The Next Step in Evaluating Productive Development Policies: Spillovers, Program Complementarities and Heterogeneous Impacts

RG-K1198

1. Justification and Background

Long-term productivity growth is a crucial determinant of sustainable growth and development. Substantial research efforts have been devoted to the search for the sources and determinants of productivity, and it is increasingly acknowledged that growth cannot be fostered only by perfecting domestic markets and liberalizing international transactions. Active public policies of some kind are also needed. This does not imply a return to old-style centrally planned industrial policies, but rather a new conceptualization of "open economy" productive development policies seeking active discovery and development of competitive advantages (Rodrik, 2004, Rodríguez-Clare, 2007).

The theoretical justification for active interventions with regards to productive development policies is based on the concepts (and evidence) of markets and coordination failures. In response to them, and somehow emulating the practice by developed economies and those that are successfully catching up to them (ECLAC, 2008), several countries in the region have put into place an increasingly complex set of programs and instruments. Indeed, in the region there are presently **multiple experiments in Productive Development Programs (PDP)** aimed at enhancing productivity. These PDPs include the following: i) business development programs (extension and technical assistance programs, support to adopt quality control and certification, training in information technology and management best practices, support for marketing and logistics, etc.); ii) business linkages programs (supplier development programs, clusters, value chains, etc.); iii) business innovation programs (e.g., R&D subsidies, technology adoption funds, R&D tax credits and university-industry collaboration); iv) exports and investment promotion (e.g., promotion at international trade fairs, technical assistance and training for exporting, tax incentives to attract FDI); v) entrepreneurship development programs (e.g., support for seed capital, angel investor networks, incubators, venture capital, etc.); and vii) programs to facilitate long-term financing. Moreover, at least for the largest countries in the region, several of these PDPs are managed at different levels of government (national, provincial and even municipal).

This research proposal builds on the program evaluation literature where the net impact of interventions is measured by comparing outcomes of a treatment group to those of a control group of non-beneficiaries. This methodology has been mostly developed for interventions targeting individuals or households. These include interventions in the areas of education, health, social policies and labor markets. In contrast, few policy interventions targeting firms have been rigorously evaluated, and then mostly in high-income economies. This research proposal will add to the existing knowledge base about such firm-targeted interventions.

In developed countries there has been, together with the deployment of new PDP programs, growing interest among policymakers in understanding the impacts of PDPs on firm performance and productivity to date. In the United States, for example, evaluation studies have demonstrated that the Manufacturing Extension Partnership (MEP) program, a type of business development intervention, can significantly improve firm productivity as compared to a control group (Jarmin, 1999). Along the same lines, the evaluation of the Small Business Innovation Research (SBIR) program of the Small Business Administration (SBA) has shown that participation in the program led to an increase in productivity and employment by beneficiaries in comparison to a control group of similar firms (Lerner, 1999). However, the evaluation also found that impacts were higher in the

case of beneficiaries located in regions with high venture capital activity or firms belonging to high-tech sectors. This evaluation also revealed that the main impact mechanism was a signaling effect that led beneficiaries to attract venture capital funding after receiving an initial grant; this mechanism was confirmed by the finding that subsequent grants had no additional impact on performance. Also in the United States, Irwin and Klenow (1996) studied the impacts of SEMATECH (a government-sponsored technological consortium of semiconductor producers) using difference-in-difference panel data methods and comparing participating firms with a control group of non-participating firms. They found that the consortium allowed for better coordination of firms' research investments and for significant savings in R&D costs. In the same vein, Scott Wallsten (2004) assesses whether policies that establish science or technology parks in the United States have been effective as stimulus for local economic growth. In order to explore this, he assembles a county-level panel dataset to explore the effects of such parks on job growth and on venture capital investment. Using non-parametric and fixed-effects methods he finds no positive effects of the parks on overall regional development.

Among studies outside of the United States, Ropert and Hewitt-Dundas (2001) examined the impacts of a small business development program in Ireland where beneficiaries located in several regional clusters received different types of interventions (from grant support for marketing, to worker training and exports assistance) and compared them with those that were not assisted (the control group). They found that firms in assisted clusters tended to grow faster in terms of employment and sales and tended to be more profitable than non-assisted firms. However, after correcting for selection the results were far more ambiguous, and only the finding for employment held. Criscuolo et al. (2012) explore the effects of business support targeted at firms located in "regional selective assistance (RSA)" areas as defined at Pan-European levels. They use changes in the program eligibility criteria generated by the redefinition of RSA areas, which occurs every seven years. The authors found that business support in these areas has had positive impacts on employment, investment and net entry but not on total factor productivity (TFP).

In Japan, Motohashi (2001) evaluated the impacts of CAL, an innovation and technology development program from SMEs, finding statistically significant differences between the treatment and control groups in sales, employment and productivity. With regards to the impacts of business innovation programs, David, Hall and Toole (2000), carry out an extensive survey of more than 35 years of evaluation econometric evidence on the impacts of grants and public procurement contracts on firm investments in R&D, based on time-series and cross-section data from various levels of aggregation (laboratory, firm, industry and country). Although the overall finding is that public funding increases firms' investment in innovation, the results are ambivalent with regards to the extent which public programs are also able to leverage private funding for that investment (the crowding-in hypothesis). In a parallel study, Hall and Van-Reenen (2001) survey the econometric evidence on the effectiveness of fiscal incentives for R&D in OECD countries. They describe the effects of tax systems on the user cost of R&D. After assessing the different methodologies and results of the surveyed studies, they conclude that a dollar in tax credit for R&D stimulates a dollar of additional R&D by firms. The developed country literature mentioned here is far from exhaustive, however, and there has been an exponential growth of research over the last decade.

Contrasting with the situation in developed countries, few PDP programs have been rigorously evaluated in Latin American and the Caribbean (LAC). Until very recently, evaluation of PDP in LAC mostly relied on beneficiary satisfaction surveys or simple case studies that, although interesting, cannot really tell whether a program is working. Fortunately, this situation has evolved, and the

Inter-American Development Bank (IDB) is playing an important role in this process. Indeed, since the mid-2000s an increasing number of studies and evaluations have analyzed the effectiveness of PDPs in LAC more rigorously. The IDB has contributed significantly to this growing literature, particularly in regard to innovation and export promotion policies. Since 2005, the IDB Evaluation Office (OVE), the Strategy Development Division (SDV) and the Competitiveness and Innovation Division (CTI) have evaluated the impact of innovation and research policies in Argentina, Brazil, Chile, Colombia and Panama.[1] Since 2007, the IDB Integration Department (INT) has evaluated the effectiveness of export promotion policies in Peru, Costa Rica, Uruguay, Chile, Argentina and Colombia. In 2008, the World Bank, building upon previous IDB work, carried out the project "Evaluating Small and Medium Enterprises Support Programs in Latin America" that assessed the impacts of some of these programs in Mexico, Chile, Colombia and Peru (Acevedo and Tan, 2009).

However, although the number of rigorous evaluations has increased in recent years, evidence on the potential effectiveness of PDP programs in the region is still scant and therefore somewhat inconclusive. In some cases, such as innovation and export promotion policies, the available evidence suggests that PDP interventions have had a significant positive impact on the outcomes of their final beneficiaries. In other cases, such as business development programs and long-term financing, the available evidence still does not permit the formulation of strong predictions. Finally, evidence is almost completely lacking for the cases of business linkages and entrepreneurship support.[2]

The knowledge gaps in this field are related not only to the lack of evidence on the impacts of particular types of programs or interventions, but also to a set of questions that have not been entirely addressed even by the evaluations already available. More precisely, almost all the past evaluations in the region have only provided convincing evidence on the so-called "average treatment effect on the treated" (ATT). In other words, the evaluations yielded evidence on whether the average beneficiary has somehow performed better than the average control firm. Although answering this question is important in order to decide whether the program has had any impact and whether it should be extended or shut down, this parameter alone provides very little information for the redesign of PDPs.

Certainly, PDPs are very complex "animals," and characterizing them as primarily involving the subsidization of firms oversimplifies what they do. PDP programs are diverse, with modalities of service delivery ranging from direct provision by public sector agencies to disbursement of funding through networks of public, private and non-profit service providers. In some cases, resources are allocated using direct transfers from the funding unit to service providers, although in an increasingly important number of cases market principles are used to allocate support through the use of matching grants, vouchers and competitive bidding. Interventions also vary with regards to their intensity: in some cases there are no restrictions on the amount of funding that companies can apply for, while in other cases very careful and complex exit rules are established. Likewise, in some cases services are provided using a group-based support modality, while in others services are tailored to the firm's specific needs. Many of these programs are being offered by different agencies operating through different windows, raising the questions of whether substitution or

[1] See De Negri, Borge Lemos and De Negri (2006a, 2006b), Benavente, Crespi and Maffioli (2007a, 2007b), Binelli and Maffioli (2007), Hall and Maffioli (2008), Chudnovsky et al. (2006 and 2008), Maffioli and Ubfal (2010).

[2] A few examples in LAC are the evaluations of the PROFO program by Benavente and Crespi (2001) and Maffioli (2005), the evaluation of the Provider Development Program in Chile by Arraiz et al. (2010) and the evaluation of the APL program in Brazil by De Negri et al. (2012).

complementary effects among programs occur, and of whether an optimum sequence of services exists. The issue of multi-treatments also extends to the problems of governance between different levels of government (national vs. sub-national). Finally, there is the issue of defining the appropriate time frame over which impacts should be measured. Indeed, in the case of several PDP programs, particularly those addressing innovation or business linkages, the technological upgrading being developed must first diffuse within the firm. This process could take some time, and adjustment costs might be important. In practical terms, this means that for some programs firms need to be followed over relatively long periods of time.

More importantly, in addition to the various knowledge gaps mentioned above, PDPs are usually justified by the presence of externalities and often designed to generate positive spillovers. For this reason, spillover effects and externalities should be carefully considered by the impact evaluation of PDPs. If that is the case, a rigorous impact evaluation of PDPs should take into consideration whether these spillovers are present. This implies assessing not only the impacts of the programs on direct beneficiaries but also identifying impacts on indirect beneficiaries. This implies estimating the effects of PDPs on firms that did not receive any direct support from the program but may have somehow benefited from it (for example, through knowledge circulation, demonstration effects, labor mobility, etc.). Although the spillover issue is critical, it has not yet been tackled systematically by any impact evaluation of PDP carried out in Latin America, and it has not been considered by many of the evaluations carried out in developed countries. (A notable exception is Parsons and Phillips, 2007). Furthermore, the consideration of spillovers in the case of PDP programs is also relevant because spillovers could still be present even when direct beneficiaries failed to innovate or to adopt a given technology, as indirect beneficiaries can learn from failures as well as well as successes.

In recent years, some efforts have been made to close some of the knowledge gaps mentioned above. Since 2009, the IDB has conducted a new series of impact evaluations of PDPs in Argentina, Chile, Colombia, Costa Rica and Brazil. In particular, these studies have focused on the following areas:

1. *The impacts of PDP on firms' performance*. Volpe Martincus and Carballo (2008), Volpe Martincus (2010), Crespi et al. (2010) and Castillo et al. (2011) used longer panel datasets to identify positive effects on firms' performances of business innovation and export promotion programs.
2. *The joint effect of combined interventions* (the so-called multi-treatment effect analysis). Volpe Martincus and Carballo (2010a) estimate the effects of three groups of programs managed by PROEXPORT, namely, advice and information, fairs and missions, and trade agendas, and their alternative combination on Colombian firms' export outcomes. They find that a combination of these three programs, which addresses information problems along the process of export development, is more effective than each of the programs individually considered. Studies by Castillo et al. (2011) estimate the effects of differential treatments for product and process innovation, finding that the impact on real wages generated by support for product innovation is more than double that generated by process innovation. Following a similar approach, Alvarez (2011) estimates the effect of the FONTEC and FONDEF program in Chile. The study finds evidence of reinforcing positive effects from both programs on productivity.

3. *Heterogeneous effects across subpopulations*. Volpe Martincus and Carballo (2010b, 2012) analyze the impact of trade promotion assistance by PROCHILE and EXPORTAR on export performance of different groups of Chilean and Argentine firms, respectively. Their results suggest that positive effects mainly accrue to smaller companies with less previous experience in international markets.
4. *The impact of linkage development policies*. Arraiz et al. (2010) evaluate the Provider Development Program in Chile, finding positive effects on sales, employment of providers and the probability that clients will export products. De Negri et al. (2012) evaluate the impact of the APL program in Brazil, including the estimation of spillover effects. The study finds positive direct impacts on employment and exports and positive spillover effects on exports.
5. *The impact of access to finance programs*. De Negri et al. (2011) analyze the effects of public credit lines on the performance of Brazilian firms, finding that access to public credit lines has a significant and robust positive impact on employment creation and exports. Two studies by Eslava et al. (2012a and 2012b) analyze the effect of second-tier credit lines on Colombian firms' performance and quality of access to credit of Colombian firms. The studies find significant positive effects on output, employment, investment and productivity over the four years following the first Bancoldex loan and positive effects on firms' credit conditions.

These recent efforts notwithstanding, many knowledge gaps remain. In particular, as previously discussed, additional evidence needs to be produced not only on PDPs' effectiveness in achieving their primary expected outcomes, but also on a set of secondary questions that may play a key role in the design and fine-tuning of policy tools. For this purpose, this research project will only support studies that, using rigorous impact evaluation techniques, could help to shed light on the most relevant unanswered questions in this area.

2. Objective

The objective of this research project is to investigate the impacts of PDPs in ways that go beyond the average treatment effects on the treated (ATT) usually estimated in the existing literature. In particular, the project will focus on the identification of (in order of priority): i) spillover effects; ii) multiple treatments and complementarities among programs; iii) heterogeneity of impacts on different sub-populations; iv) treatment intensity (dosage effects); and v) timing (or dynamic effects). In this way, the project will provide additional evidence that is crucial to the design of new policy tools and the revision of existing ones. In particular, we will be focusing on the following research questions:

(i) "How can we measure spillover effects?"

In addition to the expected direct effects of beneficiaries, PDPs can produce indirect effects on non-beneficiaries. For instance, a subsidy that favors enterprises of a certain kind may put other firms at a disadvantage. During the time they receive public support, the beneficiaries can outpace the followers in a "winner takes all" game. Conversely, there can also be positive spillovers from one supported projects to other projects via the transmission of knowledge between firms or rent spillovers. In the former case, firms that engage in the same kind of

innovative project (which can be approximated by patenting in similar patent classes or having the same kind of research expertise, i.e., researchers with similar qualifications) are likely to benefit from each others' research. In the latter case, a firm may indirectly benefit from an R&D+I program if it produces a product that makes use of new inputs produced by upstream-supported innovative firms. The likely presence of externalities should also be taken into account when devising random experiments or when creating appropriate control groups.

Uncovering whether spillovers exist may be of crucial importance for policy design, since many interventions are justified precisely on the basis of the spillovers they create. Take, for example, the case of a subsidy for the adoption of a particular technology. If the treated firms were able to fully capture the benefits of the investment in technology adoption, there would be no market failure, and thus no need for an intervention. The subsidy would only make sense if technology adoption by the treated firms were expected to create knowledge spillovers to other firms. In this setting, finding that treated firms perform better in terms of productivity with respect to a control group may be a necessary condition, but it is certainly not a sufficient condition to justify the intervention. Testing for spillover effects would be crucial in this case.

Besides the externality effects on the performance of other firms or agents in the economy, a PDP program can also have general equilibrium effects that should enter the welfare calculation. For example, a matching grant program for business innovation can raise the wages of scientists and engineers if they are in inelastic supply and thus indirectly increase the cost of undertaking research in an economy and possibly slow down the innovation activity in unsupported activities.

(ii) What about complementarities or substitution effects among programs?

In contexts where "multiple treatments" are available, the evaluator may be interested not only in the individual effects of each one of them separately, but also on potential interactions among them. In fact, it is not obvious that the effect of multiple programs will be additive; instead, the combination of different interventions may have multiplicative effects or, on the contrary, one treatment may cancel out the effect of others. Therefore, the investigation of the joint effect of different types of interventions may be crucial for the design of effective policies.[3]

In some cases synergic effects are expected to be present. This could be the case, for example, in **innovation and export promotion programs**. The rationale for these two types of programs normally rests on the existence of knowledge and information spillovers from innovation and business search activities, respectively, that potentially result in sub-optimally low levels of these activities. Existing evidence indicates that innovation programs have been successful in increasing firms' innovation spending and productivity (Maffioli and Hall, 2008)

[3] Mohnen and Roller (2005) develop a framework for testing discrete complementarities in innovation policy using European data on obstacles to innovation. They propose a discrete test of supermodularity in innovation policy leading to a number of inequality constraints. They apply the test to two types of innovation decisions: to innovate or not, and if so, by how much. Findings suggest that the evidence regarding the existence of complementarity in innovation policies depends on the phase of innovation that is targeted (making firms innovative or increasing their innovation intensity) as well as on the particular pair of policies that is being considered. The two phases of the innovation process (i.e., the probability of becoming an innovator and the intensity of innovation) are subject to different constraints. Interestingly, there seems to be a need to adopt a package of policies to make firms innovate initially, while a more targeted choice among policies is necessary to make them more innovative.

and that export promotion programs have helped firms increase and diversify their exports, primarily in terms of destination countries (Volpe, 2010). Nevertheless, despite the fact that both policies share similar frameworks or aims which may generate a potential virtuous circle, emerging research has started to looked at these policies in an integrated manner (Crespi et al., 2007). The IDB has recently launched a research project to precisely explore the interactions between innovation and export promotion programs. In the framework of this project, a case study on Chile is currently under preparation. Another example of potential synergies between programs (and potential coordination failures) is that between business incubators and venture capital funding in the area of entrepreneurship promotion. While incubators normally provide coaching and very early-stage financing for new ventures, venture capital financing focuses on late-stage financing, commercialization and scaling up. The issue here is that incubators alone can have very little impact without the financing that comes to those that graduate from the initial stage. Likewise, without a sufficient flow of new ideas from the incubation phase there may not be enough demand for the venture capital industry to take off. It is necessary to work on both dimensions (the incubation and the venture capital phase) in order to solve this coordination problem (Lerner, 2009).

On the other hand, there are many instances where substitution effects might be present. This could be the case, for example, in some sub-national PDPs. Although in principle sub-national PDPs might increase the support provided to firms in a given local context, the overall effect might not be so clear, in particular after taking into consideration that this support might decrease performance in neighboring regions (OECD, 2010). For example, there has been a proliferation of R&D tax incentives among the US states during the last 20 years. Wilson (2009) analyzes the impacts of these state level schemes and finds that, although these incentives are effective in increasing in-state R&D, almost all of that increase is due to R&D being drawn away from other states, suggesting a zero-sum game among states (i.e., a gain in one state would be offset by a loss in another state). The risks of creating a similar situation in LAC countries should not be ignored.[4] So, more research needs to be done and better data collection needs to be put in place in the region in order to tackle this **multilevel governance** issue with regards to PDP implementation.

(iii) Are the impacts heterogeneous according to certain characteristics of the beneficiary?

In most relevant contexts, it may be hard to accept that a given intervention will have a constant effect, i.e., the same impact on all units under study. Two main types of impact heterogeneity may arise. One occurs when interventions have differential effects for different groups; for instance, matching grants may have a higher impact for young innovators. The second type is related to the distribution of the effects; for instance, two programs may have the same average impact, but one may concentrate the effects on the lower part of the distribution (Frölich and Melly, 2010). Heckman, Smith and Clements (1997) suggest that, in addition to the standard Average Treatment on the Treated (ATT) parameter, the following additional parameters are also of interest in order to make an informed decision on a program:

- the proportion of treated firms that benefit from the program;
- selected quantiles of the impact distribution; and

[4] For a theoretical discussion of similar issues for the case of subsidies to attract FDI, see Fernández-Arias, Hausmann and Stein (2001). Also, Griffith, Harrison and Van Reenen (2005) for the United Kingdom.

- the distribution of gains at selected base state values.

In these contexts, restricting the analysis to the average impact on the treated population may provide an incomplete or at least imprecise assessment of the effect of a program. It is therefore of great interest to account for the possibility of impact heterogeneity in order to provide a precise assessment of the effects of an intervention. For example, González et al. (2005) evaluate the impacts of R&D subsidies in Spain, finding that they stimulate R&D and that some firms would stop performing R&D without them; most subsidies, however, go to firms that would have engaged in R&D even without them.

(iv) Are additional doses of treatment necessary?

Most of the impact evaluations summarized in the previous section analyze the binary case of participation versus nonparticipation in a given PDP program. In practice, however, units may often differ not only in their binary treatment status (participant versus non-participant) but also in treatment intensity. For instance, firms may receive different amounts of public subsidy—including more than one grant for the same program—and different firms may be granted different levels of funding depending on the nature of the program (e.g., support for individual firms vs. support for collaborative groups). This fact raises important issues to consider when designing an evaluation: the question of interest is not only whether participants perform better than non-participants, but also how different intensities of treatment may affect performance and whether it is possible to find an "optimal level" for the intervention (e.g., the amount of financing that maximizes the effect on firm performance[2]). In terms of designing these evaluations, this implies building registries of beneficiaries with information not only on when a given firm received the grant, but also information on the amount of the support and the actual disbursement of it. Controlling for the effects of treatment intensities is also critical for an informed Cost-Benefit Analysis.

Let us consider a case where additional doses of treatment might not be necessary. Although the standard market failure that motivates business innovation programs deals with the issue of the imperfect appropriability of knowledge and the presence of spillovers (Nelson, 1957; Arrow, 1962), more recently business innovation programs have additionally been justified on the basis of asymmetric information (that harms access to financing) and coordination failures. In these cases, awarding an innovative small firm with a matching grant might have a signaling effect (as found, for example, by Lerner, 1999). This lowers firms' cost of capital at the margin when applying for external sources of financing to the extent that the grant acts as a signal of "good quality" for firms and projects, thus reducing the problem of asymmetric information and relaxing the financial constraint. In this case, it could be possible to expect a "decreasing return" in the number of grants or public funding. Similar results could be expected from interventions that target coordination problems (such as inducing university-business collaboration or business linkages).

(v) How long should we wait to see results?

In general, it takes time for the effects of certain PDP programs to appear in firm investment efforts, the outputs of those efforts or their effects on economic performance. The process of

[2] Exceptions to this are Binelli and Maffioli (2008).

setting up a technological upgrading, finding the right people, financing the project, organizing the research and networking generate adjustment lags in research projects. In addition, the materialization of concrete outcomes requires a period of gestation after investment in research. It likewise takes time to apply for a patent and to get it approved, publish an article in a scientific journal and launch a new product in the market. These time lags may differ according to the chosen indicator of innovation output. For instance, it may take more time before the innovation output turns into higher profits or productivity. At the beginning of a new technology, there might be a very steep learning curve, or, in the presence of network externalities, it is only when a new product is shared by many consumers that it becomes profitable. More generally, the impact of different programs may display very different patterns over time. An intervention may generate a one-shot increase in the outcome or have strong effects that fade over time; the impact of a program may only appear after a certain period, or may even generate an initial drop in the outcome that is later overshot by increases in subsequent years.

As a result, a proper consideration of the timing of the effects is crucial in an impact evaluation setting, and failures to account for these issues may lead to misleading conclusions and policy recommendations. A clear distinction should be made between short-run and long-run effects to properly evaluate the costs and benefits of a public program. For instance, considering only a short period of time after an intervention may end up underestimating the impact if the effects take several years to appear. On the other hand, evaluations focusing only on later periods may end up underestimating the costs if an adjustment process occurs in the first years. As a matter of fact, normally input additionality effects are considered short-term impacts, while output additionality effects are normally considered long-term impacts. The majority of the impact evaluations summarized above have focused on input additionality and are thus mainly short-term impact evaluations. Only recently have evaluations in the region begun to examine long-term effects.

3. Scope and Methodology

3.1 Scope

This research network project will focus on the evaluation of a sub-set of PDPs which are at the core of the majority of the PDP programs in the region. They are, in order of priority:

(i) *Entrepreneurship Development Programs* (e.g., support for seed capital, angel investor networks, incubators, venture capital, etc.);

(ii)*Business Linkage Programs* (supplier development programs, clusters, value chains, etc.);

(iii)*Business Development Programs* (extension and technical assistance programs, support for adopting quality control and certification, training in information technology and management best practices, support for marketing and logistics, etc.);

(iv)*Business Innovation Programs* (e.g., R&D subsidies, technology adoption funds, R&D tax credits and university-industry collaboration);

(v)*Exports and Investment Promotion* (e.g., promotion at international trade fairs, technical assistance and training for exporting, tax incentives to attract FDI); and

(vi) *Programs to facilitate long-term financing.*

We use the word "priorities" to mean that particular emphasis will be placed on the selection of programs where rigorous impact evaluations have not yet been implemented. In particular, they include Business Linkages Programs (where the IDB is in the process of developing a Cluster Initiative Evaluation Toolkit) and Entrepreneurship Development Programs. Proposals in the other realms will be also accepted to the extent that they are clearly aimed at tackling the research questions mentioned in the previous sections. Proposals that "only" tackle the estimation of average treatment effects will not be given high priority.

3.2 PDP Description and Theory Review

Each study will define and discuss the intervention model (theory of change) of the PDP to be evaluated. This discussion will include at least: i) a detailed description of the program's logic, execution mechanism, expected benefits (direct and spillover effects) and average costs per beneficiaries; and ii) a thorough review of the theoretical studies and empirical evidence that support the justification of the PDP.

A necessary condition for a research proposal to be funded is that it clearly identifies the key features of the intervention model of the PDP to be evaluated and proposes measures of effectiveness clearly consistent with the benefits used to justify the program's implementation.

3.3 Empirical Strategy: Dealing with the Attribution Problem

Impact evaluations are of two main types: i) experimental with random assignment and ii) more common non-experimental designs. In experimental designs, subjects are randomly assigned to the treatment group and to a control group receiving no treatment or alternative treatments, thus ensuring that external (observed and unobserved) factors that might affect outcomes are equally present in both groups. In non-experimental designs, assignment is not random. In many cases, researchers must assess a program after it has been implemented and subjects have already enrolled in it. In this situation, the researcher constructs a control group that is as similar as possible to the treatment group as a counterfactual for how the treated would respond had it not received the treatment. Because subjects willingly enroll in the program, they may differ from the control group in both observable and non-observable (to the researcher) attributes correlated with the outcomes of interest, and thus estimates of the impact of the intervention might be biased. A variety of econometric methods are used to address selection bias issues that may arise with non-experimental designs. The current research programs will exploit the following methods, depending on program settings and available data:[5]

[5] For further details see Crespi et al. (2012), SCT-SDV Guidelines for Impact Evaluation of Science, Technology and Innovation Programs.

(i) Propensity Score Matching (PSM) Techniques;

(ii)Difference-in-Difference (DID) methods using pre and post-program panel data;

(iii)Combined PSM-DID methods;

(iv)Regression Discontinuity (RD), to the extent that there is a score-based rule for selecting beneficiaries; and

(v) Instrumental Variables (IV).

It is important to note that these methods might yield different answers to the same questions. For example, while methods (i) to (iii) provide estimates on the average treatment effects on the treated, methods (iv) and (v) normally provide these estimates but only for a sub-group of the treated (the so-called local average treatment effect). While the types of impacts to be investigated will vary by type of program, intermediate outputs could include increased investment in technology upgrading and intangible assets, skills upgrading, adoption of new technology, introduction of quality control practices and entry into export markets; improvements in these intermediate outputs eventually will lead to final outcomes. Final outcomes common to most programs will include total employment, average wages, increased sales and productivity growth.

Although in principle it is not expected that this research will be directly funding randomized experiments, it is fully open to the reception of proposals that will carry out, within the scope of programs listed in Section 3.1, experimental analysis on experiments already in the field. Several of these experiments are already underway in the region, particularly in adoption of ICT technologies (Costa Rica and Peru) and entrepreneurship (also in Chile). To the extent that there are no intellectual property impediments and that IDB research can actually add value to the current experiments, proposals that meet these conditions will be also accepted and assessed.

3.4 Cost-Benefit Analysis

Although studies will be mainly focused on the robust identification of attributable effects of PDPs, each study will include considerations on the cost-benefit of the evaluated policy. It is expected that each study will discuss at least the relationship between identified benefits and average per beneficiary direct costs in order to shed some light on the cost-effectiveness of the evaluated PDP (Klette et al., 2000). For example, Benavente and Crespi (2003) found a 21 percent social rate of return for a small business support program in Chile. Toivonen et al. (2012) study the expected welfare effects of targeted R&D subsidies using project-level data from Finland. They model the application and R&D investment decisions of firms and the subsidy-granting decision of the public agency in charge of the program. The model and institutional environment allow them to identify different benefits and costs of the R&D subsidy program. They find that expected effects of subsidies are very heterogeneous and estimated application costs on average low. The social rate of return on targeted subsidies is 30-50 percent, but the spillover effects of subsidies are smaller than effects on firm profits.

3.5 Data Availability

This research project will make extensive use of different datasets already available in the region (many of them built by countries in close collaboration with the IDB). In particular, it is expected that research proposals will make use of linked data between administrative records of different programs' beneficiaries and business registers. Data linking in the region is progressing very rapidly, and such linked datasets have been used for studies similar to those targeted by this project in the following countries:

(1) Chile, where data on business innovation programs and business development programs have already been linked to the Annual Manufacturing Survey (anonymous dataset) and the internal tax service.

(2) Argentina, where data on business innovation, access to finance, and business development programs have been linked with administrative datasets managed by the Ministry of Labor.

(3) Brazil, where data on business innovation programs, export promotion support and long term financing have already been linked to the Annual Manufacturing Survey (PIAS) and the social protection data (RAIS).

(4) Colombia, where data on business innovation programs, export promotion policies and long-term financing have already been linked with the Annual Manufacturing Survey (EAM).

Similar data also exist in Panama, where information on business innovation has been linked to the annual business survey, and Costa Rica, where information on the beneficiaries of the small business innovation program is being linked with social protection data. Finally, in Uruguay, program administration at the National Agency for Innovation and Research is linked with business data collection at the National Institute of Statistics (INE). This could allow access to data not only on beneficiaries of the programs but also on non-selected applicants.

Of course, while much progress has been made in linking business innovation, business development, export promotion and financing programs, very little progress has been made so far in linking information on business linking programs and entrepreneurship support programs. It is expected that proposals in these two areas will take important steps towards carrying out such data linking with business registers or at least provide a very detailed description of the basic dataset on which impact evaluation will be carried out. Given the timing of this research, primary data collection activities are not encouraged. However, natural or randomized control field experiments in these two areas will be seriously considered.

Proposals submitted toward this research project will have to demonstrate that researchers have been granted access to these (and other) datasets. Since the IDB has no official agreement with any of the national authorities responsible for these datasets, the research teams will be required to gain access to data in accordance with the access policies of the authority responsible for the data. One possible way to improve access and guarantee

adequate knowledge of the data structure is by having proposals include executing agency officers as part of the research team. However, this advice is not meant to substitute any procedures required by each authority responsible for the data.

4. Selection Criteria

Research institutions only may present proposals. The IDB seeks to produce up to five (5) studies and will contribute up to **US$35,000** for each study, which will be chosen based on the quality of the proposed country study, the strengths of the research team, the quality of the data and data accessibility.

5. Proposal Registration

Research institutions interested in submitting a proposal should pre-register before **April 12, 2012** by clicking here. If unable to pre-register before the due date for proposals, please send an email to red@iadb.org. Proposals are due **May 11, 2012.**

Each interested research team should submit a proposal that includes the following:

1. A background section indicating whether and how the program(s) to be evaluated are relevant for each particular country. How could each particular country study add value to the previous evaluations of these or new programs? How might the results to be generated in each particular case be important to policymakers? The assessment of the program(s) should also include a detailed description of the rationale for the program(s), the sort of market and/or coordination failure it aims to correct, the institutional setting in which the program is being run, the identification of recent changes in program delivery and the type(s) of mechanisms in place for program delivery and resource allocation.

2. The proposal should include a detailed enumeration of the research questions that it is focusing on as well as a careful presentation of the empirical strategy to address these questions and program impacts. Applicants must make very clear to the examiners of the proposal that the econometric methodology adequately addresses selection bias problems and is strong in terms of internal validity and reasonable in terms of external validity.

3. A description of the data to be used in the study. This research project is mainly based on analyzing secondary micro-data normally collected by program administrators and national statistics offices in each country. The proposal should therefore describe the main characteristics of the information available (type of data, methodology used to obtain them, periodicity and feasibility of linking them with other data, among other characteristics). Finally, given that researchers will be dealing with official data, they should clearly state how data accessibility will be granted and data confidentiality protected. To the extent that it is feasible, the IDB may contact national authorities in order to obtain access to the data.

4. The CVs of the members of the proposed research team, emphasizing relevant research experience on impact evaluation of business support programs and/or studies on productivity as well as experience using econometric micro-data analysis.

Proposing research institutions should register as Research Network members (contact Elton Mancilla at red@iadb.org) and should be based in the Latin American and Caribbean region. U.S. and European institutions do not qualify as members of the Research Network. However, researchers from the United States and Europe can participate with research teams from proposing institutions.

Proposals should be submitted using the Web Submission Form. Please note that there are two options within the submission form: one for institutions and another one for individual researchers. Please make sure to choose the institutions option.

Note: All proposals and research papers should be submitted in English, the working language of the network

5.1 Required Documentation

In addition, proposals for each subject must include:

- The name of the research leader and a list of other researchers involved. The center should present a research team whose makeup is justified by its capacity to meet the objectives of the project, including relevance of prior experience. Curricula vitae of all researchers involved in the whole project may appear in a separate annex. Subsequent substitutions for researchers originally specified in the proposal may be made with prior approval from project coordinators, but the research leader (of each subject) should lead the entire project until its full completion.

- A budget (in a separate annex) indicating the time and resources that will be used within the context of the research work plan. The budget proposed by the research center should disaggregate items financed by the IDB contribution and those financed by the research center. The budget should distinguish among amounts assigned to professional honoraria, "overhead" and other major categories of research expenditures. **The proposal and corresponding budget *must* be sent in separate files.**

- Institutions must provide the name and contact information of their legal representative, with authority to sign contracts with the IDB, if selected to conduct the study.

- Final papers will be disseminated as IDB working papers and may be included in a Book on the Development in the Americas (DIA) publication on Productive Development Policies. Until the book issue option has been fully defined, other forms of dissemination or publishing should be explicitly approved by the Research Network coordinators. Proposals may include suggestions for further dissemination of the final version of the paper and its policy implications.

6. Coordination and Schedule

The project will be administered by the Research Department (RES), under the technical coordination of Ernesto Stein (RES), with the supporting collaboration of Gustavo Crespi (IFD/CTI),

Eduardo Fernández-Arias (RES), Alessandro Maffioli (SDV/SPD), and Christian Volpe Martincus (INT/INT). Jordi Jaumandreu (Boston University) and Sergio Urzúa (University of Maryland) will serve as External Advisor(s) for the project.

The tentative schedule of activities is as follows:

- **April 12, 2012:** Due date for **pre-registration**.
- **May 11, 2012:** Due date for **receiving proposals.**
- **May 25, 2012:** Announcement of **selected research proposals**.
- **June 25, 2012:** Due date for receiving a **preliminary report** with an annotated outline of the research paper, data sources, and methodology to be used in the study.
- **July 9-10, 2012: First Discussion Seminar** in Washington, D.C., where the preliminary report, outlines, methodologies and database limitations will be discussed.
- **November 5, 2012:** Due date for receiving a **first draft** of research papers.
- **November 19-20, 2012: Second Discussion Seminar** (location TBD) with project leaders and advisors to discuss first drafts.
- **February 15, 2013:** Due date for receiving a **second draft** of research papers and delivery of complementary support documents utilized by the study to the IDB.
- **March 1, 2013: Videoconferences** with project leaders and advisors to discuss second drafts.
- **April 12, 2013:** Deadline for a **final version** of the research papers**,** including a summary that discusses policy lessons and delivery of the datasets utilized by the study to the IDB.
- **July 12, 2013:** Deadline for a **final edited version** of the research papers, following the **IDB Manual of Style** for working papers.

7. Financial Contribution and Payment Schedule

The IDB will contribute up to **US$35,000** for each study, depending on the scope of the work proposed. The payment schedule is as follows:

- **30 percent** within 30 days of signing the formal agreement between the IDB and the respective research center.
- **20 percent** within 30 days of presenting and approving the first draft of the research paper.
- **20 percent** within 30 days of presenting and approving the second draft of the research paper and upon delivery of the datasets utilized by the study to the IDB.
- **30 percent** upon approval by the Bank of the final research paper and delivery of the databases utilized by the study to the IDB.

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