University of Victoria | Economics

**Department Discussion Paper DDP2009**

**ISSN 1914-2838**

# PUBLIC FUNDING OF RESEARCH AND GRANT PROPOSALS IN THE SOCIAL SCIENCES: EMPIRICAL EVIDENCE FROM CANADA

**Marco Cozzi**
Department of Economics, University of Victoria
*Victoria, B.C., Canada V8W 2Y2*

**August, 2022**

## Abstract

I use Social Sciences and Humanities Research Council data to analyze some of the elements shaping the decision of researchers affiliated with Canadian institutions to apply for public research grants. Relying on panel data methods, I find that researchers show an aversion to the funding instability. In particular, both the volatility of the resources granted and the volatility of the funding probability deter researchers from submitting proposals. The results are robust along several dimensions, including compiling the dataset using two different units of observation, and controlling for unobserved heterogeneity with different formulations.

**Keywords:** Academic Research Funding, Public Policy, Grant Proposals, Social Sciences.

**JEL Classifications**: H50, I23, I28.

---

**Author Contact:**
Marco Cozzi, Dept. of Economics, University of Victoria, P.O. Box 1700, STN CSC, Victoria, B.C., Canada V8W 2Y2; E-mail: mcozzi@uvic.ca; Tel: (250) 721-6535

# Public Funding of Research and Grant Proposals in the Social Sciences: Empirical Evidence from Canada*

Marco Cozzi, University of Victoria

August 2022

**Abstract**

I use Social Sciences and Humanities Research Council data to analyze some of the elements shaping the decision of researchers affiliated with Canadian institutions to apply for public research grants. Relying on panel data methods, I find that researchers show an aversion to the funding instability. In particular, both the volatility of the resources granted and the volatility of the funding probability deter researchers from submitting proposals. The results are robust along several dimensions, including compiling the dataset using two different units of observation, and controlling for unobserved heterogeneity with different formulations.

**JEL Classification Codes:** H50, I23, I28.

**Keywords:** Academic Research Funding, Public Policy, Social Sciences.

**Contact details:** *Department of Economics, University of Victoria, 3800 Finnerty Road, Victoria, BC V8P 5C2, Canada. Tel: 1-250-721-6535, E-mail:* mcozzi@uvic.ca

*This paper is the revised version of the paper titled: *Public Funding of Research in the Social Sciences: Are Canadian Academics Discouraged?*

# 1 Introduction

Research in the social sciences is typically carried out at post-secondary academic organizations. In order to obtain public funding for a project, scholars specializing in those disciplines can prepare grant proposals. These request financial support from designated grant initiatives. In this article, I empirically study the determinants of the number of grant proposals submitted to a public funding agency by social scientists affiliated with Canadian institutions. The econometric analysis allows examination of whether there are some mechanisms deterring scholars from applying to public research grants. In particular, I investigate whether the instability of funding negatively affects the number of submitted applications. The Canadian empirical evidence corroborates this channel, which represents the main finding of the paper.

The literature has mainly focused on studying the consequences of the funding decisions, estimating the elasticity of some measures of research output to public funding.[1] To the best of my knowledge, there is limited empirical research on the incentives for academic researchers to craft grant proposals. A major obstacle to this line of inquiry is the lack of publicly available datasets containing information on all projects seeking funding, including the unsuccessful ones. Obvious confidentiality challenges and intellectual property concerns pertaining to the researchers with unfunded projects prevent a wide dissemination of these data. The dataset I work with features either a set of disciplines or academic institutions as the units of observation, by-passing the privacy issues, yet retaining a sufficiently low level of aggregation.

In Canada, social scientists have primarily sought funding by submitting proposals to the Social Sciences and Humanities Research Council (SSHRC), a federal agency founded in 1977.[2] My analysis focuses on the so-called Standard Research Grants (SRG), which have historically constituted the most important SSHRC initiative funding post-doctoral researchers, mainly using data from the 1995-2011 period.[3] Both the SRG scheme and the ones that replaced it are important in terms of overall funding and have been the principal way of financing basic research carried out by both experienced and emerging scholars at Canadian institutions. Among many undertakings, social scientists participate in the debate for the design of key policies, yet the research funding they receive currently accounts for approximately 0.05% of Canadian public expenditure.

Two contributions that are related to my analysis are von Hippel and von Hippel (2015) and Ayoubia, Pezzoni, and Visentina (2019). The former partially circumvented the data challenges by compiling a new dataset, directly surveying researchers in two fields: Astronomy and Psychology. The authors document that grant writing in their sample is extremely time-intensive. Drafting grant proposals on average requires 116

[1] This important issue is analyzed, among others, by Adams and Griliches (1998), Arora, David, and Gambardella (1998), Chudnovsky et al. (2008), Jacob and Lefgren (2011), Benavente et al. (2012), and Whalley and Hicks (2014).

[2] The other two federal funding agencies are the Natural Sciences and Engineering Research Council (NSERC), whose mission is fostering discovery and innovation in natural sciences and engineering, and the Canadian Institutes of Health Research (CIHR), whose mission pertains discoveries and innovations that strengthen Canada's health care system and improve the health of Canadians. Researchers might also have access to provincial funding, depending on the location of the institution they are based at. In the social sciences provincial funding has not been offered regularly, with the exception of Québec and their Fonds de Recherche du Québec Société et Culture (FRQSC).

[3] In 2012, a major restructuring of the SSHRC initiatives led to the creation of the Insight Grants, which replaced the Standard Research Grants. This is the main reason why I consider the data after 2012 only in a robustness check. Section 2 describes these programs in more detail.

hours for the Principal Investigators and 55 for the Co-Investigators. They also argue that funding rates of less than 20% led one half of grant applicants to abandon their requests for federal research funds, after a multi-year effort. This is potentially inefficient, as they find that some of these projects are indistinguishable in quality from the research that does receive funding. Ayoubia, Pezzoni, and Visentina (2019) argue that, apart from the possible financial reward, crafting a grant proposal can have some additional benefits. They rely on a confidential Swiss dataset, with information on all researchers applying for funding to a public grant scheme in the 2008–2012 period. According to the authors, the sunk costs incurred by applicants to prepare their proposals are not fruitless, as there is a positive effect on the scientists' number of publications, the average impact factor of the journals where they publish, and their probability of collaborating with co-applicants. However, their findings are difficult to reconcile with the results in von Hippel and von Hippel (2015), whose respondents reported limited such benefits. A possible explanation for this difference is the underlying institutional setup of the public grant initiatives: the sample in Ayoubia, Pezzoni, and Visentina (2019) refers to research that, in order to be eligible for funding by the Swiss National Science Foundation, must be carried out collaboratively. Alternatively, the statistics computed by von Hippel and von Hippel (2015) might be less reliable, because of the small sample size and conceivable self-selection biases, induced for example by disgruntled academics with unsuccessful grant proposals.

An open question related to the assessment of the benefits and costs of submitting grant proposals is whether reviewers can show biases towards easily identifiable subsets of researchers, such as minorities and women. Changing attitudes in these biases could partially drive the decisions of researchers to submit applications. Viner, Powell, and Green (2004) have emphasized the negative effects of these biases, but their importance may have decreased over time, at least in some disciplines, as argued by Broder (1993). In the context of SSHRC scholarships awarded to graduate students, Chandler (2018) finds very weak evidence of same-gender preferences for male evaluators.[4] However, in a simulation study, Day (2015) shows that small levels of reviewers' bias can substantially influence the rate at which grant applications are funded. A bias of only 3% of the total score is sufficient to determine a statistically significant difference in the number of funded grants across two groups of researchers, one group being a preferred class of investigators.

In the literature little is known regarding the incentives for researchers to apply for public funding.[5] My paper contributes to this debate. On the basis of panel data regression analysis, I show that a higher instability of the funding opportunities leads Canadian researchers to submit fewer grant proposals, which is a novel finding. The result is robust along several dimensions, including compiling the dataset using two different units of observation (i.e., the SSHRC academic disciplines or the Canadian academic institutions), controlling for unobserved heterogeneity with different formulations (i.e., fixed effects and random effects), and two different time windows (i.e., excluding or including the post-2012 reform years).

[4] Two papers assessing the effectiveness of some SSHRC programs are Courty and Sims (2015), which studies the Canada Research Chairs initiative, and Chandler (2020), which deals with the Graduate Scholarships.

[5] For general surveys on the economics of science see Stephan (1996), Antonelli, Franzoni, and Geuna (2011) and Stephan (2012).

The rest of the paper is organized as follows. Section 2 describes the institutional background. Section 3 contains a thorough panel data analysis, using methods for a limited dependent variable on both discipline-level and institution-level data. Section 4 offers a discussion of the main results together with an extensive robustness analysis. Section 5 concludes. A general discussion of the aggregate trends in the SSHRC data is presented in an Appendix.[6]

# 2 SSHRC Grant Initiatives

In this section, I concisely describe the main characteristics and institutional features of the SSHRC research grants. A general discussion of the aggregate trends in the number of applications submitted, and in the proposals and funding success rates, is found in the Appendix and it is also presented in Gordon (2016).

## 2.1 Institutional Background

The breakdown of the SSHRC expenses is disseminated in their annual reports. For the 2010-11 fiscal year, SSHRC (2011) shows that \$89.8 million (24.9% of the total budget, net of indirect costs) was devoted to Investigator-Framed Research, which is the wording used to itemize the SRG costs.[7] The other expense categories show that \$118.8 million (33.0%) was devoted to Fellowships, Scholarships and Prizes, \$53.7 million (14.9%) to the Canada Research Chairs initiative, \$26.9 million (7.5%) to Strategic Research Development, \$26.2 million (7.3%) to Research Networking, \$20.0 million (5.6%) to Internal Services, \$16.0 million (4.5%) to Targeted Research and Training Initiatives, and \$8.9 million (2.5%) to Research Dissemination and Knowledge Translation.

The SRG was designed to support research programs and develop excellence in any subject area eligible for funding from SSHRC. SRG proposals were typically due in October, but starting with the 2007-08 competition applicants were strongly encouraged to complete a notification of intent to apply by mid-August. The researchers that were awarded a grant were usually notified in the spring of the following year, which is also when they could start using the funds. In their last round, these grants allowed for a maximum of \$250,000 of funding over three years, but this limit changed considerably over time. Nevertheless, it was customary for SSHRC to trim the proposed budgets and, in the 2010 competition, the average value of the awarded three-year SRGs was \$81,382. The SRG allowed for a number of eligible expenses (e.g., stipends for research assistants, travel costs, software and computing equipment), some of which were eventually curtailed. In particular, in the year 2000 the so-called Research Time Stipend (RTS) was introduced, which remained in place until 2010. The RTS allowed researchers to buy out some of their teaching duties. In terms of the possible outcomes, some proposals were

[6] Three appendices available upon request include further details on the empirical methods used (Appendix A), on the panel dataset compiled for the econometric analysis (Appendix B), and on some additional robustness checks (Appendix C).

[7] The SSHRC budgets show that, over the 1995-2011 time period, the indirect costs of research accounted for approximately 50% of the total expenses. These represent funds distributed to eligible institutions, receiving research funds from any of the three federal granting agencies, to finance a portion of the costs associated with conducting academic research. Indirect costs funds are typically used to finance equipment and infrastructure costs, which are not under the direct control of the researchers working at those institutions.

recommended for funding, but did not receive any due to the limited resources that SSHRC allocated to this initiative. Also for this reason, unsuccessful projects could be re-submitted to subsequent SRG competitions.

As for the assessment of the submitted projects, the SRG applications were assigned to designated (field-specific) adjudication committees. These committees consisted of scholars from the Canadian research community. In principle, their composition could change every year, but in practice some experts were asked to participate for several consecutive years. The committees were in charge of evaluating and ranking all applications, and relied on reports by external reviewers, usually with two referees per proposal. Both the external reviewers and the adjudication committees followed specific criteria developed by SSHRC to assess various dimensions of the proposals. Applicants were also evaluated according to their experience, with new scholars (i.e., within six years of obtaining their Ph.D.) reviewed separately, with different scoring criteria.

In 2012, the SRG was replaced by the Insight initiative, but the two programs share several features. A major innovation was the creation of two separate competitions: the Insight Grants (IG) and the Insight Development Grants (IDG). These initiatives have separate deadlines, budgets, and adjudication committees. The IDG were designed to support preliminary research ideas, rather than comprehensive research agendas. Since their creation, these grants have allowed for a maximum of $\$75,000$ of funding over two years, and 50% of the total available resources have been reserved to fund proposals submitted by new (emerging) scholars. The IG were designed to support research excellence, meant to be achieved with a full-fledged research agenda. In their latest incarnation, depending on the project size, applicants can choose between two funding streams. One stream of these grants allows for a maximum of $\$100,000$ of funding over five years, while the other stream provides between $\$100,000$ and $\$400,000$ of funding over the same time horizon.[8]

# 3 Empirical Analysis

In this section, I develop an econometric investigation into the determinants of the number of grant applications. To study the grant proposal decisions and how they respond to incentives, one would ideally need data at the researcher level. These data are not publicly available due to confidentiality.[9] The published SSHRC data can be compiled with two different levels of aggregation: at the discipline level ($d$) or at the institution level ($i$). I will present regressions for both cases, using similar econometric models for count panel data.[10] A short description of the variables used in the regression analysis is included in Table 1. Both datasets lead to similar results, which is reassuring. One of the main advantages of using panel data is the availability of estimators that control for time-invariant unobserved heterogeneity. Adams and Griliches (1998) and Payne and Siow (2003) show the importance of doing so in their U.S. data.

**[Table 1 about here]**

[8] More details on the IG and IDG initiatives are available in SSHRC (2022a) and SSHRC (2022b).

[9] SSHRC maintains a researchers' database that is easily accessible. However, this contains information only on the projects that were granted funding in one of their initiatives, which is clearly a selected sample. For a discussion on the possible effects of selectivity biases see Arora and Gambardella (2005).

[10] In terms of notation, the $(j,t)$ indexes refer to the cross-sectional and time series dimensions of the panel dataset, respectively.

As for the proposals, the success rate, and the value of the awarded grants, their timing warrants some additional comments. First, the number of proposals dated $t$ refers to the applications submitted in the competition whose results are announced in year $t$, irrespective of the related deadline to submit the projects, which falls in October of year $t-1$. As for the success rates and the awarded amounts, their timing also implies that the index $t$ refers to the year when the competition results are announced, namely when the applicants are notified whether their project was granted some funding, in the spring of year $t$. In round $t$ of a competition, at the time the applications are due, researchers do not have information on the outcome of their proposals. Because of this, these two variables will enter with a lag in the baseline regressions.[11]

As for the rolling coefficient of variation of the explanatory variable $x$ for the unit of observation $j$ in the $n$-year window before period $t$ ($cv\_x_{j,t-1}$), it is defined as: $cv\_x_{j,t-1} = \frac{\sqrt{(\frac{1}{n})\sum_{s=t-1}^{t-n}(x_{j,s}-\overline{x}_{j,t-1})^2}}{\overline{x}_{j,t-1}}$, where $\overline{x}_{j,t-1} = (\frac{1}{n})\sum_{s=t-1}^{t-n} x_{j,s}$ is the rolling average.[12]

## 3.1 Discipline-level Panel Data Analysis

I collected the data from the annual SSHRC reports. In this sample, the units of observation are the 29 SSHRC disciplines.[13] I consider the 1995-2011 period, namely the Standard Research Grants years.[14]

The number of proposals is a count variable, hence, I rely on panel data generalizations of the Poisson regression model, controlling for unobserved heterogeneity with fixed effects (as a robustness check, I also use random effects). The dependent variable ($proposals_{d,t}$) is the number of research grant proposals submitted to SSHRC in a specific discipline ($d$), and in a given fiscal year ($t$). The benchmark specification of the econometric model

[11] Notice the following relationship, obtained from manipulating the definition of the expected value of a grant for unit of observation $j$ ($\overline{awardedcad}_{j,t}$): $proposals_{j,t} \equiv (awardedcad_{j,t}/\overline{awardedcad}_{j,t}) \times (1/successrate_{j,t})$. This suggests that, conditional on the value of the awarded grants, including as control variables both the success rate and the value of the awarded grants contemporaneously (i.e., both dated $t$) could lead to a negative sign for the success rate parameter. However, this is not necessarily a mechanical relationship, because there are no data on the expected value of a grant. I thank the editor for stressing the need to discuss this mechanism.

[12] Since SSHRC in the on-line reports usually lists the statistics of the last three rounds of a grant initiative, I use a three-year window ($n=3$), because this is the information that can be easily gathered by the researchers planning to submit a proposal. I also experimented with a five-year window ($n=5$), at the cost of losing more observations: the results were similar, and the parameters associated with the variables of interest had better $p$-values.

[13] The disciplines pertaining to SSHRC are: Anthropology, Archaeology, Archival Science, Classics/Classical and Dead Languages, Communications and Media Studies, Criminology, Demography, Economics, Education, Fine Arts, Folklore, Geography, History, Industrial Relations, Interdisciplinary Studies, Law, Library and Information Science, Linguistics, Literature and Modern Languages, Management/Business/Administrative Studies, Mediaeval Studies, Philosophy, Political Science, Psychology, Religious Studies, Social Work, Sociology, Urban and Regional Studies/Environmental Studies. There is also a residual category labeled Other.

[14] The details of the data construction are included in Appendix A. In particular, over the sample period, I kept a fixed definition for the disciplines. The years 1995 and 1996 are not used for the dependent variable, but are used to compute the lagged variables and the rolling coefficient of variations (which in 1997 are based on only two values).

takes the following form:[15]

$$\mathbb{E}[proposals_{d,t}|\mathbf{X}_{d,t}] = Exp\left(\beta_0 + \beta_1 proposals_{d,t-1} + \beta_2 awardedcad_{d,t-1} + \beta_3 successrate_{d,t-1} + \beta_4 cv\_awardedcad_{d,t-1} + \beta_5 cv\_successrate_{d,t-1} + \eta_d + \lambda_t\right). \quad (1)$$

In terms of explanatory variables, the benchmark specification relies on: a) an autoregressive component of order 1 ($proposals_{d,t-1}$); b) the dollar amount of grants awarded in a discipline in the previous competition ($awardedcad_{d,t-1}$); c) the success rate for each discipline in the previous competition ($successrate_{d,t-1}$); d) the rolling coefficients of variation of the last two variables ($cv\_awardedcad_{d,t-1}$ and $cv\_successrate_{d,t-1}$).

**[Table 2 about here]**

Table (2) reports the regression results for seven different specifications. Columns (1) to (5) use fixed effects estimators, and present progressively richer models, while columns (6) and (7) are based on random effects, and focus on the two most general models. Column (1) refers to a basic specification that omits the two variables capturing the funding instability, which are included in all the other regressions, presented in columns (2) to (7).[16]

The estimated coefficient on $proposals_{d,t-1}$, the autoregressive term, is always positive and highly significant. This variable seems to capture the influence of institutional features leading to reinforcement effects, such as the existence of field-specific associations and societies that facilitate obtaining information on the grant initiatives and feedback on the grant proposals.

If researchers were to be risk neutral, only the expected monetary value of a grant would influence their decisions. The regressions allow for more general cases, whereby $awardedcad_{d,t-1}$, the value of the awarded grants, and $successrate_{d,t-1}$, the funding probability, enter separately (but are treated symmetrically). The estimated coefficients for these two control variables are invariably negative, even though they are not always statistically significant at the 10% level. The estimated signs are consistent with the idea that scholars working in a discipline that has recently obtained generous grants with a high success rate do not need to apply immediately for additional funding. A mechanism that might contribute to explaining this result is how and when the awarded funds are actually spent. In the typical case of a grant proposal with three years of funding, SSHRC makes the approved funds available at the beginning of each fiscal year. The granted amounts are transfered in full, irrespective of the actual expenses carried out by the PI and their team. It is not uncommon that at the end of the three-year period there are some resources left over. These carry-over funds can be treated in different ways, but an important aspect is that SSHRC does not ask for the unspent portion of the awarded grants to be

[15] $\mathbf{X}_{d,t}$ is the vector of regressors and $\mathbb{E}$ is the conditional expectation operator. Poisson models are used to fit non-negative random variables, so they rely on an exponential formulation of the conditional mean function, denoted by $Exp(.)$ in Eq. (1). The $\beta_j$'s, $j = 0, ..., 5$, are parameters to be estimated. $\eta_d$ stands for the unobservable (time-invariant) idiosyncratic effect. $\lambda_t$ are time dummies included to control for aggregate changes.

[16] The minor differences in the number of observations across specifications are due to missing values in some of the regressors, which for that discipline-year pair do not allow to build the contribution to the likelihood. The random effects are assumed to follow a gamma distribution, and the null hypothesis of their absence is always rejected at the 1% level.

returned. At some institutions, the researcher can continue spending the carry-over funds beyond the planned duration of the grant, while in other cases the unspent resources are "seized" by the institution to pay for some general research costs. The negative point estimates might capture a time-stretching channel: when large grants are obtained with a high success rate, the considerable time costs of writing a new grant and fleshing out a different project can be partially smoothed-out, by increasing the effective duration of a grant. This can be achieved directly, by the explicit actions of a researcher, or indirectly via the institution they belong to, which could use the carry-over funds to finance internal grants whose application packages typically require less work to prepare.

The two regressors denoting the coefficients of variation are meant to identify the effect of the funding instability. Their estimated parameters have a negative sign in all specifications, and are virtually always statistically significant at either the 1% or 10% level, implying that researchers display an aversion to unstable sources of funding for their research projects.[17] Increases in the volatility of the awarded resources and/or in the volatility of the funding probability deter researchers from submitting proposals. Taking for granted that a higher degree of risk in public funding initiatives will reduce the grant-writing efforts of risk-averse researchers, a complementary interpretation of this result is that most projects require an extended period of time to come to fruition. For instance, many researchers need to collect primary data over a long period of time, or to purchase prolonged access to expensive databases. Similarly, researchers relying on specialized labs to perform experiments might need to undertake several exploratory rounds, eventually followed by the final runs, after preliminary issues are detected and fixed. In the absence of stable funding, the investigators might not be in a position to obtain crucial results in the later stages of the project life-cycle. This could be problematic, for example, when addressing the concerns that inevitably arise during the peer review publication process. This seems to be a salient aspect, as a number of social science disciplines are characterized by long publication lags. Another reason potentially explaining the negative point estimates could be that a steady source of funding allows the PI's to build a stable team, hiring the same research assistants for a long time horizon, reducing the need, the time, and the related risks of training new collaborators. This margin might be threatened by periods characterized by limited funding, which can sever the professional relationships built with past research assistants and collaborators.

Regressions (3), (4) and (5) introduce different lag structures on both the awarded amounts and the success rates. The variables $awardedcad_{d,t-2}$ and $successrate_{d,t-2}$ are meant to capture the effects of backward looking behavior, possibly including the dynamics caused by changes in the grant schemes rules, and the feature that grant holding researchers have the option to apply for a new grant every three years. The estimated coefficients for these two control variables indicate that they do not seem to be important. The variables $awardedcad_{d,t}$ and $successrate_{d,t}$ are meant to capture the effects of forward looking behavior, as they refer to information that the researchers will get access to in the future. Lacking data on expectations, for the future variables I use the realized values. The rationale behind including them is that researchers might have an appreciation of the quality of their prospective proposals, eventually submitting them only when they will be deemed ready for

[17] In specification (5), the coefficient on the rolling coefficient of variation of the success rate is statistically significant at the 11% level.

external scrutiny. The negative coefficient on the future success rate suggests that this delaying effect might be at play. If a researcher believes that the probability of getting funded will increase in the future (say, because of the additional time spent polishing an incomplete but promising application) this will have a negative effect on the number of proposals submitted in the current competition. Overall, the parameter estimates for both regressors are highly statistically significant, but the fact that the two signs differ does not have a simple explanation. This discrepancy could be due to working with series that do not reflect the actual expectations of the researchers at the time of taking the grant crafting decision. Therefore, the preferred specifications are the ones based on past values only, because they do not suffer from these data limitations.
An important consideration is that the inclusion of the lag structure does not alter the estimates of the parameters of interest. Both the sign and the size of the estimated parameters on the two volatility variables are found to be robust across specifications. To conclude with, it is worth mentioning that the results of the random effects regressions, in columns (6) and (7), display only minor differences.

Arguably, the disciplines dataset is not a random sample, because of the plausible strong correlation between specific fields. The discipline-level analysis might suffer from some biases, whose effects on the estimated parameters are hard to assess. In the next subsection I still use the SSHRC data, but with a different level of aggregation, which should mitigate this potential problem.

### 3.2 Institution-level Panel Data Analysis

For this part of the analysis, I compiled data from 15 annual SSHRC reports, which list the competition statistics for the post-secondary institutions participating in a specific round of the SRG initiative. In this sample, a unit of observation is a post-secondary institution that applied for at least one research grant in the 1997-2011 period.[18] This dataset has some advantages. First, it stems from a more coherent aggregation of researcher-level information. In particular, academic institutions are the entities formally in charge of handling SSHRC grant applications and funding. Typically, they establish dedicated research offices, whose job is to support the development of grant proposals and to administer the funding obtained from research grants. Second, since I observe the same academic institutions for several years, I can construct variables capturing the cumulated histories arising from past outcomes. In a learning set-up, these can be interpreted as proxies for the uncertain talent in research, that conceivably the academic institutions are also trying to assess.[19] These additional controls are meant to approximate the ability of groups of researchers affiliated with the same institution, while they are in the process of learning their academic type.[20] Another advantage of this dataset is that it allows

[18] There are reports available also for the years 1995 and 1996. However, some observables are not reported, hence I dropped these two waves. The panel is unbalanced, and there are up to 145 institutions. More detailed sample selection criteria and the full list of institutions in the dataset are included in Appendix B.

[19] It is hard to know whether the unobservable characteristics of the post-secondary institutions have been changing over time. Some indirect, and by all means imperfect, evidence is related to their ranking. Although the relative academic standing and prestige of some institutions did evolve in the sample period, there were no drastic changes in terms of entry and exit from this market. A notable exception is represented by the Ontario Institute of Technology, which was founded in 2002. Since then it has been quite active in its research endeavors, applying for and receiving a number of grants.

[20] Implementing this step in the discipline-level dataset would not be a reasonable procedure, because it would imply an explicit ranking of the different fields in the social sciences.

use of geographical dummies as control variables in random effects regressions.
The econometric model extends Eq. (1), using additional regressors, its more general specification being:

$$\begin{aligned}\mathbb{E}[proposals_{i,t}|\mathbf{X}_{i,t}] = Exp\,(&\beta_0 + \beta_1 proposals_{i,t-1} + \beta_2 awardedcad_{i,t-1} + \beta_3 successrate_{i,t-1} \\ &+\beta_4 cv\_awardedcad_{i,t-1} + \beta_5 cv\_successrate_{i,t-1} \\ &+\beta_6 awardedcad_{i,t-2} + \beta_7 successrate_{i,t-2} + \beta_8 awardedcad_{i,t} + \beta_9 successrate_{i,t} \\ &+\beta_{10} tot\_awardedcad_{i,t-1} + \beta_{11} tot\_propfunded_{i,t-1} + \eta_i + \lambda_t)\,.\end{aligned}$$

The dependent variable ($proposals_{i,t}$) is the number of research grant proposals submitted to SSHRC by an academic institution ($i$) in a given fiscal year ($t$).[21]

**[Table 3 about here]**

The regression results are included in Table (3), and they follow a similar organization to the one used for Table (2). Columns (1) to (5) rely on fixed effects estimators, and present progressively richer models, while columns (6) and (7) are based on random effects, and focus on the two preferred specifications.[22]

Overall, the results obtained with the institution-level data are in line with the estimates computed with the discipline-level panel. In particular, researchers in the social sciences are dissuaded from applying for research grants when funding becomes more volatile. Just like in the regressions based on discipline-level data, in columns (1) to (7), both the instability of funds received and the instability of the success rate have a negative impact on the number of submitted grant proposals.[23]

Similar to the discipline-level panel, the number of proposals shows a positive and significant autocorrelation. A sensible interpretation in this context could be that whenever the research office at a post-secondary institution is effective in reducing the administrative burden, it makes the development of proposals less arduous for a protracted period. Alternatively, the institutions that were lucky in the past have more funds available to help researchers develop competitive proposals for several rounds of the grants competitions.

The sign on both the value of the awarded grants and on the success rate is also consistent with the results in the previous subsection. These parameters are now estimated more precisely and, in the regressions with the same specification, they now tend to be somewhat larger in absolute value.

[21] Variables whose names display the *tot* prefix stand for running totals at the academic institution level. $tot\_awardedcad_{i,t-1}$ stands for the cumulative dollar value of grants received. Similarly, $tot\_propfunded_{i,t-1}$ stands for the cumulative number of proposals that were granted funding. $\eta_i$ stands for the unobservable (time-invariant) idiosyncratic effect. Time dummies $\lambda_t$ are included to control for aggregate changes, as well as geographical dummy variables (when identified).

[22] The fixed effects regressions have fewer observations because the conditional estimator requires time variation in the dependent variable, and the information on the institutions whose number of proposals is fixed over time cannot be used. The random effects are assumed to follow a gamma distribution, and the null hypothesis of their absence is always rejected at the 1% level.

[23] In specifications (3) and (5), the coefficient on the rolling coefficient of variation of the success rate is statistically significant at the 19% and 11% levels, respectively.

Researchers appear to be forward looking, at least to some degree, but the related mechanism might be somewhat different from the one described above. The coefficient on the future success rate is not statistically significant, and the future value of the grants received still has a positive and statistically significant estimate. The backward looking variables do not seem to be extremely important.

As for the two cumulated history variables, $tot\_awardedcad_{i,t-1}$ and $tot\_propfunded_{i,t-1}$, inspecting the estimates in columns (4), (5) and (7) suggests that they might play a minor role, as they are statistically significant in only one specification. This seems to indicate that the academic institutions in this sample have a somewhat accurate assessment of their research strengths and weaknesses, which are captured by the idiosyncratic effects $\eta_i$.

# 4 Discussion

The regression analysis showed that the funding instability has a detrimental effect on the number of grant applications. I begin this Section with a discussion of the potential limitations of the econometric framework, with some emphasis on what could be the causes behind the fluctuations in funding.

## 4.1 Econometric Challenges

As for the potential limitations of the statistical analysis, a striking outcome is the similarity of results across different datasets, econometric specifications, and estimators. The stability in both the fixed-effects vs. random-effects estimates, and in the disciplines vs. institutions ones, suggests that the identification of the parameters of interest might be predominantly achieved via the time series variation. In this regard, there are some potential obstacles. Even though in the sample period there is considerable variation in the success rates (the average one ranges from 29.8% to 43.0%, as displayed in Panel 3 of Figure 1), the time series dimension of the datasets is relatively short. Furthermore, the great recession and its aftermath happened toward the end of the sample period, potentially playing an important role due to the sizable fiscal adjustments that took place in the public sector.

The following comments deal with demand and supply sides issues. In Section 3, the reduced form regressions modeled the demand for grants funding, capturing the decisions made by researchers (whose behavior was then aggregated in either dataset). An implicit assumption to achieve consistent estimates of the causal effect of funding instability on the number of grant applications is that the sources of fluctuations in funding were exogenous. Given that in this environment the supply side is characterized by only one institution, idiosyncratic shocks do not wash out, and strategic elements play a more important role than in other applied problems where competition forces contribute to shaping the supply side. For instance, SSHRC's decision on how much to award to different disciplines and/or institutions at different times might have been driven by some specific objectives. Unfortunately, these goals are not disclosed in a way that allows for the econometric model to include a more explicit role for SSHRC's decisions. This would require information on SSHRC's preferences and objectives, which are unobservable and extremely hard to infer. If SSHRC systematically reacted to decreases in the number of grant proposals by reducing the funding instability in an attempt to maximize the number of applications, the

coefficients estimates would be biased. However, there is no informal evidence corroborating this mechanism, and, due to the short and unbalanced nature of the panel datasets, it is not possible to conduct formal Granger causality tests. In principle, a Difference-In-Differences (DID) analysis could overcome some of the threats to identification. However, when focusing on the SSHRC data, the reform that was implemented in 2012 affected all disciplines and institutions. Because of the aggregate nature of the policy change, a DID analysis cannot be performed on the SSHRC data alone, because there is no credible control group.[24]

As for the fluctuations in the value of funds allocated to grant initiatives, they can be driven by a number of causes. First, these could be induced by a restructuring of the grant initiatives, set in motion by a change in goals and priorities at the granting institutions, with a conceivable reallocations of funds between programs. In this case, it is difficult to understand if these changes are caused by the behavior of the number of grant applications. Second, granting institutions are subject to fluctuations in their budget. In this case, fiscal adjustments and/or changes in the political climate are the likely reasons behind a reduction in the budget allocated to public agencies, including SSHRC. Unless the granting institution has access to other sources of financing, say via partnerships with private organizations (a rare occurrence in the social sciences), changes in public budgets necessarily translate into changes in funds that are allocated to research grants. The years following the great recessions are an example of such mechanisms, where the observed swings in the success rates were partially due an overall reduction in public spending. These outcomes are for the most part outside the control of the granting institutions, which have to adjust to the overall trends in public finance, and the exogeneity of the variables of interest should be preserved.

## 4.2 Taking Stock

In many respects, the Canadian experience is not unique. For Australia, Fretz and Veall (2001) report sizable differences across disciplines in both the funding rates and the awarded amounts. For the U.S., Stephan (2012) documents that over time the National Science Foundation (National Institute of Health) funded research proposals at rates ranging between 20% and 37% (10% and 40%). Furthermore, in the early 2000's the NSF increased the average grant size by 41%, with the side effect of reduced success rates. Given the different nature of the Canadian and American systems, though, in the U.S. the number of applications (both overall and per applicant) increased, despite the increase in funding instability. As argued above, this is not the case for Canada. Conceivably, since Canadian post-secondary institutions typically do not rely on "soft money" to pay for their faculties' salaries (e.g., the summer support is guaranteed, as standard contracts for faculty members pay a salary for 12 months), Canadian researchers in the social sciences do not face an immediate and substantial economic cost of reduced research funding. If Canadian researchers abandon the routine of crafting grant proposals because of an increase in funding instability, they can switch to other income-generating activities, such as consulting work or writing textbooks, which might be deemed less risky. This can be especially important for tenured faculties, as research grants can be less salient for their future careers and economic outcomes.

[24] A possible alternative could be to combine SSHRC and NSERC data, using the NSERC disciplines as the control group. Unfortunately, the publicly available NSERC data do not include essential information at the discipline level, making this type of analysis not viable. Moreover, I was not able to obtain the required disaggregated data from NSERC.

The regression results show that Canadian researchers in the social sciences disliked the funding instability experienced during the SRG regime. Although evaluating the effectiveness of the 2012 SSHRC reform deserves a paper in its own right, it is informative to include a short discussion of whether the funding instability channel still plays a role when the more recent grant initiatives are included in the dataset. The nature of the 2012 reform added a number of econometric complications, such as setting in motion stock-flow dynamics due to transitioning to projects funded for five years, and the plausible introduction of a structural break in the regression model. With these caveats in mind, as a robustness check I ran the same regressions as in Section 3.1 on the whole 1995-2017 sample, which includes both the pre-reform and post-reform periods.[25] The sign, size and significance levels of most parameters are similar to the benchmark estimates, and the significance levels of the instability variables are always better.[26] Therefore, it is possible to argue that mechanisms similar to the ones observed in the SRG regime might shed some light also on the more recent trends, partially accounting for the sizable decline in grant proposals observed between 2015 and 2017. In particular, when faced with a more uncertain return, some researchers might have stopped undertaking a costly action, seeking less public funding for their research endeavors.

# 5 Conclusions

In this paper, I conducted an empirical investigation on the determinants of the decision to apply for public research grants. Using data on Canadian researchers in the social sciences, I documented a number of facts, with an emphasis on the researchers' aversion to the instability in public funding. In particular, using panel data estimators that control for unobserved heterogeneity, I found that the volatilities of both the probability of funding and of the value of the awarded grants deter researchers from submitting grant proposals.

To mitigate this effect, SSHRC and other granting institutions could smooth the value of grants awarded over time. This would minimize the detrimental effects of the funding instability on the number of grant proposals, fostering competition among researchers and possibly increasing the quality of the projects financed with public resources.

# 6 Appendix - Aggregate Time Series Evidence

In this appendix, I document some facts related to the SSHRC research grants over the 1995-2017 period. In the graphs, the vertical lines represent the implementation of the 2012 SSHRC grants reform, which introduced the Insight initiatives as the new framework for administering and funding research grants.[27]

[25] Performing this robustness check on the institution-level panel is not worthwhile. Starting from the 2014 fiscal year only the success rate is reported. This has the problematic consequence that it is not possible to reconstruct the number of applications for the large number of institutions that do not get funded. All the waves after 2013 have to be dropped. Aggregating the IG and IDG for only two years does not seem reasonable, as it would only provide an assessment of the short term response, which the time series data show to be potentially different from the longer term one.

[26] The full results are shown in Appendix C, Table 4.

[27] To ensure comparability between the Standard Research Grants and the Insight initiatives, for the latter I added up the proposals submitted to, and funded by, both Insight schemes.

## 6.1 Grant Proposals and Funding Trends for all SSHRC Disciplines

**[Figure 1 about here]**

Figure (1) shows four different plots displaying the aggregate trends of all SSHRC disciplines.[28] The first panel depicts the time series of the overall grant proposals submitted, together with the overall number of projects funded. Several patterns emerge. First, both series have trended upward, with both the proposals and the projects funded more than doubling until their peaks in 2011. The series for the number of proposals shows remarkable growth from 2000 until 2011, and since then it has behaved more erratically. A large decline in submissions has been observed in the recent years. The series for the number of projects funded has rather different dynamics. In particular, after the sudden fall in 2012, it decreased slowly until 2015, and only more recently did it partially reverse this trend. The second panel depicts the funding (requested and granted) in millions of real Canadian dollars (CAD). In the first twenty years of the sample, Canadian researchers in the social sciences almost tripled their requests in terms of research funds amounts, which reached 400.6 million in 2014. The total funds disbursed have been increasing by a similar factor, with some significant differences. In particular, the latter has decreased between 2004 and 2011, only regaining its 2004 value in 2012. This suggests that there was a period where SSHRC was in a position to accommodate systematically larger budget requests, as argued by Gordon (2016), a tendency that eventually stopped (possibly because of a changing political climate, and/or the rapid growth was deemed unsustainable). The third panel depicts two series related to the grants' success rates. The solid line can be interpreted as the unconditional (ex-post) probability of a proposal being funded, while the dashed line as the share of the total requested funding that was actually paid out. The probability of success has been varying wildly, with a range of 19.7 percentage points. In some years, researchers faced a probability of success in excess of 42%, while more recently, the corresponding figures have been below 24%. The decline in the proposals' success rates started in the late 1990's, with sizable fluctuations around this trend.[29] Historically, the funding success rate has co-moved with the proposals' success rate. The fourth panel displays the average funding per project. The solid line depicts the average amount of grant dollars requested per proposal, while the dashed line is the average amount paid out per successful proposal. These series also changed drastically over time, suggesting some strategic behavior by the researchers and a change in standards applied by SSHRC. In real terms, from its trough to its peak, the amount requested per project increased by 55.2%, from $\$78,901$ to $\$122,423$, with a sudden acceleration after 2011. Perhaps, what is even more spectacular is the narrowing gap between the two series. This suggests that SSHRC, as far as funding decisions are concerned, has relied on both the extensive and the intensive margins, with the related mix changing over time. In particular, the 2012 reform brought about another change: fewer projects were funded overall, but the researchers began obtaining virtually the full amount of their proposed budgets. This new regime has also been discussed by Gordon (2016), who emphasized how this might be due to a strategic element. Different committees did not have an incentive to cut the proposed budgets, because the savings made were not retained

[28] All pecuniary series are adjusted for inflation using the CPI index, with 2002 as the base year.

[29] Stock-flow dynamics are partially responsible for the large change in the success rate observed following the 2012 reform.

in the same field. Given the historical values, it is plausible that until the reform took place, researchers were expecting a substantial reduction in their proposed costs, with this downward adjustment intensifying after 2004. However, following the reform, the requested and actual funding almost converged. The increase in the requested funds could be due to a combination of a genuine underlying increase in the cost of doing research (e.g., because of expensive, specialized equipment, or a paradigm shift towards pricey experiments and data collection endeavours) and an attempt to undo the expected trimming of the budgets.

Taken together, these plots suggest that Canadian researchers in the social sciences have been facing a turbulent environment, with drastic changes in both the amount of funding received and the likelihood of being funded.

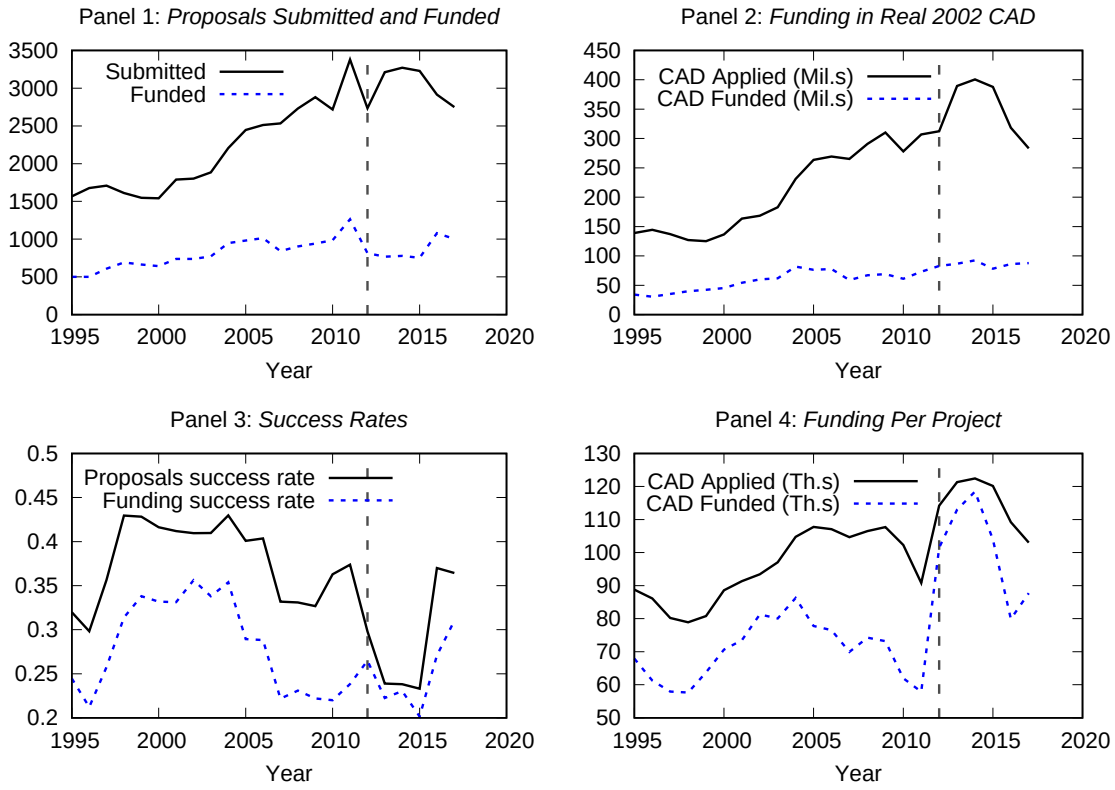


Figure 1: Trends for All SSHRC Disciplines, 1995-2017. The vertical lines represent the implementation of the 2012 SSHRC grants reform. Source: Author's calculations from SSHRC yearly reports.

| Variable | Description |
|---|---|
| $proposals_{j,t}$ | Number of grant proposals submitted by unit of observation $j$ in the competition adjudicated in year $t$. |
| $awardedcad_{j,t}$ | Dollar amount (CAD) of grants awarded to unit of observation $j$ in the competition adjudicated in year $t$. |
| $successrate_{j,t}$ | Success rate for unit of observation $j$ in the competition adjudicated in year $t$. |
| $cv\_awardedcad_{j,t-1}$ | Rolling coefficient of variation of the dollar amount awarded in the three-year window before period $t$. |
| $cv\_successrate_{j,t-1}$ | Rolling coefficient of variation of the success rate in the three-year window before period $t$. |
| Institution variable | |
| $tot\_awardedcad_{i,t-1}$ | Running total of the dollar amount of grants awarded to institution $i$ up to period $t-1$. |
| $tot\_propfunded_{i,t-1}$ | Running total of the number of proposals granted funding for institution $i$ up to period $t-1$. |

Table 1: Description of the variables used in the econometric analysis. The top portion lists variables that are present in both the disciplines and the post-secondary institutions regressions. The bottom portion lists variables that are included only in the institutions specifications. $j$ denotes the index for the cross-sectional dimension, which can be either disciplines ($d$) or institutions ($i$).

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| $proposals_{d,t-1}$ | 0.00189*** | 0.00187*** | 0.00201*** | 0.00155*** | 0.00209*** | 0.00210*** | 0.00219*** |
| | (0.000396) | (0.000396) | (0.000415) | (0.000400) | (0.000416) | (0.000414) | (0.000415) |
| $awardedcad_{d,t-1}$ | -0.00924 | -0.00410 | -0.00120 | -0.0467*** | -0.0409*** | -0.000876 | -0.0414*** |
| | (0.0117) | (0.0119) | (0.0122) | (0.0126) | (0.0127) | (0.0121) | (0.0127) |
| $successrate_{d,t-1}$ | -0.216** | -0.308*** | -0.309*** | -0.119 | -0.0952 | -0.319*** | -0.101 |
| | (0.108) | (0.113) | (0.113) | (0.114) | (0.114) | (0.113) | (0.114) |
| $cv\_awardedcad_{d,t-1}$ | | -0.214*** | -0.210*** | -0.200*** | -0.194*** | -0.223*** | -0.208*** |
| | | (0.0660) | (0.0669) | (0.0662) | (0.0670) | (0.0669) | (0.0670) |
| $cv\_successrate_{d,t-1}$ | | -0.142* | -0.140* | -0.139* | -0.134 | -0.154* | -0.149* |
| | | (0.0836) | (0.0847) | (0.0838) | (0.0848) | (0.0846) | (0.0847) |
| $awardedcad_{d,t-2}$ | | | -0.0101 | | -0.0423*** | -0.00898 | -0.0417*** |
| | | | (0.00886) | | (0.00924) | (0.00886) | (0.00924) |
| $successrate_{d,t-2}$ | | | 0.0409 | | 0.00571 | 0.0256 | -0.0107 |
| | | | (0.112) | | (0.112) | (0.112) | (0.112) |
| $awardedcad_{d,t}$ | | | | 0.0887*** | 0.101*** | | 0.103*** |
| | | | | (0.00822) | (0.00869) | | (0.00868) |
| $successrate_{d,t}$ | | | | -0.402*** | -0.447*** | | -0.453*** |
| | | | | (0.110) | (0.111) | | (0.111) |
| $N$ | 419 | 411 | 410 | 411 | 410 | 410 | 410 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Poisson panel data regressions for the number of grant applications ($proposals_{d,t}$), discipline-level data, 1995-2011. All regressions include time dummies. (1)-(5) include discipline fixed effects, and (6)-(7) discipline random effects. $cv\_x_{d,t-1}$ stands for the 3-year rolling coefficient of variation of the explanatory variable $x$ before period $t$.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| $proposals_{i,t-1}$ | 0.00533*** | 0.00528*** | 0.00479*** | 0.00602*** | 0.00568*** | 0.00574*** | 0.00652*** |
| | (0.000651) | (0.000684) | (0.000690) | (0.000696) | (0.000701) | (0.000684) | (0.000695) |
| $awardedcad_{i,t-1}$ | -0.0618*** | -0.0504*** | -0.0665*** | -0.0313** | -0.0444*** | -0.0510*** | -0.0313** |
| | (0.0137) | (0.0141) | (0.0142) | (0.0144) | (0.0144) | (0.0141) | (0.0144) |
| $successrate_{i,t-1}$ | -0.303*** | -0.379*** | -0.301*** | -0.356*** | -0.249*** | -0.370*** | -0.348*** |
| | (0.0769) | (0.0789) | (0.0789) | (0.0790) | (0.0791) | (0.0783) | (0.0784) |
| $cv\_awardedcad_{d,t-1}$ | -0.0833* | -0.0953* | -0.0660 | -0.105** | -0.0804 | -0.117** | -0.126** |
| | (0.0502) | (0.0504) | (0.0504) | (0.0506) | (0.0505) | (0.0504) | (0.0506) |
| $cv\_successrate_{d,t-1}$ | -0.119** | -0.145*** | -0.143*** | -0.116** | -0.104* | -0.177*** | -0.148*** |
| | (0.0548) | (0.0555) | (0.0554) | (0.0558) | (0.0557) | (0.0555) | (0.0558) |
| $awardedcad_{i,t-2}$ | | -0.0201* | -0.0545*** | 0.0184 | -0.0125 | -0.0176* | 0.0232* |
| | | (0.0108) | (0.0114) | (0.0126) | (0.0130) | (0.0108) | (0.0126) |
| $successrate_{i,t-2}$ | | -0.251*** | -0.165** | -0.266*** | -0.162** | -0.250*** | -0.266*** |
| | | (0.0760) | (0.0769) | (0.0763) | (0.0771) | (0.0755) | (0.0757) |
| $awardedcad_{i,t}$ | | | 0.104*** | | 0.123*** | | |
| | | | (0.0116) | | (0.0118) | | |
| $successrate_{i,t}$ | | | -0.0692 | | -0.0502 | | |
| | | | (0.0769) | | (0.0770) | | |
| $tot\_awardedcad_{i,t-1}$ | | | | 0.000896 | 0.0151** | | -0.00285 |
| | | | | (0.00747) | (0.00763) | | (0.00746) |
| $tot\_propfunded_{i,t-1}$ | | | | -0.000621 | -0.00198*** | | -0.000335 |
| | | | | (0.000624) | (0.000640) | | (0.000623) |
| $N$ | 1017 | 1017 | 1017 | 1017 | 1017 | 1041 | 1041 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Poisson panel data regressions for the number of grant applications ($proposals_{i,t}$), institution-level data, 1997-2011. All regressions include time dummies. (1)-(5) include institution fixed effects, and (6)-(7) institution random effects and province dummies. $cv\_x_{i,t-1}$ stands for the 3-year rolling coefficient of variation of the explanatory variable $x$ before period $t$. $tot\_x_{i,t-1}$ stands for the running total at the post-secondary institution level up to period $t-1$.

## References


Adams, J., and Griliches, Z. (1998). "Research Productivity in a System of Universities," *Annales d'Économie et de Statistique*, Vol. 49-50, 127-162.

Antonelli, C., Franzoni, C., and Geuna, A. (2011). "The Organization, Economics, and Policy of Scientific Research: What we do Know and What we Don't Know - an Agenda for Research," *Industrial and Corporate Change*, Vol. 20, 201-213.

Arora, A., David, P., and Gambardella, A. (1998). "Reputation and Competence in Publicly Funded Science: Estimating the Effects on Research Group Productivity," *Annales d'Économie et de Statistique*, Vol. 49-50, 163-198.

Arora, A., and Gambardella, A. (2005). "The Impact of NSF Support for Basic Research in Economics," *Annales d'Économie et de Statistique*, Vol. 79-80, 91-117.

Ayoubia, C., Pezzoni, M., and Visentina, F. (2019). "The important thing is not to win, it is to take part: What if scientists benefit from participating in research grant competitions?," *Research Policy*, Vol. 48, 84-97.

Benavente, J., Crespi, G., Garone, L., and Maffioli, A. (2012). "The Impact of National Research Funds: A Regression Discontinuity Approach to the Chilean FONDECYT," *Research Policy*, Vol. 41, 1461-1475.

Broder, I. (1993). "Professional achievements and gender differences among academic economists," *Economic Inquiry*, Vol. 31, 116-127.

Chandler, V. (2018). "Do Evaluators Prefer Candidates of Their Own Gender?," *Canadian Public Policy*, Vol. 44, 289-302.

Chandler, V. (2020). "Candidate–Evaluator Similarity, Favouritism, Informational Advantage, and Committee Dynamics," *Canadian Public Policy*, Vol. 46, 414-428.

Chudnovsky, D., Lopez, A., Rossi, M., and Ubfal, D. (2008). "Money for Science? the Impact of Research Grants on Academic Output," *Fiscal Studies*, Vol. 29, 75-87.

Courty, P., and Sims, J. (2015). "Retention of talented academic researchers: Evidence from a government intervention," *Canadian Journal of Economics*, Vol. 48, 1635-1660.

Day, T. (2015). "The big consequences of small biases: A simulation of peer review," *Research Policy*, Vol. 44, 1266-1270.

Fretz, D., and Veall, M. (2001). "Economists and the ARC Large Grants Scheme: A Brief Report," *Economic Record*, Vol. 77, 183-188.

Gordon, S. (2016). "The economics of SSHRC research grants (Parts I-IV)," *Worthwhile Canadian Initiative - Blog*, Aug. $9^{th}$-$12^{th}$, retrieved on-line at (accessed 28 December 2019):
`http://worthwhile.typepad.com/worthwhile_canadian_initi/2016/08/sshrc1.html`

Jacob, B., and Lefgren, L. (2011). "The Impact of Research Grant Funding on Scientific Productivity," *Journal of Public Economics*, Vol. 95, 1168-1177.

Payne, A., and Siow, A. (2003). "Does Federal Research Funding Increase University Research Output?," *The B.E. Journal of Economic Analysis & Policy*, Vol. 3, Article 1.

Social Sciences and Humanities Research Council. (2011). SSHRC 2010-11 Annual Report. It can be retrieved on-line at (last accessed 1st June 2022):
https://www.sshrc-crsh.gc.ca/about-au_sujet/publications/SSHRC_Annual_Report_2010-11_e.pdf

Social Sciences and Humanities Research Council. (2022a). SSHRC grant rules can be retrieved on-line at (last accessed 1st June 2022):
http://www.sshrc-crsh.gc.ca/funding-financement/programs-programmes/insight_development_grants-subventions_de_developpement_savoir-eng.aspx

Social Sciences and Humanities Research Council. (2022b). Insight grants objectives can be retrieved on-line at (last accessed 1st June 2022):
http://www.sshrc-crsh.gc.ca/funding-financement/umbrella_programs-programme_cadre/insight-savoir-eng.aspx

Stephan, P. (1996). "The Economics of Science," *Journal of Economic Literature*, Vol. 34, 1199-1235.

Stephan, P. (2012). How Economics Shapes Science, Harvard University Press, Cambridge, MA.

Viner, N., Powell, P., and Green, R. (2004). "Institutionalized biases in the award of research grants: a preliminary analysis revisiting the principle of accumulative advantage," *Research Policy*, Vol. 33, 443-454.

von Hippel, T., and von Hippel, C. (2015). "To Apply or Not to Apply: A Survey Analysis of Grant Writing Costs and Benefits," *PLoS ONE*, Vol. 10, e0118494.

Whalley, A. and Hicks, J. (2014). "Spending Wisely? How Resources Affect Knowledge Production in Universities," *Economic Inquiry*, Vol. 52, 35-55.

# Appendix A - Data and Estimation (Not for publication)

- The raw data on the SSHRC grants used in this paper can be downloaded from the following website:

  `http://www.sshrc-crsh.gc.ca/results-resultats/stats-statistiques/index-eng.aspx`

- Notes for the discipline panel dataset creation: a) if in a year there are no applications submitted in a discipline, the related awarded funding is set to zero. b) From 1997, "Literature" becomes "Literature and Modern Languages". I computed the intermediate sums, as this discipline used to be disaggregated into several languages. c) In 1998, there is a "Not applicable" category with 1 application, distinct from the "Other" category: I dropped it. d) From 2000, the "Administrative Studies" discipline was relabeled as "Management/Business/Administrative Studies". For consistency, I relabeled the former category also for the first part of the sample. e) In 2001 and 2002 "Folklore" is not included: I assigned missing values. There is also a new discipline: "Women's Studies". "Nursing" and "Public Health" were in the "Other" category, and I included "Women's Studies" under "Other" as well. f) In 2007, "Modern Languages and Literature" becomes "Literature and Modern Languages". I relabeled the former category also for the first part of the sample. g) From 2005, "Women's Studies" and "Medical Studies" no longer appear as disciplines. h) In 2005, "Archival Science" does not appear: I treated it as a missing value. i) In 2013, the IDG has an "Unknown" category with a 25% success rate: I dropped it.

- The estimation was performed with STATA SE 15.1, and the panel data regressions use STATA built-in estimators and commands.

- Since the number of proposals is a count variable, I relied on a panel data version of a poisson regression with Random Effects or Fixed Effects. The typical STATA commands are:

  - For the discipline-level data:

    ```
    xtpoisson applications lapplications lawardedcad lsuccessrate awardedcad_cv
                                successrate_cv i.year, fe
    ```

  - For the institution-level data:

    ```
    xi, noomit:  xtpoisson applications lapplications lawardedcad lsuccessrate
                    awardedcad_cv successrate_cv i.year i.region
    ```

# Appendix B - List of Academic Institutions (Not for publication)

| *Id* | *Institution* | *Id* | *Institution* |
|---|---|---|---|
| 1 | *Memorial* | 31 | *HEC Montréal* |
| 2 | *U Prince Edward Island* | 32 | *ENAP* |
| 3 | *Acadia* | 33 | *INRS* |
| 4 | *Cape Breton* | 34 | *Télé-université* |
| 5 | *Dalhousie* | 35 | *UQÀChicoutimi* |
| 6 | *King's College (Halifax)* | 36 | *UQÀHull* |
| 7 | *Mount Saint Vincent* | 37 | *UQÀMontréal* |
| 8 | *NS Agricultural College* | 38 | *UQÀRimouski* |
| 9 | *NS College of Art and Design* | 39 | *UQOutaouais* |
| 10 | *Saint Mary's* | 40 | *UQAbitibi-Témiscamingue* |
| 11 | *Sainte-Anne* | 41 | *UQTrois-Rivières* |
| 12 | *St. Francis Xavier* | 42 | *Sherbrooke* |
| 13 | *Atlantic Baptist College* | 43 | *Dawson College* |
| 14 | *Moncton* | 44 | *Marianopolis College* |
| 15 | *Mount Allison* | 45 | *Collège Valleyfield* |
| 16 | *New Brunswick* | 46 | *Vanier College* |
| 17 | *St. Thomas* | 47 | *Brock* |
| 18 | *Cégep de Maisonneuve* | 48 | *Carleton* |
| 19 | *Cégep Drummondville* | 49 | *Collège Dominicain* |
| 20 | *Cégep du Vieux Montréal* | 50 | *Confederation College* |
| 21 | *Cégep Édouard-Montpetit* | 51 | *Guelph* |
| 22 | *Collège John Abbott* | 52 | *Lakehead* |
| 23 | *Collège Lionel-Groulx* | 53 | *Laurentian* |
| 24 | *Collège Saint-Jean-sur-Richelieu* | 54 | *McMaster* |
| 25 | *Bishop's* | 55 | *Nipissing* |
| 26 | *Concordia* | 56 | *Ontario Bible College* |
| 27 | *Laval* | 57 | *OCAD University* |
| 28 | *McGill* | 58 | *Ontario Institute of Technology* |
| 29 | *Montréal* | 59 | *Ottawa* |
| 30 | *École Polytechnique de Montréal* | 60 | *Queen's* |

Table: Units of Observation in the Panel Dataset

| *Id* | *Institution* | *Id* | *Institution* |
|---|---|---|---|
| 61 | *Redeemer University College* | 91 | *Algonquin College of Applied Arts* |
| 62 | *Royal Military College* | 92 | *Canadian College of Naturopathic Medicine* |
| 63 | *Ryerson* | 93 | *Hearst University* |
| 64 | *Saint Paul* | 94 | *Humber College* |
| 65 | *Sault College of Applied A&T* | 95 | *Institute for Christian Studies* |
| 66 | *Sudbury U* | 96 | *McMaster Divinity College* |
| 67 | *Seneca College* | 97 | *Brandon* |
| 68 | *Sheridan Institute of TAL* | 98 | *Canadian Mennonite U* |
| 69 | *St. Michael's Hospital* | 99 | *Manitoba* |
| 70 | *Toronto* | 100 | *Université de Saint-Boniface* |
| 71 | *Pontifical Institute of Mediaeval Studies* | 101 | *Winnipeg* |
| 72 | *Trinity College (UoT)* | 102 | *Briercrest College and Seminary* |
| 73 | *St. Michael's College (UoT)* | 103 | *Regina* |
| 74 | *Victoria College (UoT)* | 104 | *Campion College* |
| 75 | *Wycliffe College (UoT)* | 105 | *Luther College Regina* |
| 76 | *Toronto School of Theology* | 106 | *Saskatchewan* |
| 77 | *Trent* | 107 | *St Thomas More Collegiate* |
| 78 | *Waterloo* | 108 | *Alberta* |
| 79 | *Renison College* | 109 | *Ambrose U/Canadian Bible College* |
| 80 | *St. Paul's United College* | 110 | *Athabasca* |
| 81 | *Saint Jerome's U* | 111 | *Augustana University College* |
| 82 | *Western Ontario* | 112 | *Calgary* |
| 83 | *Brescia University College* | 113 | *Concordia University Edmonton* |
| 84 | *Huron College* | 114 | *The King's University (Edmonton)* |
| 85 | *King's University College* | 115 | *Lethbridge U* |
| 86 | *Knox College* | 116 | *Taylor College and Seminary* |
| 87 | *Wilfrid Laurier* | 117 | *Grant MacEwan* |
| 88 | *Windsor* | 118 | *Medicine Hat College* |
| 89 | *York* | 119 | *Mount Royal University* |
| 90 | *Algoma University College* | 120 | *Southern Alberta Institute of Technology* |

Table: Units of Observation in the Panel Dataset

| *Id* | *Institution* |
|---|---|
| 121 | *Grande Prairie Regional* |
| 122 | *Lethbridge Community* |
| 123 | *Red Deer College* |
| 124 | *St. Mary's University College* |
| 125 | *U of British Columbia* |
| 126 | *Regent College* |
| 127 | *Fraser Valley U* |
| 128 | *Kwantlen Polytechnic University* |
| 129 | *Northern British Columbia* |
| 130 | *Northern Lights College* |
| 131 | *Okanagan College* |
| 132 | *Royal Roads U* |
| 133 | *Simon Fraser* |
| 134 | *Thompson Rivers* |
| 135 | *Trinity Western* |
| 136 | *Victoria* |
| 137 | *British Columbia Institute of Technology* |
| 138 | *Camosun College* |
| 139 | *Capilano University* |
| 140 | *Vancouver Island U* |
| 141 | *North Island College* |
| 142 | *Columbia Bible College* |
| 143 | *Emily Carr University of Art & Design* |
| 144 | *Vancouver School of Theology* |
| 145 | *Yukon College* |

Table: Units of observation in the institution panel dataset. Notes: a) Yukon is lumped together with Atlantic Canada in terms of geographical region. b) In the year 2000 the Research Time Stipend was introduced, which lasted until 2010: I consider the total requested and awarded (inclusive of the RTS). c) U of Michigan, Kalamazoo, Cambridge applied (most likely due to researchers that moved) but were dropped as they are outside Canada. d) Institutions that changed name were kept as the same institution (e.g., in 2005 University College of the Cariboo was renamed as Thompson Rivers University). e) The Technical University of British Columbia applied in 2002, but it was in operation only between 1999 and 2002 (it was dropped from the dataset). f) The First Nations University of Canada had a complicated history (it was put on probation and applied only in 2006, so it was dropped from the dataset). g) Tyndale UC applied only in 2011 (it was dropped from the dataset). h) The following institutions had their name listed in the SSHRC reports, but never applied in the sample period and were dropped in some regressions: Cégep du Vieux Montréal, Cégep Édouard-Montpetit, Confederation College, St. Michael's Hospital, Southern Alberta Institute of Technology.

## Appendix C - Robustness Analysis (Not for publication)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| $proposals_{i,t-1}$ | 0.00170*** | 0.00170*** | 0.00136*** | 0.000911*** | 0.00100*** | 0.00139*** | 0.00103*** |
| | (0.000236) | (0.000237) | (0.000252) | (0.000247) | (0.000256) | (0.000251) | (0.000255) |
| $awardedcad_{i,t-1}$ | 0.0190*** | 0.0224*** | 0.0175** | 0.00187 | 0.00176 | 0.0177** | 0.00170 |
| | (0.00699) | (0.00709) | (0.00719) | (0.00729) | (0.00733) | (0.00718) | (0.00732) |
| $successrate_{i,t-1}$ | -0.390*** | -0.538*** | -0.507*** | -0.385*** | -0.367*** | -0.513*** | -0.372*** |
| | (0.0939) | (0.0985) | (0.0988) | (0.0992) | (0.0996) | (0.0987) | (0.0995) |
| $cv\_awardedcad_{d,t-1}$ | | -0.219*** | -0.227*** | -0.202*** | -0.213*** | -0.234*** | -0.221*** |
| | | (0.0522) | (0.0524) | (0.0521) | (0.0524) | (0.0524) | (0.0524) |
| $cv\_successrate_{d,t-1}$ | | -0.305*** | -0.311*** | -0.317*** | -0.335*** | -0.321*** | -0.345*** |
| | | (0.0631) | (0.0635) | (0.0631) | (0.0635) | (0.0635) | (0.0634) |
| $awardedcad_{i,t-2}$ | | | 0.0229*** | | -0.00794 | 0.0234*** | -0.00774 |
| | | | (0.00537) | | (0.00585) | (0.00537) | (0.00585) |
| $successrate_{i,t-2}$ | | | -0.172* | | -0.220** | -0.180* | -0.229** |
| | | | (0.0965) | | (0.0968) | (0.0964) | (0.0967) |
| $awardedcad_{i,t}$ | | | | 0.0707*** | 0.0756*** | | 0.0762*** |
| | | | | (0.00503) | (0.00552) | | (0.00552) |
| $successrate_{i,t}$ | | | | -0.513*** | -0.521*** | | -0.523*** |
| | | | | (0.0954) | (0.0956) | | (0.0954) |
| $N$ | 579 | 571 | 570 | 571 | 570 | 570 | 570 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Poisson panel data regressions for the number of grant applications ($proposals_{d,t}$), discipline-level data, 1995-2017. All regressions include time dummies. (1)-(5) include discipline fixed effects, and (6)-(7) discipline random effects. $cv\_x_{d,t-1}$ stands for the 3-year rolling coefficient of variation of the explanatory variable $x$ before period $t$.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| $proposals_{i,t-1}$ | 0.00528*** | 0.00535*** | 0.00472*** | 0.00607*** | 0.00560*** | 0.00597*** | 0.00675*** |
| | (0.000653) | (0.000686) | (0.000691) | (0.000697) | (0.000702) | (0.000686) | (0.000698) |
| $awardedcad_{i,t-1}$ | -0.0607*** | -0.0498*** | -0.0671*** | -0.0309** | -0.0455*** | -0.0505*** | -0.0308** |
| | (0.0137) | (0.0141) | (0.0143) | (0.0144) | (0.0145) | (0.0141) | (0.0144) |
| $successrate_{i,t-1}$ | -0.316*** | -0.379*** | -0.303*** | -0.358*** | -0.250*** | -0.365*** | -0.343*** |
| | (0.0785) | (0.0804) | (0.0804) | (0.0805) | (0.0806) | (0.0799) | (0.0800) |
| $cv\_awardedcad_{d,t-1}$ | -0.0966* | -0.108** | -0.0811 | -0.118** | -0.0954* | -0.137*** | -0.146*** |
| | (0.0503) | (0.0504) | (0.0504) | (0.0506) | (0.0506) | (0.0504) | (0.0506) |
| $cv\_successrate_{d,t-1}$ | -0.122** | -0.141** | -0.137** | -0.113** | -0.0998* | -0.178*** | -0.150*** |
| | (0.0548) | (0.0555) | (0.0554) | (0.0557) | (0.0557) | (0.0555) | (0.0558) |
| $awardedcad_{i,t-2}$ | | -0.0225** | -0.0579*** | 0.0152 | -0.0170 | -0.0199* | 0.0208* |
| | | (0.0108) | (0.0114) | (0.0126) | (0.0130) | (0.0108) | (0.0126) |
| $successrate_{i,t-2}$ | | -0.193** | -0.125 | -0.208*** | -0.121 | -0.175** | -0.191** |
| | | (0.0771) | (0.0779) | (0.0773) | (0.0782) | (0.0766) | (0.0768) |
| $awardedcad_{i,t}$ | | | 0.113*** | | 0.131*** | | |
| | | | (0.0116) | | (0.0118) | | |
| $successrate_{i,t}$ | | | -0.241*** | | -0.222*** | | |
| | | | (0.0773) | | (0.0774) | | |
| $tot\_awardedcad_{i,t-1}$ | | | | 0.00174 | 0.0159** | | -0.00304 |
| | | | | (0.00748) | (0.00763) | | (0.00746) |
| $tot\_propfunded_{i,t-1}$ | | | | -0.000682 | -0.00202*** | | -0.000318 |
| | | | | (0.000624) | (0.000641) | | (0.000623) |
| $N$ | 932 | 932 | 932 | 932 | 932 | 939 | 939 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Poisson panel data regressions for the number of grant applications ($proposals_{i,t}$) dropping the zero values, institution-level data, 1997-2011. All regressions include time dummies. (1)-(5) include institution fixed effects, and (6)-(7) institution random effects and province dummies. $cv\_x_{i,t-1}$ stands for the 3-year rolling coefficient of variation of the explanatory variable $x$ before period $t$. $tot\_x_{i,t-1}$ stands for the running total at the post-secondary institution level up to period $t-1$.