The permanent effect of extraordinary events on scientists' performance

Theme: **Universities as interactive partners**

Keywords: Scientist performance, publication determinants, funding, networking, matching techniques

Introduction:

Having a great academic performance is not only because of funding or prestige. There are some desirable factors, increasing the individual's motivation by all means, which influences the willingness or ability of scientists for conducting research. Having less teaching work-loads, higher salary with low inequity and fair access to sufficient research facilities and equipment are mentioned in the literature as some examples of these factors.

To make a contribution on the aforementioned factors, this research searches for the permanent effect of specific shocks during the scientists' career on their research performance. To be more explicit, the research tests whether benefiting from great financing early in one's career opens a different path in front of a young scientist, or whether publishing a major paper permanently shifts up the performance of a researcher, or whether experiencing a specific collaboration with industry or other researchers may be highly influential on the future research performance of a researcher.

Literature review and proposed hypotheses:

Being in the same city or within close location gives the opportunity to the researchers to have productive research collaboration. Katz (1994) show the positive effect of geographical

proximity on intra-national scientific collaboration in Canada, the United Kingdom and Australia. In another interesting study, Boschma (2005) argues that geographical proximity is neither a necessary nor a sufficient factor improving knowledge production. However, the author explains that this kind of proximity may facilitate interactive learning.

In order to look at the effect of proximity in Quebec, it is possible to use the physical distance of co-workers (either working on the same paper or having access to one grant) as a proxy for geographical proximity. We may then be able to test whether Geographical proximity of individuals is a significant factor in generating higher numbers of patent and papers in genomics and biotechnology.

Belonging to a productive network should be an advantage for scientists. Newman (2001a, b) finds that the probability of collaborating between two scientists increases with the number of their other common collaborators and also indicates that the probability of publishing an article with a new collaborator increases with the diversity of the author's past collaborators. In addition, Newman (2001a, b) finds that most authors in a co-publication network are connected with each other via one or two of their collaborators, a concept generally referred to as betweenness centrality. For instance, Beaudry and Allaoui (2012) show a positive effect of betweenness centrality on the scientific productivity of Quebec's scientists. This research will test whether scientists occupying better network positions, such as (a) cliquishness (b) betweenness centrality and (c) degree centrality, co-author a greater number of publications and patents.

Fox (1983) indicates numerous psychological factors affecting scientific productivity; "inner compulsion" which exist even without external rewards and incentives; "stamina or the capacity

to work hard" which is durable for long range goals; "cognitive, emotional, and perceptual styles of the productive scientist" which is evaluated by clinical investigation. The research demonstrates that "productive scientists show high ego strength, personal dominance, preference for precision and exactness, strong control of impulse, and a preoccupation with ideas and things rather than people" (pp. 287). In a similar study, Wood (1990) argues that ability, creativity, motivation, self-discipline and ambition correlate with research productivity.

Ramsden (1994) and Amabile (1994) indicate that intrinsic motivation is an important factor as it results in conducting research for its own sake. Similarly, Dewett (2007) refers to the intrinsic motivation as a factor that positively affect the creativity via improving the willingness to take risks. Hartley and Branthwaite (1989) argue that scientific publisher can be categorized as thinkers versus doers (in terms of composition style) or as anxious versus enthusiastic (in terms of attitudes and feelings). Such psychological measures can be transformed into indices expressing the entrepreneurial flame of scientists. It is then possible to test whether the scientists that possess the entrepreneurial flame tend to patent more, all other things being equal.

Lertputtarak (2008) finds that research productivity mainly correlates with desirable factors, which influence the willingness of scientists for conducting research and increase an individual's motivation. The author refers to the following as the main desirable factors: (1) reduce teaching work-loads; (2) overcome the inequity in salary; (3) provide sufficient research facilities, consisting resources, materials, machinery, equipment, research assistants, technicians, facilitators, databases, books, and stationery; (4) set appropriate financial regulation and policies; (5) top up the insufficient research funding; (6) form positive academic and provide "both socializing and reinforcing organizational messages about norms, values and expectations concerning research" (pp. 205). Considering the mentioned finding we are able to test the

following hypotheses for the case of Quebec: (a) more supportive university environment, such as having access to more time or equipment, increases the propensity to patent or publish, (b) benefitting from large start-up grants at an early stage in one's career has a permanent effect/shift on the subsequent number of patents or papers generated by scientists, (c) publishing a highly cited paper permanently shifts upwards the future performance of a researcher in terms of the number of academic publications, and (d) collaborating with famous and/or prolific researchers permanently increase the future technology and scientific performance of a scientist.

Methodology and data:

A data set is built based on the integration of data and information in three areas of funding, publishing and patenting in Quebec. For publications, Elsevier's Scopus provides information on scientific articles (date of publication, journal name, authors and their affiliations). In terms of patent data, the United States Patent and Trademark Office (USPTO) have information of patent content, the name and address of all inventors, and patent assignees. Finally, the University Research Information System (*Système d'information sur la recherche universitaire* or SIRU) of the Quebec Ministry of Education, Leisure and Sports is a data set on the grants and contracts obtained by Quebec academics during the period 1985-2008, including yearly amount, source, type, or other funding information.

Using this combined data set, we investigate what happens to the future performance of scientists of similar intrinsic abilities when they get different support from their environment, or when they collaborate with different researchers. Such comparison can be made in two ways: first, by bringing together scientists in three or five categories according to their scientific impact of research and then considering the impact of environment on the transition from one category to

another; second, by building a database of 'twin' scientists with common intrinsic characteristics and then comparing the effect of environmental event on them. This method is generally referred to as matching technique and requires the use of econometric models.

In these models, the left hand side variable is the difference between the performances of the twins, explained by the differences in their funding, networking, and support. Looking at the literature, it is possible to add control variables such as age, gender, prestige of university, and field and context. It is important to note that these are characteristics variables in the sense that they are determinants of scientific production but they are control variables here because they improve the significance of the model.

Finding:

Until now, we have tried to build up the model and appropriate data set and there is no result at this time but the result will be delivered with the full paper.

Implications for business management or policy:

This paper ends up with proposing specific factors creating tangible difference in scientists' performance. Having these factors in hand, the policy makers can focus on them to dedicate the resources for the programs, which produces more gain with higher efficiency

References:

Amabile, T.M., 1994. The atmosphere of pure work: Creativity in research and development. The social psychology of science, 316-328.

Beaudry, C., Allaoui, S., 2012. Impact of public and private research funding on scientific production: The case of nanotechnology.

Boschma, R., 2005. Proximity and innovation: a critical assessment. Regional studies 39, 61-74.

Dewett, T., 2007. Linking intrinsic motivation, risk taking, and employee creativity in an R&D environment. R&D Management 37, 197-208.

Fox, M.F., 1983. Publication productivity among scientists: A critical review. Social Studies of Science 13, 285-305.

Hartley, J., Branthwaite, A., 1989. The psychologist as wordsmith: a questionnaire study of the writing strategies of productive British psychologists. Higher Education 18, 423-452.

Katz, J.S., 1994. Geographical proximity and scientific collaboration. Scientometrics 31, 31-43.

Lertputtarak, S., 2008. An investigation of factors related to research productivity in a public university in Thailand: a case study. Victoria University.

Newman, M.E.J., 2001a. Clustering and preferential attachment in growing networks. Physical Review E 64, 025102.

Newman, M.E.J., 2001b. Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality. PHYSICAL REVIEW-SERIES E- 64, 16132-16132.

Ramsden, P., 1994. Describing and explaining research productivity. Higher Education 28, 207-226.

Wood, F., 1990. Factors influencing research performance of university academic staff. Higher Education 19, 81-100.