success rates relating to decisions made in financial years 2013/2014 to 2015/2016. R^2 is 0.36, and around 0.60 if the two outliers at bottom right are discounted.

ROs with higher REF quality measures submit more proposals to ESRC[3]. There seems not to be any association between REF quality and the number of proposals submitted *per FTE*[4] (Figure 4):

[3]It is of course possible that submitting more proposals to ESRC results in a higher quality measure, but given the relatively small sums that ESRC might award to any individual RO it seems unlikely that causation could operate that way round.

[4] This may be stretching the idea of REF data as a proxy too far, so should be taken as suggestive only.

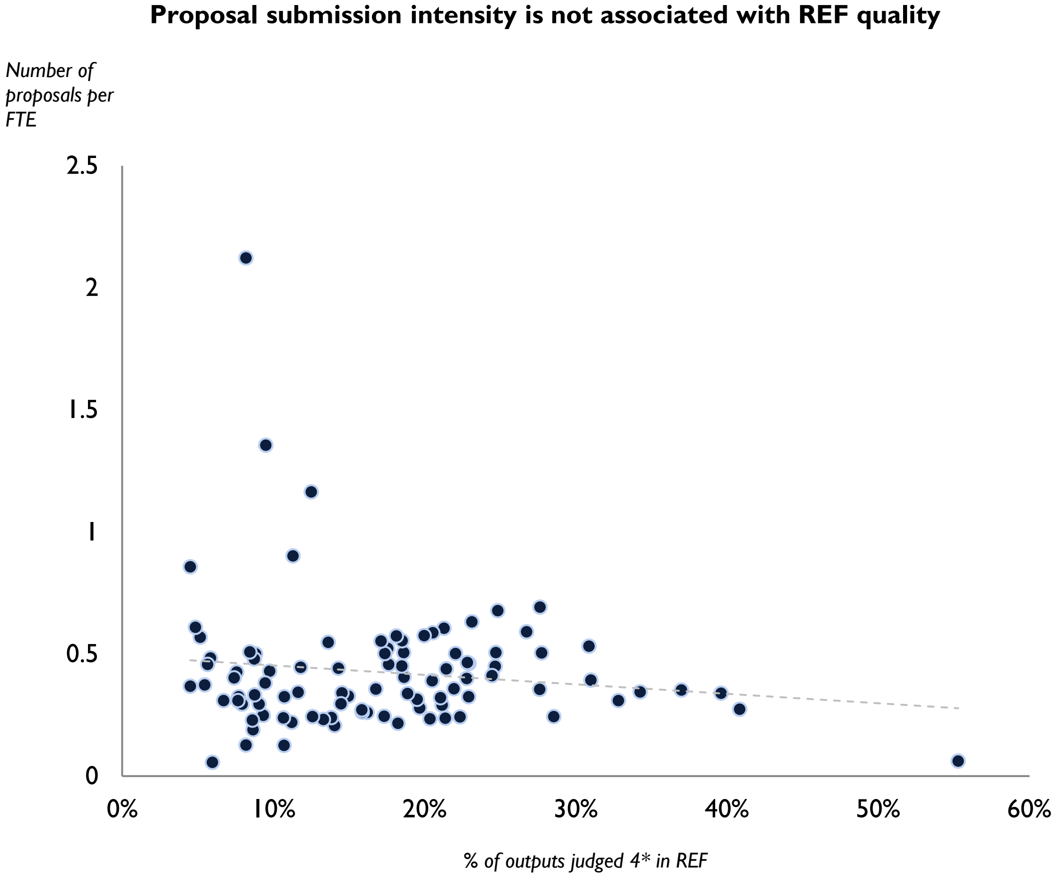

Figure 4: Number of proposals per FTE *vs* REF quality outcome for 96 ROs with non-zero success rates relating to decisions made in financial years 2013/2014 to 2015/2016. R^2 is 0.02 and regression line is shown for illustrative purposes only.

Application volume information is to some extent redundant as it is so strongly correlated with the quality indicator. Figure 5 shows the key underlying association: that between the log odds of fundability and the REF quality measure:

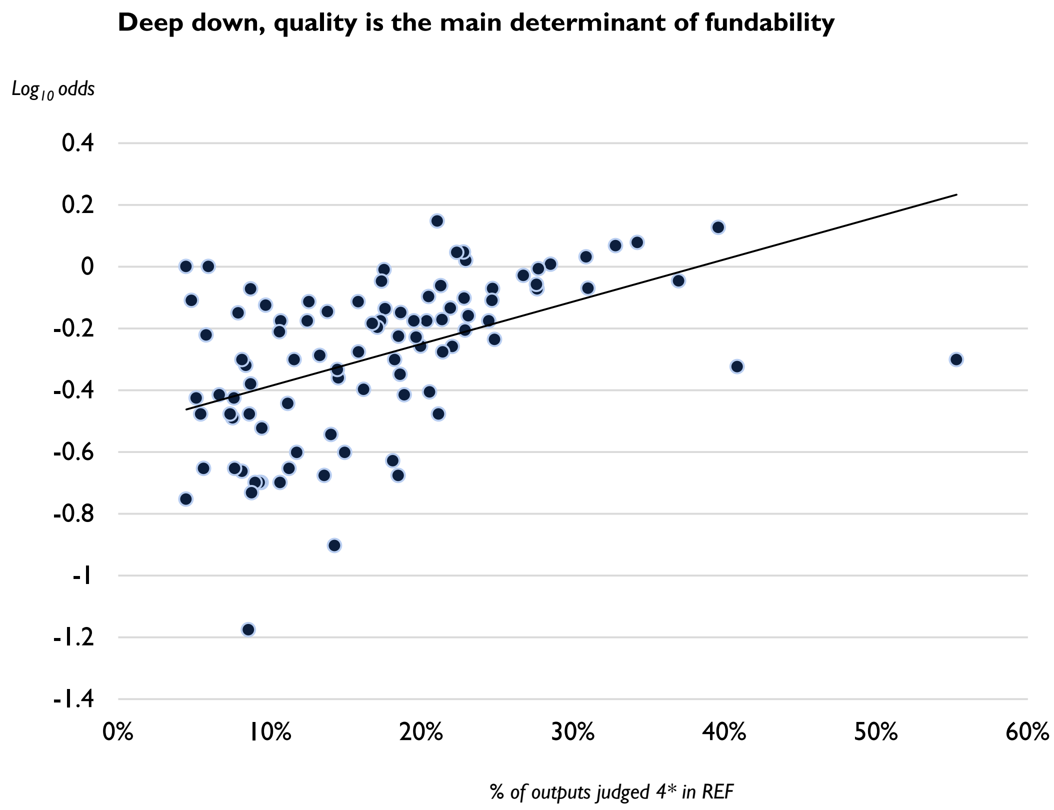

Figure 5: $\log_{10}$ (odds of fundability) *vs* REF quality measure for 96 ROs with non-zero success rates relating to decisions made in financial years 2013/2014 to 2015/2016. Log odds of 0 indicate equal chances of success and failure, i.e. a 50% success rate. R^2 is about 0.24, higher if the outliers are excluded.

Proposal volume on its own has little, if any, effect on fundability. The main influence is quality (as indicated in this analysis by REF outcomes.)

Scale of activity is not related to fundability. No matter how large or small they are, groups of researchers of similar quality and with similar application behaviours will have similar abilities to produce fundable proposals.

Strategies for success

An increase in the odds of fundability implies an increase in the fundability rate. And increased fundability rates are necessary for higher overall success rates. We know what might affect the odds of fundability, so is there a winning application strategy?

The underlying factors that may influence fundability are research quality (the strongest influence) and proposal volume (a much weaker influence[5].) As Figure 6 shows, the best thing that an RO can do if it wants a higher success rate is to improve its research quality. Simply submitting more proposals has a negligible, perhaps zero, effect on fundability:

All other things being equal, improving research quality is probably the best way of helping to increase proposal fundability

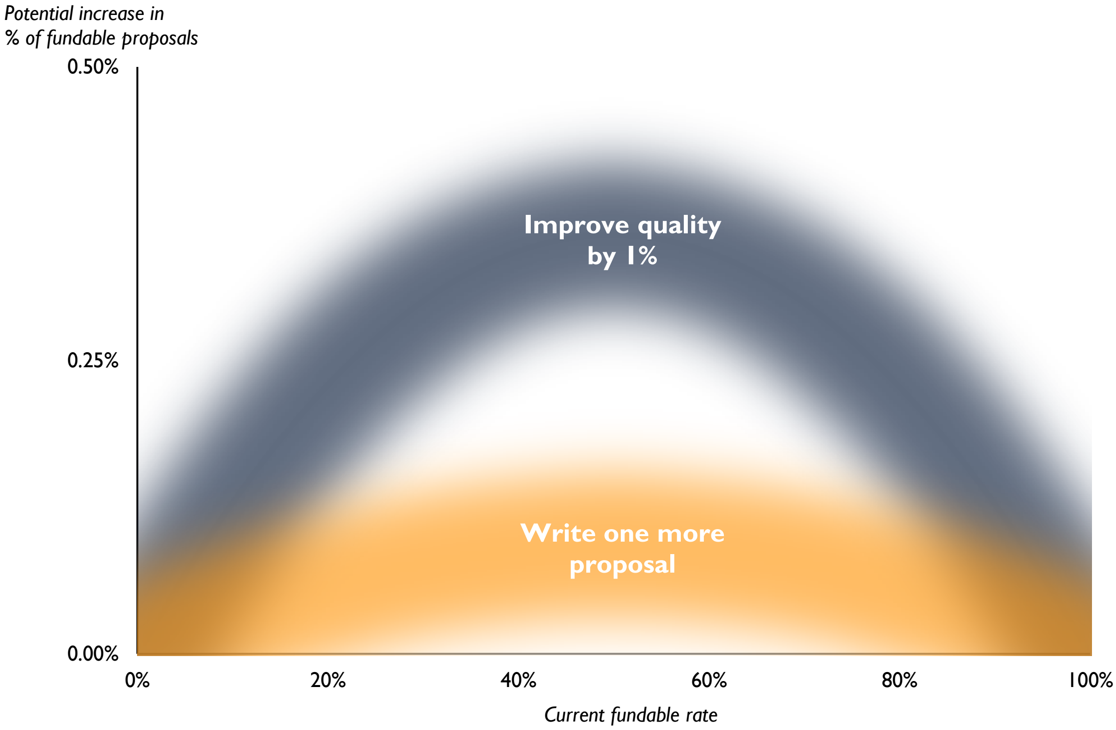

Figure 6: potential increases in the proportion of fundable proposals achieved by increasing quality by 1% or submitting an additional proposal. Width of shading is illustrative only and does not reflect actual confidence intervals. Details of calculations are in the annex.

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[5] The potential change in fundability depends on the actual current % fundable – see the annex. For odds ratios close to 1 (as found here) the maximum change is found for ROs with fundability rates of around 50%. ROs doing very much better or worse than this would be expected to be less able to influence fundability: the former because there is less room for improvement, the latter perhaps because other factors dominate.

Even for those with potentially most to gain, an additional proposal written might increase the fundability rate by just 0.1% at most. And this assumes that writing proposals somehow leads to higher fundability rates – it seems more plausible that those with higher fundability rates write more proposals. For all ROs, changes in quality will have the strongest influence on fundability.

Conclusions

While it's hard to discern meaningful differences in overall success rates, it's safer to conclude that all ROs do not have the same fundability rate. There will be as many causes of differential fundability rates as there are ROs, disciplines, calls, Councils…

The big one is 'quality'. Which is a shame as no one agrees on what quality means or how to measure it. Still, for this analysis at least, using REF scores as proxies for quality seems to work reasonably well. There are of course assumptions and issues within this approach, but just as a rough approximation it seems that, when it comes to ESRC proposal fundability, research quality matters.

It also seems likely that higher quality leads to enhanced fundability, rather than enhanced fundability leading to higher quality. ESRC isn't a big enough funder to account for the wide range of quality found in REF. The outputs of our review processes really don't contain enough signal to account for what happens outside ESRC. Research quality feeds into proposal quality.

In contrast, it's just as easy to create stories about how increased proposal volume leads to greater fundability, as a result of learning and experience, as it is to claim that those who best know how to write fundable proposals are more likely to do it.

We know that applications to ESRC are sparse[6]. This makes it hard to believe that learning how to write fundable proposals through personal experience is something that happens at the individual level. The most reasonable interpretation of what we see is that ROs with enhanced abilities to produce fundable proposals are more likely to write proposals in the first place. Simply writing more proposals is not a strategy for success.

What's not important is as interesting as what is. Scale of activity may not matter at all. Being larger makes no difference to fundability, positively or negatively.

Again it's possible to tell many stories about this. There are nice ones about how the Research Councils put quality first and will fund excellence wherever it is found. And there are more troubling ones. For example, how is that larger clusters of researchers, which surely are likely to come with more diverse disciplinary mixes and backgrounds, do not produce more fundable proposals? The Research Councils promote multidisciplinarity and all the signs are that it is in proposals. But this doesn't show in the figures.

[6] For example, the average time between applications is about six years.

Annex

Regression analysis

The text is relatively guarded in its conclusions because they depend very much on what to include in the analysis. If the data set, the variables, their combination and the type of analysis carried out vary, the conclusions on what influences fundability rates also vary. This makes it hard to identify a specific, unique, truth, and makes it less than sensible to rely on *p* values to support that version of the truth.

Rather than opting for a single regression of the many that are possible and asserting based on that, the analysis process involved looking at many different approaches to see if anything consistent emerged. Whatever was 'true' most often was taken as being most likely to be true overall. Quality mattered very consistently, volume less so, quality usually mattered more than volume, and sale of activity never mattered at all.

A representative analysis, on which Figure 3 was based, is summarised below:

Overall Fit	
Multiple R	0.59
R Square	0.35
Adjusted R Square	0.33
Standard Error	0.21
Observations	96

	coeff	*std err*	*t stat*	*p-value*	*lower*	*upper*
Intercept	-0.518	0.0458	-11.31	4.17E-19	-0.61	-0.43
No. FTE returned in REF	0.0002	0.0004	0.51	0.61	-0.0006	0.0011
100 x Av % 4* by UoA	0.0062	0.0030	2.06	0.04	0.0002	0.0122
Number of proposals	0.0016	0.0011	1.46	0.15	-0.0006	0.0038

This analysis used the log odds of fundability as the dependent variable and was based on the most recent three years' data. As can be seen, it returned a relatively high *p* value for the number of proposals. Longer periods gave different results, but with more questionable relevance to current conditions. The final conclusions represent an attempt to balance practical utility with the rigour necessary to give confidence in the result, though it's worth noting that only a fraction of the total variability is explained by any model.

Log odds and probabilities

Analyses are based on log odds, but these are not very intuitive measures of outcomes. Figure 4 translates the change in log odds into changes in absolute probabilities of fundability based on the formulae below.

By the definition of odds, if the probability of occurrence of an event having probability *p* following a unit increase in an explanatory variable is *p*' (assume that we are taking natural logs) then:

$$\frac{p'}{(1-p')} = e^{\beta}\ \frac{p}{(1-p)}$$

$$\frac{p'}{p} = e^{\beta}.\frac{(1-p')}{(1-p)}$$

$$\frac{1}{p} = \frac{\left(e^{\beta} - p'e^{\beta}\right)}{p'(1-p)}$$

$$\frac{1}{p} = \frac{e^{\beta}}{p'(1-p)} - \frac{e^{\beta}}{(1-p)}$$

$$\frac{1}{p} + \frac{e^{\beta}}{(1-p)} = \frac{e^{\beta}}{p'(1-p)}$$

$$\frac{(1-p) +\ pe^{\beta}}{p(1-p)} = \frac{e^{\beta}}{p'(1-p)}$$

$$\frac{1-p+pe^{\beta}}{p} = \frac{e^{\beta}}{p'}$$

So the ratio of the initial and final probabilities following unit increase is

$$\frac{p'}{p} = \frac{e^{\beta}}{1-p+pe^{\beta}} = \boldsymbol{\frac{e^{\beta}}{1+p(e^{\beta}-1)}}$$

And to calculate the difference in probability following a unit increase:

$$\frac{p' - p}{p} = \frac{p'}{p} - 1$$

$$p' - p = p\left(\frac{p'}{p} - 1\right)$$

$$= p\left(\frac{e^{\beta}}{1 + p(e^{\beta} - 1)} - 1\right)$$

$$= \frac{pe^{\beta}}{1 + p(e^{\beta} - 1)} - p$$

$$= \frac{p\left(e^{\beta} - 1 - pe^{\beta} + p\right)}{1 + p(e^{\beta} - 1)}$$

$$\boldsymbol{p' - p = \frac{p(1 - p)\left(e^{\beta} - 1\right)}{1 + p(e^{\beta} - 1)}}$$

And this difference takes a maximum value when

$$\boldsymbol{p = \frac{\sqrt{e^{\beta}} - 1}{(e^{\beta} - 1)}}$$

For odds ratios near 1, as we have in this analysis, this maximum occurs very close to 0.5. For more extreme odds it moves towards 0 (for very short odds) and 1 (for very long odds.)