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**Field Experiments and Government
Support for Business Innovation:
A Roundtable Summary**

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Industry Canada

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Social Research and Demonstration Corporation

The views expressed in this report do not reflect those of Industry Canada or the Government of Canada.

INTRODUCTION

This report summarizes the presentations and discussions that took place at the Industry Canada Roundtable “Field Experiments and Government Programs to Support Business Innovation” held on January 15, 2009, in Ottawa. The Roundtable was attended by academic and non-academic experts as well as representatives of Industry Canada and other federal departments and organizations. The Roundtable examined whether it was feasible to use field experiment to test the effectiveness of government support programs to promote private-sector innovation and R&D expenditures.

The Roundtable heard a presentation on field experiments by Gary Burtless of The Brookings Institution as well as a presentation by the Social Research and Demonstration Corporation (SRDC) on its report “The Use of Randomized Field Experiments to Assess the Effectiveness of Government Programs to Support Innovation: A Feasibility Study.” The report was then reviewed by Laval professor Guy Lacroix, University of Calgary professor Ken McKenzie, and Sam Stevens, Director General of the Ontario region of the Industrial Research Assistance Program (IRAP). A general discussion followed.

MORNING SESSION

Ron Parker, Senior Assistant Deputy Minister, Industry Canada

Helping improve Canada’s business sector performance is a key mandate of Industry Canada. The innovation performance of the Canada’s business sector has been rather poor compared to other G-7 countries. The Government of Canada spent \$5 billion to help business innovation in 2008 but Industry Canada does not have a good understanding of the outcomes of these programs, i.e., whether, and to what extent, government assistance makes a difference. The purpose of this roundtable is to assess whether field experiments can be used to improve our understanding of this issue. Can we use experiments to assess the relative efficiency of tax credits and grants at the enterprise level? Some important experimental work has been carried in Canada by SRDC in the social policy domain. This Roundtable is to seek participants’ views on the feasibility of using the same methodology to help Industry Canada acquire solid empirical evidence to provide advice to the Minister.

Gary Burtless, The Brookings Institution, Washington, DC

Randomized social experiments have been used to evaluate social policy in the U.S. and in Canada. They have been used in a large number of areas including welfare policy, training, unemployment insurance, and health insurance. In the 1970s, as economists and statisticians gain influence in government agencies, a few large-scale projects were launched to answer big questions, such as the effect of a Negative Income Tax or the introduction of health insurance. In the 1980s, there were many social experiments on smaller, specific questions related to labour market and training programs.

Social experiments are used as a practical way to obtain reliable results in a relatively short period of time. Experiments can be expensive and time consuming but no more so than other methods when program and survey costs are taken into account. Lessons drawn from U.S. randomized experiments will remain relevant for many years. For example, results from health-insurance experiments in the 1970s are still used today.

Alternatives to random assignment have failed to yield reliable results, as they present difficulty in establishing causality, suffer from selection effects, are difficult to understand, and are often subject to specialists' debate over threats to validity. For example, a field experiment in the U.S. found that wage vouchers hurt the voucher holders — a conclusion that would have been very difficult to reach in the absence of an experiment.

It has been argued in some circles that social experiments raise ethical issues because they deny potential benefits to the control group and potentially inflict punitive or untried policies on the program group. However, it is much better to inflict treatment on smaller populations than to do so on a national scale. How else can we learn about the effect of treatments on prime matters like health? In the U.S., randomization has become the norm for best practice evaluation. If you ethically assign people at random when testing life-saving drugs, you can ethically assign firms when testing government supports for R&D expenditures.

Randomized experiments have had an influence on policy by informing policymakers of the potential cost and impacts of proposed program reform. Program administrators curtailed or eliminated failing programs as a result of experiments. The comprehensive U.S. welfare reform, which was once considered punitive, is now accepted. Experiments showed that job search led to

higher immediate earnings gains than training. The bottom line is that experiments have had some major impacts in some key areas.

Jean-Pierre Voyer, SRDC President, and Doug Tattrie, SRDC Senior Research Associate

The SRDC report focuses on two types of government supports for R&D expenditures — tax credits and grants — to be used in three potential experiments. Some design features are common to all three experiments.

- The outcome measure is R&D expenditures (easier to define and data is available).
- The intervention consists of incremental changes in supports (cheaper and more realistic).
- Target would be smaller firms (would require smaller subsidies and provide more numerous participants).
- Participating firms would be limited to prior R&D performers (allows for a reduced sample size; participants are more likely to receive treatment).

The first experiment tests the effectiveness of an augmented tax credit for R&D expenditures. Program-group firms would be eligible for this additional tax credit while comparison group firms could receive only the currently available credits.

Under the Income Tax Act, small Canadian private firms can receive a fixed percentage tax credit for R&D expenditures. Real tax credits cannot be tested experimentally without legislation. Consequently, for the purpose of the experiment, the Canada Revenue Agency (CRA) would continue to pay out tax credits as usual. CRA would then forward the firm's tax returns to the organization in charge of the experiment. The organization would then use a grant to mimic an additional tax credit for firms that fall in the program group. The impact of the offer of additional "credits" would be the difference between the R&D expenditures made by the entire program group and those made by the entire control group. In other words, firms in either group that did not receive "credits" would be included in those calculations. The experiment would have low operating costs and would entail minimal extra work for CRA.

Some considerations are worth mentioning:

- Some aspects of the tax code may be incompatible with a short-term experiment.

- The additional “credit” is legally a grant and requires “top ups” to leave the firm in the same financial position as a tax credit.
- The experiment must leave firms sufficient time to plan their R&D.
- Firms may shift already planned R&D over time to take advantage of the temporary additional credit. Any such shift can be taken into account with a lengthier follow-up period.

The second experiment tests the effectiveness of the offer of direct grants for R&D. In its simplest form, a funding organization receives R&D proposals from firms, selects the best proposals and funds those proposals. An experiment can only test one or two of many methods of grant funding for R&D.

The second experiment would randomly assign the current clients of an existing funding organization and invite them to submit a new R&D proposal. Accepted proposals of control group members would receive regular funding (perhaps, 50 per cent of costs) while the program group would receive enhanced funding (perhaps, 60 per cent of costs). The enhanced funding might cause more submissions or increases in the amount spent per accepted proposal. The impact of the *potential* to receive an enhanced grant would be the difference between the entire R&D expenditures of all firms in the program group and corresponding R&D expenditures in the entire control group. Both supported and unsupported R&D expenditures from all firms would be included in the calculation.

The third experiment would have two program groups: one group would potentially receive an additional “credit” (as in the first experiment) while the second group would potentially receive an enhanced grant (as in the second experiment). When the R&D expenditures of these program groups are separately compared to the control group, they would be similar to the first and second experiments. When the R&D expenditures of the two program groups are compared with each other, they would reveal the relative effectiveness of additional credits versus additional grants in increasing R&D expenditures. The experiment would target firms which have previous experience with both credits and grants.

All three experiments could use corporate tax data which are detailed, complete, and audited. However, tax data are subject to delays and some variables are defined only for tax purposes.

Tax data can be supplemented by survey data with appropriate allowance for survey non-response. Sample sizes for the first and second experiments range from 1,000 to 4,000 participants. The experiment would take about nine years to complete and would cost between \$25 million and \$50 million. These preliminary figures are similar to other major experiments conducted in the past by SRDC.

In conclusion, it is feasible to test the effect of the offer of an additional tax credit or an enhanced grant on R&D expenditures. It is also feasible to test the impact of an additional tax credit relative to an additional grant on R&D expenditures.

A concern was expressed that non-participating firms might complain about the extra government money given to their program-group competitors. Tattrie said that the experiment can reduce the likelihood of complaints by recruiting a sample that is diverse, in terms of industry and geography.

Another concern was expressed that the control-group members would not let their tax data be used or would not respond to surveys. Tattrie said firms would give written permission for the use of their tax data prior to random assignment. Withdrawals and non-response have always been manageable in previous experiments.

AFTERNOON SESSION

In the afternoon session, the Roundtable heard experts express their views on the SRDC report and the issues surrounding government support for R&D and innovation. A general discussion followed.

Guy Lacroix, Professor, Université Laval

The SRDC report argues convincingly for the use of a field experiment. The paper did not oversell field experiments. Experiments are extremely valuable tools for estimating treatment effects. However, field experiments are expensive and do not avoid the need for sophisticated statistical techniques. An experiment would have too small a sample size to explain why there is a great deal of variation in R&D across regions and across sectors.

The paper was a little too quick to dismiss non-experimental methods. Non-experimental methods are sometimes worthwhile alternatives. For example, a non-experimental method,

regression-discontinuity, could be used in place of the grant experiment proposed in Experiment II. A regression-discontinuity design assumes that all grant proposals are assigned a numerical score. Projects with scores slightly above a cut-off score would receive funding. The effectiveness of these grants would be determined by comparing these firms to similar firms that did not receive funding because they had scores slightly below the funding cut-off. This design, while not perfect, would be much cheaper and quicker relative to an experiment.

One participant noted that this non-experimental method would only shed light on a very narrow slice of all firms at the margin of getting a grant but not those with great passing scores or terrible failing scores. Another noted that the success of this method depended on the quality of the score.

Ken McKenzie, Professor, University of Calgary

Industry Canada should be congratulated for considering this kind of experiment. Field experiments are the “gold standard” when designed carefully under the right conditions. Canada provides generous grants and tax credits but has poor R&D performance relative to other OECD countries. The overall production tax regime should be examined because it affects how the fruits of R&D — the products and processes — are taxed.

R&D programs typically involve multi-year commitments so it is important that firms in an experiment be informed of the new credits well in advance so they can adjust their spending plans. A very important issue, and potentially serious problem, is that firms can shift R&D forward to take advantage of the temporary experimental tax credit. This may bias the experimental results upward.

An experiment that focuses recruitment on prior R&D performers will select firms that are either R&D oriented or responsive to government R&D assistance programs, or both. It will capture only the intensive margin. Caution is required when attempting to transferring experimental results from one particular setting to the entire population of firms. Participating firms in such experiment self-select and may provide more enthusiastic responses to increased government assistance than non-participating firms.

There is a risk that the supply of scientists and engineers be inelastic. Any national subsidy may, to a large extent, simply raise the salaries of R&D personnel affecting the price of R&D

rather than the quantity of R&D. This should be kept in mind even though it is a problem with all studies of R&D subsidies, not just with field experiments. It could be argued that an experiment would not exercise much upward pressures on the salaries of R&D staff and therefore could well result in increased quantity of R&D. However, such pressures are likely to be important if and when a more generous government assistance program is introduced more widely.

Government support for R&D expenditures could be supplemented with measures to increase the number of degrees awarded in the natural science and engineering fields. We need to examine the entire policy landscape related to R&D — policies to support post-secondary education as well as the entire tax and fiscal system.

Sam Stevens, Director General, Ontario Region, IRAP

Non-experimental approaches, although not perfect, give a reasonably good answer most of the time at a fraction of the cost of an experiment. Current tax credits schemes serve clients who can afford to wait 15 months to get their money. R&D's biggest impact is with big firms. But many firms in Canada are not financially strong enough to wait for tax credits. IRAP works with roughly 8,000 firms a year. Ninety-three per cent are small firms. A lot of our firms are marginal. The only way we can encourage firms to do R&D is to de-risk it. There is no mystery why firms are not doing R&D: they just don't have the money to do it.

General Discussion

Several participants noted that field experiments would change the quantity of R&D without necessarily changing the prices of inputs (such as scientists' salaries) which should be unaffected by the tiny size of the experiment. But a similar program applied to the entire economy would affect the price of inputs in the short and medium term. Consequently, the full-scale program would have a different impact than the experiment.

Other participants wondered whether it would be more effective and policy relevant to use experimental incentives to increase the number of firms doing R&D (the extensive margin) as well as encouraging R&D out of prior performers (the intensive margin).

A third concern was whether program-group firms would use the experimental support to undercut the prices of their non-experimental competitors or pass on credits to non-experimental

partners in exchange for R&D contracts. Either effect might exaggerate the impact of the additional support.

There was considerable discussion over the timing of R&D investments. It was noted that firms must be given time to plan their R&D investments in order to take advantage of the credits. Otherwise, the experiment would underestimate the longer-term effects of the additional incentives. In addition, there was concern that firms would shift future planned R&D expenditures into the present in order to take advantage of the extra support during the short-term experiment and reduce their expenditures once the experiment is over. This effect may exaggerate the effect of the incentives during the experiment. One solution included tracking firms for a longer period. Another participant suggested that the effect could be measured by providing three years of incentives to one program group and five years of similar incentives to another program group.

One speaker noted that R&D grants and tax credits tend to increase the stock of patents and intellectual capital. Rather than doing that, what is needed is to change the mix of supports toward commercialization of that stock.

Another participant said that surveying firms about R&D is complex. Some respondents are tax consultants, not the firms themselves. Furthermore, not all provinces have the same credits and R&D changes widely from year to year within a single firm.

Large firms do R&D, noted a third participant. It might be the case that Canada is currently doing a comparable amount of R&D for similar-sized firms in the United States. If the action in R&D is happening with large firms, then perhaps changing the behaviour of large firms should be the priority rather than focusing on small firms.

A fourth participant suggested that alternative experiments might test the U.S. program of tax credits for *incremental* R&D, increased support for commercialization, and paying tax credits quarterly rather than annually.

The final words went to Gary Burtless. Policymakers should be genuinely uncertain about the likely impact of a policy before testing it in an experiment. It does not make sense to undertake on the intensive margin if you think there is a sizeable potential impact in increasing the number of firms that engage in R&D. SRDC could design an experiment to answer questions about both

the intensive and the extensive margin but it would be expensive. To conduct the experiment, you need to be able to get the data in practice, not just in theory. Policymakers should be cautious about launching an experiment when the general equilibrium response is likely to overwhelm the impact of a small-scale study. Experiment 1 (additional tax credits) is very doable and would allow policymakers to learn a lot about what raises R&D spending. If this is an outcome that is worth the millions needed to run an experiment, then it is a great idea. Experiment 2 (additional grants) has a less clearly defined treatment and is likely to be more expensive as it involves the collection of survey data. Experiment 3 is the only experiment that answers the key question: Can we induce a bigger effect on firm R&D spending through a grant program or through a tax credit program? To my knowledge, there is no available evidence, experimental or non-experimental, that answers this question.