

# Do funding agencies select and enable risky research: Evidence from ERC using novelty as a proxy of risk taking

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A major rationale for public funding of research is to promote risk taking in research that the private sector is less inclined to support (Nelson, 1959; Arrow, 1962). Yet in recent years, there has been considerable concern expressed by scientists and review boards that public funding of science is increasingly risk averse. Funders have countered this criticism by soliciting the submission of “high risk/high gain” research to either regular or specially designed programs and by encouraging reviewers to consider risk in their evaluation. Little evidence, however, has been gathered to address the extent to which these programs accomplish their stated goal.

This paper sets out to examine the degree to which funders select researchers with a track record of conducting risky frontier research and the extent to which “treatment” by the grant promotes risk taking by recipients in their frontier research. We analyze the ERC grants, a program within the EC funding for basic research, set up in 2007 as its instrument for supporting excellence science. The ERC, with its big and sizeable grants, was explicitly designed to support “high risk/high gain.” From their

mission statement: *“Scientific excellence is the sole selection criterion. In particular, high risk/high gain pioneering proposals which go beyond the state of the art, address new and emerging fields of research, introduce unconventional, innovative approaches are encouraged”* and *“its grants will help to bring about new and unpredictable scientific and technological discoveries”*. Given the stated goal, a priori one would expect **selection** of those who have followed a riskier research agenda. The underlying rationale as to why ERC **treatment** should promote risk taking is the longer length of time the grant provides researchers to pursue more risky avenues (5 years) and the freedom associated with a large sum awarded to conduct research (i.c. up to 2,5 million euro) (Hollingsworth, 2004; Heinze et al., 2009; Azoulay et al., 2011). The two-stage review process of the ERC also allows to test the differential effects of risk taking on the review process. The scientific council of the ERC, itself composed of eminent researchers across all fields and geographic areas, selects the panel members and informs them of the goals of the ERC. In stage one, a shortened proposal is scored exclusively by members of the panel. Conditional upon passing stage one, proposals proceed to a stage two evaluation where both panel members and external reviewers play a role. For starting grants, selection of final grantees is made by the panel after interviews of a select group of stage two “winners”. For advanced grants, the final selection is done without interviews.

A priori we expect the ERC to support research from excellent PIs who have shown a propensity for risk taking given the stated goal of supporting high risk/high gain research, both in the selection and in the treatment. We measure risk taking in the publication records both ex ante and ex post of the applicants, using a measure of novelty (Wang et al., 2017). Publications that contain new referenced journals are said to be “novel,” while those that do not have new combinations are “non-novel.” The research of Wang et al. (2017) shows that novelty is “rare” and has properties that one would associate with risk, such as a higher mean citation performance with a higher variance, i.e., a higher likelihood to score as a breakthrough but at the same time a higher likelihood to be a “missed”. Wang et al. (2017) also show that novel papers are more likely to be highly-cited in the long run but not in the short run. We employ the novelty of research as a measure of risk, recognizing that it is but one dimension of risk.

We measure excellence by the presence of publications in a top 10% Journal Impact Factor (JIF) journal in the field of the applicant as well as having one or more top 1% highly cited papers.

We first examine the selection process, modeling three stages: Success, success at stage 1, and success at stage 2. Preliminary results are shown in table 1.

Insert Table 1 here

We find a preference at both stages of selection for supporting “excellent” researchers as measured by either publication in a top JIF journal in the field or by having a top 1% highly cited paper. We also find evidence for selection against risk taking. The novel measure is negative and highly significant in the overall selection equation. This holds particularly for the stage 1 selection. The interaction term shows that the effect is mitigated by the presence of highly cited publications or publications in top JIF journals, but only partly mitigated, i.e. panel members seem to be somewhat less biased against risk taking for

those with an excellent track record. Conditional on making it to stage two, however, we find the effects of the excellence and risk taking record to be mitigated but still present.

We find the results to be somewhat field and gender dependent as well as related to the career stage of the applicant. Starting grant applicants are always penalized for risk taking at all stages of selection and irrespective of their excellence track record, both in the first and the second stage. Advanced grant applicants are penalized for risk taking but this penalty is offset when they have a profile of excellence. Significant selection effects on risk for advanced grants only take place in the first stage. In the life sciences, selection on high gain plays a strong role, while risk taking is highly penalized and not offset by excellence. In the physical sciences and engineering excellence also plays a role but the penalty on risk is smaller and only marginally significant. In social sciences and humanities excellence is rewarded but there is also a penalty for risk taking. There is no evidence the penalty is offset by excellence. Regarding gender differences, the selection bias against novelty is only present at the second stage for females but only present at the first stage for males with some mitigation for excellence.

We run the selection models year-by-year to see if the penalty against novelty was always present or evolved over time, as the “founding fathers,” with their enthusiasm for frontier research, began to play a smaller role in the selection of panel members and the program became more institutionalized and more protective of supporting its reputation, which focused more on the high gain part, as witnessed, for example, by the KPI chosen by European Commission to monitor the ERC, built exclusively on top 1% highly cited papers. No KPI is associated with risk taking. The empirical results are consistent with this interpretation. The penalty against novel research only begins to appear in year 2012 and persists thereafter.

We employ a diff-in-diff approach to test for the presence of treatment effects. The diff-in-diff approach first examines the differences between the treated (i.e., funded) and control (i.e., unfunded) groups before the treatment (i.e., funding). This pre-treatment difference correlates with the selection effect discussed supra. Subsequently, the diff-in-diff analysis compares the difference between the treated and control groups after the treatment. Then the difference between (a) the post-treatment difference and (b) the pre-treatment difference is estimated and tested. This diff-in-diff can be interpreted as the treatment. The diff-in-diff approach allows the post-treatment difference to be explained by both the selection effect and the treatment effect, and by taking out the pre-treatment difference to single out the treatment effect. This diff-in-diff strategy is operationalized by including the following independent variables in the regression analysis: treatment (dummy: funded, success at stage 1, or success at stage 2), after (dummies, 1 if after funding), and the interaction between the two. The interaction effect is the diff-in-diff and estimates the treatment effect. Results are summarized in Table 2.

Insert table 2 here

The major independent variable of interest is whether or not the scientist was funded and the major dependent variable is the risk-score of the researcher’s portfolio of publications both before and after the funding decision. We find only minimal evidence of a “treatment” effect: starting grantees appear

to take on riskier research after being funded. There is no evidence of treatment effects for men or for recipients at other career stages.

Ongoing research concentrates, among other things, on further unravelling the interactions between high gain and high risk, by looking at other dependent variables in the diff-in-diff for assessing selection and treatment, by including a measure of high gain as well as the combination of high gain and high risk.

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**Table 1. ERC funding selection**

	(1) Funded vs unfunded Probit	(2) Funded vs unfunded Probit	(3) Success at stage 1 Probit	(4) Success at stage 1 Probit	(5) Success at stage 2 Probit	(6) Success at stage 2 Probit
Have novel pub	-0.295*** (0.082)	-0.334*** (0.066)	-0.360*** (0.083)	-0.341*** (0.065)	-0.041 (0.131)	-0.201+ (0.105)
Have JIF top 10% pub	0.459*** (0.062)		0.418*** (0.066)		0.213* (0.088)	
Have top 1% cited pub		0.533*** (0.055)		0.503*** (0.059)		0.273*** (0.078)
Have highly novel pub						
JIF * Novel	0.105 (0.089)		0.183* (0.090)		-0.057 (0.136)	
Top cit * novel		0.174* (0.074)		0.189* (0.075)		0.117 (0.111)
Ln(Pubs)	0.240*** (0.021)	0.190*** (0.021)	0.275*** (0.023)	0.225*** (0.024)	0.059* (0.024)	0.037 (0.024)
Advanced	0.027 (0.034)	0.035 (0.034)	0.231*** (0.038)	0.240*** (0.039)	-0.304*** (0.038)	-0.309*** (0.039)
Female	-0.023 (0.035)	-0.020 (0.036)	-0.047 (0.038)	-0.044 (0.039)	0.035 (0.044)	0.045 (0.044)
Panel	Y	Y	Y	Y	Y	Y
Call year	Y	Y	Y	Y	Y	Y
N	8772	8788	8772	8788	6460	6467
Pseudo R2	0.041	0.052	0.068	0.079	0.030	0.032
<b>LS</b>						
Have novel pub	-0.441 (0.288)	-0.483*** (0.127)	-0.548* (0.220)	-0.452*** (0.121)	-0.015 (0.563)	-0.270 (0.220)
Have JIF top 10% pub	1.151*** (0.195)		0.940*** (0.163)		0.821* (0.355)	
Have top 1% cited pub		0.759*** (0.109)		0.728*** (0.112)		0.429** (0.165)
JIF * Novel	0.107 (0.293)		0.251 (0.227)		-0.218 (0.565)	
Top cit * novel		0.176 (0.139)		0.176 (0.137)		0.030 (0.229)
N	3416	3417	3416	3417	2494	2494
Pseudo R2	0.044	0.058	0.077	0.091	0.032	0.034
<b>PE</b>						
Have novel pub	-0.268* (0.126)	-0.179+ (0.099)	-0.359** (0.126)	-0.182+ (0.098)	-0.034 (0.193)	-0.223 (0.155)
Have JIF top 10% pub	0.327*** (0.086)		0.271** (0.092)		0.161 (0.120)	
Have top 1% cited pub		0.441*** (0.077)		0.441*** (0.083)		0.136 (0.113)
JIF * Novel	0.222+ (0.134)		0.307* (0.136)		0.039 (0.199)	

Top cit *		0.136		0.119		0.255
novel		(0.108)		(0.111)		(0.163)
N	4160	4166	4160	4166	3066	3067
Pseudo R2	0.047	0.054	0.074	0.082	0.030	0.031
<b>SH</b>						
Have novel	-0.218	-0.385**	-0.221	-0.429**	-0.114	-0.178
pub	(0.139)	(0.141)	(0.145)	(0.143)	(0.196)	(0.195)
Have JIF top	0.468***		0.533***		0.050	
10% pub	(0.130)		(0.143)		(0.161)	
Have top 1%		0.454***		0.379**		0.326*
cited pub		(0.129)		(0.140)		(0.152)
JIF * Novel	-0.178		-0.221		-0.022	
	(0.174)		(0.189)		(0.225)	
Top cit *		0.133		0.180		0.021
novel		(0.172)		(0.183)		(0.223)
N	1196	1205	1196	1205	900	906
Pseudo R2	0.054	0.064	0.070	0.074	0.045	0.049
<b>Starting</b>						
Have novel	-0.333**	-0.269***	-0.323**	-0.201**	-0.202	-0.288*
pub	(0.097)	(0.076)	(0.093)	(0.073)	(0.164)	(0.124)
Have JIF top	0.534***		0.510***		0.197+	
10% pub	(0.072)		(0.074)		(0.114)	
Have top 1%		0.568***		0.555***		0.243*
cited pub		(0.064)		(0.067)		(0.099)
JIF * Novel	0.106		0.115		0.069	
	(0.104)		(0.102)		(0.170)	
Top cit *		0.067		0.002		0.181
novel		(0.085)		(0.084)		(0.132)
N	5343	5355	5343	5355	3686	3691
Pseudo R2	0.037	0.046	0.048	0.055	0.034	0.036
<b>Advanced</b>						
Have novel	-0.226	-0.568***	-0.459*	-0.745***	0.223	0.024
pub	(0.164)	(0.141)	(0.178)	(0.140)	(0.214)	(0.213)
Have JIF top	0.273*		0.214		0.206	
10% pub	(0.121)		(0.139)		(0.142)	
Have top 1%		0.456***		0.396**		0.308*
cited pub		(0.108)		(0.125)		(0.129)
JIF * Novel	0.108		0.327+		-0.260	
	(0.175)		(0.193)		(0.222)	
Top cit *		0.490**		0.679***		-0.065
novel		(0.153)		(0.160)		(0.222)
N	3429	3433	3429	3433	2774	2776
Pseudo R2	0.046	0.062	0.072	0.094	0.007	0.008
<b>Female</b>						
Have novel	-0.083	-0.239+	0.095	-0.120	-0.455+	-0.399*
pub	(0.163)	(0.134)	(0.165)	(0.134)	(0.249)	(0.202)
Have JIF top	0.655***		0.822***		-0.163	
10% pub	(0.132)		(0.147)		(0.212)	

Have top 1% cited pub		0.490*** (0.120)		0.511*** (0.128)		0.126 (0.167)
JIF * Novel	-0.148 (0.179)		-0.304+ (0.183)		0.348 (0.268)	
Top cit * novel		0.080 (0.152)		-0.007 (0.157)		0.282 (0.224)
N	1761	1764	1761	1764	1202	1203
Pseudo R2	0.074	0.078	0.105	0.103	0.057	0.060
<b>Male</b>						
Have novel pub	-0.326** (0.098)	-0.360*** (0.079)	-0.460*** (0.099)	-0.403*** (0.078)	0.099 (0.156)	-0.114 (0.125)
Have JIF top 10% pub	0.432*** (0.072)		0.339*** (0.078)		0.312** (0.098)	
Have top 1% cited pub		0.556*** (0.064)		0.507*** (0.069)		0.347*** (0.089)
JIF * Novel	0.148 (0.104)		0.293** (0.107)		-0.192 (0.161)	
Top cit * novel		0.208* (0.087)		0.255** (0.089)		0.040 (0.131)
N	7011	7024	7000	7013	5258	5264
Pseudo R2	0.038	0.051	0.066	0.079	0.029	0.031
<b>CALL 2007</b>						
Have novel pub	-0.287 (0.363)	-0.164 (0.247)	-0.131 (0.360)	-0.248 (0.252)	-0.961 (0.859)	0.394 (0.613)
Have JIF top 10% pub	0.803*** (0.209)		0.794*** (0.212)		0.101 (0.518)	
Have top 1% cited pub		0.609** (0.187)		0.560** (0.188)		0.452 (0.399)
JIF * Novel	0.141 (0.381)		-0.011 (0.376)		0.892 (0.889)	
Top cit * novel		0.139 (0.261)		0.254 (0.267)		-0.587 (0.645)
N	488	492	484	488	278	291
Pseudo R2	0.075	0.077	0.072	0.076	0.043	0.043
<b>CALL 2008</b>						
Have novel pub	-0.119 (0.372)	-0.600+ (0.348)	-1.102* (0.502)	-0.990* (0.426)	1.302+ (0.693)	0.431 (0.560)
Have JIF top 10% pub	0.693* (0.306)		0.135 (0.373)		0.737* (0.348)	
Have top 1% cited pub		0.655* (0.287)		0.378 (0.359)		0.695* (0.332)
JIF * Novel	-0.277 (0.416)		0.957+ (0.551)		-1.679* (0.705)	
Top cit * novel		0.388 (0.375)		1.039* (0.451)		-0.772 (0.582)
N	481	484	438	441	405	406
Pseudo R2	0.153	0.172	0.235	0.269	0.030	0.024
<b>CALL 2009</b>						

Have novel pub	-0.239 (0.278)	-0.109 (0.239)	-0.305 (0.297)	-0.350 (0.258)	-0.060 (0.479)	-0.013 (0.397)
Have JIF top 10% pub	0.649** (0.198)		0.701** (0.221)		0.232 (0.307)	
Have top 1% cited pub		0.626*** (0.172)		0.396* (0.183)		0.539* (0.241)
JIF * Novel	0.228 (0.295)		0.247 (0.318)		0.154 (0.497)	
Top cit * novel		0.059 (0.257)		0.301 (0.283)		0.050 (0.415)
N	866	867	866	867	671	672
Pseudo R2	0.055	0.056	0.126	0.119	0.037	0.044
<b>CALL 2010</b>						
Have novel pub	-0.035 (0.228)	-0.075 (0.176)	-0.250 (0.259)	0.034 (0.192)	0.262 (0.365)	-0.381 (0.275)
Have JIF top 10% pub	0.672*** (0.175)		0.501* (0.200)		0.510* (0.229)	
Have top 1% cited pub		0.624*** (0.151)		0.681*** (0.173)		0.111 (0.219)
JIF * Novel	-0.145 (0.249)		0.096 (0.284)		-0.367 (0.379)	
Top cit * novel		-0.075 (0.203)		-0.228 (0.228)		0.386 (0.291)
N	1254	1256	1254	1256	1000	1001
Pseudo R2	0.064	0.069	0.123	0.131	0.026	0.026
<b>CALL 2011</b>						
Have novel pub	-0.602** (0.206)	-0.375* (0.167)	-0.692** (0.218)	-0.352* (0.177)	-0.049 (0.355)	-0.285 (0.286)
Have JIF top 10% pub	0.278 (0.170)		0.330+ (0.189)		-0.034 (0.248)	
Have top 1% cited pub		0.557*** (0.143)		0.653*** (0.159)		-0.027 (0.212)
JIF * Novel	0.415+ (0.219)		0.561* (0.233)		-0.145 (0.364)	
Top cit * novel		0.158 (0.188)		0.176 (0.203)		0.110 (0.296)
N	1400	1402	1400	1402	1085	1086
Pseudo R2	0.044	0.054	0.081	0.093	0.024	0.024
<b>CALL 2012</b>						
Have novel pub	-0.400* (0.172)	-0.474** (0.145)	-0.324* (0.162)	-0.425** (0.130)	-0.373 (0.256)	-0.368+ (0.216)
Have JIF top 10% pub	0.252* (0.126)		0.299* (0.129)		-0.025 (0.184)	
Have top 1% cited pub		0.438*** (0.117)		0.330** (0.118)		0.359* (0.156)
JIF * Novel	0.281 (0.183)		0.189 (0.175)		0.337 (0.266)	
Top cit * novel		0.386* (0.159)		0.341* (0.147)		0.316 (0.228)

N	2070	2072	2070	2072	1438	1439
Pseudo R2	0.027	0.043	0.038	0.048	0.020	0.028
<b>CALL 2013</b>						
Have novel pub	-0.329+ (0.177)	-0.442** (0.139)	-0.289+ (0.161)	-0.356** (0.124)	-0.229 (0.247)	-0.375+ (0.202)
Have JIF top 10% pub	0.435** (0.131)		0.394** (0.130)		0.223 (0.166)	
Have top 1% cited pub		0.520*** (0.115)		0.557*** (0.118)		0.166 (0.146)
JIF * Novel	-0.007 (0.187)		-0.067 (0.175)		0.121 (0.257)	
Top cit * novel		0.139 (0.151)		0.022 (0.142)		0.303 (0.214)
N	2211	2213	2211	2213	1549	1550
Pseudo R2	0.035	0.046	0.038	0.050	0.017	0.019

Table 2. ERC funding selection and treatment: diff-in-diff

	(1) Having novel pubs Funded vs unfunded Probit	(2) Having novel pubs Stage 1 success Probit	(3) Having novel pubs Stage 2 success Probit
Success	-0.212*** (0.037)	-0.181*** (0.038)	-0.114** (0.041)
After	-0.365*** (0.039)	-0.355*** (0.045)	-0.461*** (0.045)
Success * After	-0.039 (0.050)	-0.063 (0.051)	0.028 (0.056)
Ln(Pubs)	0.805*** (0.025)	0.811*** (0.025)	0.890*** (0.021)
Advanced	-0.059 (0.039)	-0.044 (0.039)	-0.003 (0.031)
Female	0.060 (0.043)	0.060 (0.043)	0.047 (0.035)
Panel	Y	Y	Y
Call year	Y	Y	Y
N	17584	17584	12932
Pseudo R2	0.256	0.257	0.298

<b>LS</b>			
	(1)	(2)	(3)
Success	-0.313*** (0.064)	-0.241*** (0.065)	-0.234** (0.074)
After	-0.424*** (0.068)	-0.404*** (0.076)	-0.630*** (0.080)
Success * After	-0.031 (0.086)	-0.105 (0.087)	0.128 (0.098)
N	6820	6820	4982
Pseudo R2	0.275	0.275	0.335

<b>PE</b>			
Success	-0.085 (0.052)	-0.089+ (0.054)	-0.026 (0.056)
After	-0.293*** (0.055)	-0.287*** (0.062)	-0.356*** (0.061)
Success * After	-0.092 (0.070)	-0.078 (0.071)	-0.055 (0.077)
N	8292	8292	6102
Pseudo R2	0.209	0.210	0.250

<b>SH</b>			
Success	-0.360*** (0.098)	-0.308** (0.099)	-0.167 (0.104)
After	-0.492*** (0.109)	-0.495*** (0.124)	-0.504*** (0.115)
Success * After	0.149 (0.138)	0.094 (0.140)	0.141 (0.145)
N	2472	2472	1848
Pseudo R2	0.296	0.296	0.324

<b>Starting</b>			
Success	-0.232*** (0.044)	-0.178*** (0.044)	-0.179** (0.053)
After	-0.346*** (0.047)	-0.327*** (0.051)	-0.575*** (0.060)
Success * After	-0.042 (0.061)	-0.118+ (0.060)	0.143* (0.072)
Pseudo R2	0.220	0.221	0.258

<b>Advanced</b>			
Success	-0.204** (0.070)	-0.232** (0.077)	-0.029 (0.065)
After	-0.413*** (0.071)	-0.433*** (0.088)	-0.327*** (0.067)
Success * After	-0.019 (0.092)	0.052 (0.099)	-0.109 (0.089)
N	6862	6862	5546
Pseudo R2	0.339	0.339	0.332

<b>Female</b>			
Success	-0.212* (0.084)	-0.129 (0.084)	-0.200* (0.093)
After	-0.352*** (0.083)	-0.338*** (0.091)	-0.492*** (0.100)
Success * After	-0.110 (0.110)	-0.132 (0.108)	0.008 (0.126)
N	3546	3546	2409
Pseudo R2	0.277	0.276	0.276

<b>Male</b>			
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Success	-0.209*** (0.042)	-0.189*** (0.043)	-0.093* (0.045)
After	-0.371*** (0.045)	-0.363*** (0.051)	-0.455*** (0.050)
Success * After	-0.021 (0.057)	-0.046 (0.058)	0.034 (0.062)
N	14038	14038	10512
Pseudo R2	0.256	0.257	0.304