WPS3760

Evaluating Training Programs for Small and Medium Enterprises

Lessons from Mexico

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World Bank Policy Research Working Paper 3760, November 2005

The World Bank
World Bank Institute and
Latin America and the Caribbean Region
Poverty Sector Unit

Abstract

While there have been numerous impact evaluations of unemployed individuals participating in retraining programs or in programs to foster self-employment, impact evaluations of enterprises benefiting from training programs for small and medium enterprises (SMes) are rare. The authors reevaluate the impact of the largest SME program in Mexico, the Comprehensive Quality and Modernization Program (CIMO). They show that compared to the control group, CIMO firms increased investments in worker training, had higher rates of capacity utilization, and were more likely to adopt quality practices. The evidence also suggests that these improved intermediate outcomes were associated with increased productivity growth among CIMO participants, impacts that were especially strong throughout the 1991-93 period. However, the productivity impacts of CIMO are not apparent in the 1993-95 period.

This paper – a collaborative product of the World Bank Institute and the Poverty Sector Unit, Latin America and Caribbean Region – was prepared as part of the World Bank Report (2004) on "How Well Do SME Programs Work? Evaluating Mexico's SME Programs Using Panel Firm Data" and is also part of larger effort in the region to study small and medium enterprise (SME) development and evaluate policy interventions to promote SME productivity and competitiveness. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at htan@worldbank.org or gacevedo@worldbank.org. (18 pages)

I. Introduction

Many countries, both industrialized and developing, have programs that provide small and medium size enterprises (SMEs) with training and technical assistance. While not strictly labor market programs – their objective is typically to improve the productivity and competitiveness of SMEs – such programs can have indirect effects on the economic welfare of employees through higher wages from improved productivity, and on their employment stability through reduced labor turnover and job growth.

Mexico is no exception. By one estimate, Mexico had over 130 government programs targeting SMEs in 2002. The characteristics of these programs are highly heterogeneous, though two broad types of programs can be distinguished. Programs of the first type, assessment-consulting programs, all have the same general structure of subsidizing assessments to determine the weaknesses of individual firms, then providing the appropriate consulting, training or technology support to remedy those weaknesses. One example of this type of program is the Program of Comprehensive Quality and Modernization (CIMO/PAC by its acronym in Spanish, henceforth, CIMO). Created in 1987 during Mexico's entry in the General Agreement on Tariffs and Trade (GATT), CIMO was designed to raise SME productivity in order to improve Mexico's competitive position. In 2001, CIMO changed its name to PAC (Training Support Program) and the government introduced some slight modifications to its original design. World Bank (2004) discusses these changes. Programs of the second type, knowledge-sharing programs, offer no assessments or solutions directed to individual firms. Instead, this second type subsidizes shared research programs, organizes industry fairs, encourages industry partnerships, and develops economy-wide standards that do not target any individual firms but rather groups of firms.

How effective have such programs of training, consulting and technology support been in improving the performance or productivity of small and medium enterprises? Despite policy interest in the topic, knowledge about how effective SME programs are is very limited. This is in contrast to the large literature on impact evaluations of programs targeting **individuals** that participate in retraining programs or in programs to foster self-employment (Smith 2000, Ravallion *et al*., 2002, Jalan and Ravallion, 2003). In this latter literature, the net impact of a program is measured by comparing labor market outcomes of program beneficiaries to a control group of similar individuals that did not participate in the program. Similar rigorous impact

evaluations of **enterprises** participating in SME programs are rare, not only in Mexico but elsewhere in industrialized and developing countries as well. An exception are two impact evaluations of the CIMO program conducted by the Ministry of Labor and Social Welfare of Mexico (STPS), one in 1995 the other in 1997, that compared a group of program beneficiaries to a control group of SMEs outside the program.

This paper takes a second critical look at the methodology used previously to evaluate the CIMO program, taking advantage of the fact that the research team was provided access to the raw data collected for both evaluation studies. This re-examination of the CIMO data serves several purposes. First, it provides a broad description of the way in which STPS first designed and implemented the net impact evaluation study and then analyzed the data to arrive at conclusions regarding the impact of program participation on intermediate outcomes and on firm performance. Second, it asks whether the panel data could have been analyzed differently, to get more accurate estimates of the impacts of program participation that would allow calculation of reliable cost-benefit measures of CIMO interventions. Specifically, it addresses the apparent contradiction between the finding that program participation improved intermediate outcomes of CIMO firms, but was nonetheless associated with lower post-program levels of performance. To anticipate the results that follow, this paper concludes that the contradictory result is driven principally by self-selection of weaker firms into the CIMO program.

Section II provides a brief overview of the CIMO program, followed in Section III by a review of the methodology used by STPS in the two impact evaluations of the CIMO program (STPS 1995, 1997). Essentially, STPS adopted a quasi-experimental approach in which two groups of enterprises were followed over time – one group that benefited from the CIMO program and a control group that did not – to measure the impacts of CIMO on enterprise and worker performance. Section IV reports the findings for our re-examination of the data, where production functions were estimated that fully exploited the panel (longitudinal) nature of the firm-level data to measure the net impacts of program participation on productivity growth, taking into account potential biases from self-selection into CIMO. The paper concludes in Section V with comments on methodological and policy lessons gleaned from this exercise.

II. An Overview of the CIMO Program

CIMO, a program that provides subsidized training and technical assistance to SMEs, is the oldest SME program in Mexico, having been in existence since 1987. The program is operated by STPS through a regionally dispersed network of promoters (Training Promotion Units, UPCs by their acronym in Spanish) situated in local associations and in chambers of commerce. The objectives of the CIMO program are to:

- raise the productivity and quality of workers;
- promote quality systems, human resource management, and labor relations in enterprises;
- foster industrial clusters and inter-firm linkages; and
- align the supply of training in each region with the skill needs of enterprises.

Several features of the CIMO program are noteworthy. First, STPS recognized early on that a focus on training alone was inadequate. SMEs face a variety of constraints – such as low product quality, use of obsolete technology, constraints on access to credit, poor management and marketing skills – and training alone would do little to address issues of low worker productivity. In response, CIMO was restructured to provide SMEs with an integrated package of training and technical assistance through training institutions and consultants. Second, unlike many SME programs in other countries, CIMO proactively seeks out and engages SMEs using its decentralized network of UPCs located in local associations and chambers of commerce.

CIMO does not directly provide training to SMEs, but instead subsidizes the provision of training and other support services by other public or private providers. Firms that express interest in participating in CIMO first undergo a diagnostic by CIMO promoters to identify production methods, skills and other firm-specific constraints, and are then offered training and other technical assistance tailored specifically to their needs on a cost-sharing basis. Where feasible, an effort is made to match firms with local service providers on a group basis so that delivery of training and consulting services can take advantage of economies of scale and foster local enterprise clustering and collective action among enterprises. CIMO also subsidizes the cost of producing training materials, developing training programs, and assessing workers skill needs. The program can pay for up to half of participating firms' costs, subject to a cap on total expenditures per firm.

Over time, the scope of the training and technical assistance program has expanded dramatically – in 2001, CIMO or PAC supported around 94,000 firms, or around 3 percent of all Mexican firms, benefiting a total of 333,500 workers (Flores Lima and Solana, 2003 and World Bank, 2004).

III. The 1995 and 1997 CIMO Evaluation Studies

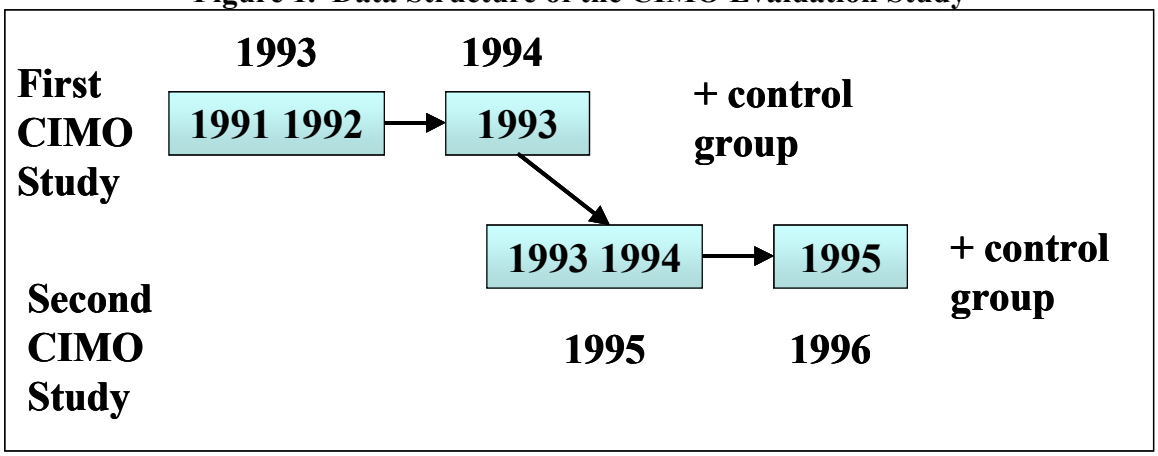
To assess the economic impact and cost effectiveness of the CIMO program, the STPS conducted two impact evaluation studies – one in 1995 and another in 1997. To summarize, the studies found that program participation had statistically significant, positive impacts on beneficiaries as compared to the control group in some outcomes but not in others. Compared to their pre-participation status, there were improvements in intermediate outcomes – worker training, use of quality systems, workforce organization, job retention, and labor turnover – as compared to the control group. However, the impacts of CIMO on final outcomes like productivity and wage gains were more difficult to measure. In both studies, post-program participation comparisons revealed that the CIMO group tended to have lower average productivity than the control group, which did not logically follow from the evidence on positive impacts of participation on intermediate outcomes.

Both 1995 and 1997 studies adopted a quasi-experimental approach in which two groups of enterprises were followed over time: a "treatment" group that participated in the CIMO program and a matched "control" group that did not, but which was otherwise observationally comparable in terms of employment size, sector, and geographic location. A common survey instrument, appropriately adapted for program participation status and sector, was applied to both groups of enterprises. CIMO promoters surveyed the treatment sample and INEGI, the national statistical office, surveyed the control sample. Both sets of survey enumerators underwent the same training to ensure the uniformity of elicited information. For the CIMO treatment group, information was elicited regarding enterprise conditions, both pre- and post-program participation, so as to allow for before-and-after comparisons of outcomes.

Figure 1 shows the structure of the panel data used in the two CIMO evaluation studies. The first CIMO evaluation study (August 1995) covered the period between 1991 and 1993, and was enumerated in 1993 (for pre-participation data in 1991 and 1992) and again in 1994 (for post-participation data on 1993). The original sample sizes were 442 firms for the treatment

group and 381 for the control group. The control group was selected by INEGI using a probabilistic design based on sub-sector, firm size and geographic location to match the CIMO sample. Due to non-response, plant closures, and incomplete responses to questionnaires, the final sample sizes were 248 and 316 firms for the treatment and control groups, respectively. The combined sample had roughly equal numbers of manufacturing (284) and non-manufacturing enterprises (280), and spanned three employment size categories: 30 percent micro (with less than 16 workers), 50 percent small (16-100 workers), and 20 percent medium-size enterprises (101-250 workers).

Figure 1. Data Structure of the CIMO Evaluation Study



The second STPS study (November 1997), covering the period between 1993 and 1995, followed a similar design. Two groups, a CIMO and a control group, were identified based on similar characteristics, such as economic sub-sector, size, geographic location and sales in constant pesos of 1993, and tracked over time. One innovation of this second study was that it also included a sample of CIMO and non-participating firms from the first STPS study, so that one sub-set of firms could be followed over the entire 5-year period. Table 1 shows the final sample for the second study: 595 firms in the treatment group and 638 firms in the control group, of which 381 were firms that participated in both studies.

Table 1. Sample Size of the Second STPS Study

Group	*Participated in 1st study*	*Did not participate in 1st study*	*Total*
CIMO	139	456	595
Control	242	396	638
Total	381	852	1,233

Source: STPS, 1997

The survey questionnaires asked SMEs both quantitative and qualitative questions. Quantitative questions included information on staff remuneration, training, number of personnel, their professional profiles, sales, inventories, and fixed capital, among other areas. Qualitative questions explored the structure of the firms, market orientation, employment, organization, training practices, and production processes through a series of multiple-choice questions. These data were used in both studies for three types of analyses: (i) tabular comparisons of the treatment and control groups, (ii) simple regression analyses of the determinants of productivity outcomes, including program participation, and (iii) cost-benefit analysis of the program. The principal findings from both studies are summarized below.

A. Tabular Comparisons of Pilot and Control Groups from STPS Studies

In the 1995 STPS study, which spanned the period between 1991 and 1993, enterprises that participated in the CIMO program:

- were more likely to provide employees with training, and more likely to invest more per worker in training as compared to the control group;
- were more likely to provide formal training courses (90 percent), as compared to 50 percent for the control group;
- had lower rates of capacity utilization in 1991 (72 percent versus 76 percent for the control group) but by 1993, there were no significant differences in utilization rates between the two groups;
- had lower absolute levels of production in both 1991 and 1993, but closed the gap over time because of a 22 percent increase for CIMO firms as compared to a slight decline for the control group; and
- were more likely to report introduction of organizational changes associated with productivity improvements as compared to the control group.

The 1997 STPS study had results that were roughly similar to those of the previous study. In 1993 (in most cases, prior to program participation), CIMO enterprises on average had lower rates of capacity utilization, labor productivity, pay, job retention, use of quality control, sales, and levels of production as compared to the control group. By 1995, however, the tabulations showed:

- A higher proportion of CIMO firms had some form of organizational change (80 percent versus 51 percent) than in the control group. These changes included reorganization of teamwork, quality control circles, and client orientation.
- More CIMO firms provided training, and of those in training, a greater proportion relied on external training providers.
- A higher proportion of CIMO firms introduced changes in their fabrication methods and production processes.
- Between 1993 and 1995, a higher proportion of CIMO firms introduced quality control systems so that by 1995 there was no difference in levels of quality control use between the two groups.
- Over time, production and sales of both groups declined in real terms because of adverse economic conditions due to the tequila crisis. However, the rate of decline in value added between 1994 and 1995 was slightly higher in the pilot group (16 percent) as compared to the control group (11.6 percent).

B. Post-Program Impact Measurements Using Regression Models

Following the tabular comparisons, both studies used regression models to estimate the impacts of program participation on final outcomes (wages and productivity) for possible use in cost-benefit analyses. Despite the availability of three years of pre- and post-participation data, neither study fully exploited the panel information on enterprises. Instead, both studies essentially estimated cross-section regressions – for 1993 in the first study, and for 1995 in the second study – to explain post-program differences in **productivity levels** between the treatment and control groups, controlling for firm attributes such as size and industrial sector.

The first STPS study estimated a model relating labor productivity (value added per worker) in 1993 to an extensive range of explanatory variables and a CIMO indicator variable, with a value of 1 if an enterprise was in the treatment group, and equal 0 otherwise. Of particular interest was whether the estimated coefficient of the CIMO indicator variable was positive, which would indicate that program participation was associated with higher labor productivity. Instead, the estimated coefficient was negative. The model also sought to identify

which groups of enterprises benefited most from the CIMO program by estimating the model separately for each sector and firm size, again with mixed results by size. The inclusion of several endogenous variables, such as wages, to explain labor productivity differences was also questionable. Since wages are an outcome of training and of program participation, they are correlated not only with the outcome the model is trying to explain – labor productivity – but also with the variable – CIMO participation – whose impact on productivity the study was attempting to estimate.

The second STPS study used a Cobb-Douglas production function framework to estimate the impact of CIMO on productivity levels in 1995. A production function is an input-output relationship that measures the output possible with different combinations of inputs of labor, raw and intermediate materials, and equipment. This methodology was an improvement over the previous study because it embedded the analysis in a theory-grounded framework; however, it too did not exploit the panel nature of the data, except in using lagged explanatory variables. The model estimated a cross-sectional production function for 1995, in which the logarithm of value-added was regressed on the logarithms of fixed capital assets and labor, plus the logarithm of investments in training in 1994 and in 1995, use of quality control in 1994 and in 1995, and an indicator variable for organizational change in 1995. These separate variables were hypothesized to collectively measure the impact of program participation on productivity. Separate production functions were estimated for the two groups, so the net impacts of the CIMO program on productivity were not directly estimated controlling for differences between the two groups of firms. If it had, the results would also have been negative, as in the first study.

To summarize, both STPS impact evaluation studies found statistically significant impacts of CIMO participation on intermediate outcomes—such as investments in training, capacity utilization, use of quality control systems, workplace organization, changes in production processes, and job retention—that are believed to lead to productivity improvements. But they found no evidence that participation in the CIMO program had a positive impact on post-program labor productivity or value added, which was counter-intuitive.

IV. A Re-examination of the Evidence

How can this apparent contradiction between positive intermediate outcomes but negative final impact on firm performance be resolved, and the estimation methodology improved? The

earlier findings suggested that CIMO appears to attract into the program firms that are, on average, less productive, than others in the larger population of SMEs. These productivity differentials persist despite efforts to closely match CIMO beneficiaries with non-participant firms with similar observable characteristics. If self-selection of weaker firms into CIMO were the issue, then simple comparisons of post-program outcomes of the treatment and control groups would not yield accurate estimates of program impacts; rather, any improvements in performance due to the program would be confounded by any existing pre-program differences in productivity levels between the two groups.

The solution, which is investigated here, is to frame the impact analysis in terms of changes over time in firm-level performance, in effect separating out pre-program initial productivity differences from possible impacts of program participation on productivity growth over time. This approach, which is called "difference-in-differences," essentially compares pre- and post-program changes in performance (first difference) of the treatment group with changes over time in the performance of the control group (difference between groups in first differences). By abstracting from initial productivity level differences between the two groups attributable to self-selection into CIMO, the analysis can then focus on measuring the unbiased (by self-selection) impacts of the program on performance.

To see this, consider a simple Cobb-Douglas production function:

$$log(VA_t) = \alpha\, log(K_t) + \beta\, log(L_t) + \theta\, CIMO + \varepsilon_t \qquad (1)$$

where VA is value-added, K is capital assets, L is total employment, ε is a regression error term, and θ is the parameter that shows the impact of CIMO on labor productivity. If the regressions were cross-sectional, as in the first CIMO study, and focused only on the post-program year, 1993, the large pre-program productivity level differences would almost certainly be reflected in a **negative** estimate of the θ parameter. Pooling all three years of data for 1991, 1992 and 1993 would not address the large pre-program productivity level differences between the two groups, since the θ parameter would still be negative, reflecting the lower overall productivity levels of CIMO firms over the three-year period.

The difference in differences (DID) approach eliminates the level differences in productivity, which may be caused by unobserved factors such as managerial ability. All three years of data are used and the production function is estimated using **changes over time** in each

variable in equation (1) rather than **levels** of each variable in each year. Such a first-differenced production function is shown below:

$$\Delta \log(VA_t) = \alpha \Delta \log(K_t) + \beta \Delta \log(L_t) + \theta CIMO + \varepsilon_t \qquad (2)$$

where Δ denotes the difference between the level of each variable in a given year from the previous year.[3] By purging the data of the time-invariant level differences in productivity due to unobserved firm-level ability effects, this procedure turns the focus of the regression analysis to whether CIMO participation, θ, affects productivity growth.

To test the efficacy of this approach, the panel data sets from both STPS evaluation studies – the 1991-1993 and 1993-1995 samples plus the 1991-1995 sample of firms that appeared in both studies – were combined and the variables re-defined to ensure that they were comparable over time.[4] Tables 2 and 3 summarize several key outcome variables for the CIMO and control groups.

Table 2. Effects of CIMO Participation on Intermediate Outcomes

Variable	Period	Effect (double difference)	Prob.
Mean private investment (per worker) in training	1991-1993	192.7	0.024
Mean private investment (per worker) in training	1993-1995	170.0	0.002
Share of firms with quality control mechanisms	1994-1995	23.1	0.000

Source: Own calculations based on STPS databases.
Note: All estimated effects are statistically significant.

Table 2 confirms the findings of the previous CIMO studies that the program improved intermediate outcomes of participating firms relative to the control group. In both the 1991-1993 and 1993-1995 periods, CIMO had a positive and significant effect relative to the control group in terms of raising training investments per worker; CIMO firms invested an average of 170-190 pesos more (in 1994 constant pesos) in training per worker than non-CIMO firms. The table also shows that a higher proportion of CIMO firms (23 percent) adopted quality control systems throughout the 1994-1995 period, as compared to the control group. As discussed earlier in Section II, the CIMO program sought to influence these two intermediate outcomes so as to improve performance and productivity of participating firms.[5]

Table 3 reports the simple means of alternative measures of labor productivity for CIMO and non-CIMO firms in 1991, 1993 and 1995, and separates the samples into ones that

participated in the first and second study only, and one that participated in both studies. Two broad trends emerge regardless of which definition of value added was used. First, the control group selected for the first study was more comparable to the treatment group – in terms of average pre-participation labor productivity – than the control group for the second study. Firms in the second control group had labor productivity levels that were over twice that of the sample of CIMO firms; in contrast, the first study's control group had productivity levels that were "only" 50 percent higher than that of CIMO firms. It would be a formidable challenge for any program, however effective, to overcome such a large initial productivity disadvantage for the group of CIMO firms. And it suggests that greater attention should be placed on selecting more appropriate (and comparable) control groups for evaluation studies.

Table 3. Mean Labor Productivity

Groups	Value added Per Worker			Production value minus materials cost per worker		
	1991	**1993**	**1995**	**1991**	**1993**	**1995**
Firms only in the first study						
Non-CIMO	47,391	34,964		63,898	49,140	
CIMO	31,741	35,146		35,078	37,024	
Firms only in the second study						
Non-CIMO		178,734	207,989		186,299	225,120
CIMO		79,704	84,114		71,735	78,964
Firms in both studies						
Non-CIMO	46,738	65,459	128,253	57,752	55,658	113,618
CIMO	30,874	51,815	51,372	38,174	38,884	51,203

Source: Bank staff calculations.
Note: All figures in 1994 Mexican pesos.

The second point that emerges, abstracting from level differences, is that labor productivity in both treatment and control groups rises over time. CIMO participants improve their post-program performance relative to their **own** pre-participation levels, particularly in the 1991-1993 period, but because their productivity grew faster than that of the control group, in which growth rates were actually negative, the productivity gap between CIMO and non-CIMO firms shrank over the 1991-1993 period. This would indicate a positive net impact of program participation on performance. However, the data for the 1993-95 period is mixed – labor productivity in both groups grew, and the productivity gap did not fall – suggesting an

insignificant impact of the program. The gap actually increased for the treatment and control groups that were followed over both studies, as is evident from the third panel of table 3.

To accommodate these differential changes in productivity levels over time, we used the panel data sets assembled for each study to re-estimate the Cobb-Douglas production functions in first differences, as in equation (2). Two specifications of value added were used; one reported by STPS, the other defined simply as value of production less the costs of intermediate inputs and materials. Production functions, estimated separately for each study, were augmented with a set of industry dummy variables to control for industry effects. For the second study, we included an indicator variable for 1995 to control for the potential negative productivity effects of the economic downturn; we also included 1991-93 data on the sample of firms from the first study that were followed over the 1993-95 period to see if a longer panel would change the estimates of the productivity impact of CIMO participation.

Table 4. Production Function Estimates for 1991-1993

	Dependent variable: Log(Value added) 1991-1993						**Dependent variable: Log(Production value - materials cost) 1991-1993**					
Variable	*Levels*			*First differences*			*Levels*			*First differences*		
	Coefficient		z-statistic	Coefficient		z-statistic	Coefficient		z-statistic	Coefficient		z-statistic
Log(Capital assets)	0.224	*	11.5	0.099	*	4.1	0.239	*	9.4	0.099	*	3.2
Log (Employment)	0.828	*	27	0.416	*	7	0.8	*	19.9	0.432	*	5.5
CIMO Variable	-0.098		-1.6	0.058	*	2	-0.184	*	-2.3	0.108	*	2.9
Constant	7.876	*	33.4	0.037		1.2	7.838	*	25.2	-0.051		-1.3
No. of observations	1533			1017			1516			998		

Note: Industry dummy variables included but not reported.
Value added variable was created by STPS.
* Denotes significance at 5 % level.

Table 4 reports the results of estimating two production function specifications for the 1991-1993 period of the first study: one in levels corresponding to equation (1), and one in first differences corresponding to equation (2). As hypothesized, the results **in levels** suggest that CIMO had no impact on productivity levels of participants as compared to the control group; in fact, the θ parameter suggests that CIMO participants had productivity levels that were about 9 to 18 percent lower than the control group. In contrast, when estimated **in first-differences**, the θ parameter switched signs and became positive – 6 to 11 percent, depending on the measure of

value added – and statistically significant. In other words, once the initial productivity level differences caused by self-selection of weaker firms into CIMO were controlled for, participation in the program was associated with a positive impact on performance.

Tables 5 and 6 report the corresponding production functions results using the alternative measures of output, but estimated for the 1993-95 period (first panel), and for the full five-year 1991-95 period when a sub-sample of treatment and control group firms from the first study were added (second panel). Like the previous results, CIMO had a negative impact on the productivity of participants when the production function was estimated **in levels**. The estimated θ parameter was not only negative and large (-53 to -60 percent), but statistically very significant as well. **In first-differences**, however, estimates of the θ parameter became much smaller (-5 percent) or not statistically different from zero, depending upon the value added measure used. When the data were augmented to include some firms from the first study (the 1991-95 panel), the estimated θ parameters of CIMO were not statistically different from zero. It is unclear if this absence of an impact is a reflection on the program's lack of effectiveness, or the selection of an inappropriate control group for the CIMO firms.

Table 5. Production Function Estimates for 1993-95 and 1991-95
Dependent variable: Log(Value Added)

Variable	1993-1995				1991-1995			
	Levels		*First differences*		*Levels*		*First differences*	
	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic
Log(Capital assets)	0.184 *	13.8	0.069 *	3.5	0.187 *	16.7	0.071 *	4.5
Log (Employment)	0.875 *	36.2	0.504 *	9.3	0.854 *	40.5	0.466 *	10.9
CIMO Variable	-0.527 *	-9.8	-0.051	-1.9	-0.485 *	-9.8	-0.006	-0.3
Constant	9.368 *	49.6	0.298 *	4.9	8.918 *	53.0	0.311 *	6.5
1995 dummy	-0.151 *	-8.3	-0.379 *	-13.7	-0.065 *	-3.5	-0.386 *	-16.3
No. of observations	3621		2394		4805		3424	

Note: Industry dummy variables included but not reported.

* Denotes significance at 5 % level.

Table 6. Production Function Estimates for 1993-95 and 1991-95
Dependent variable: Log(Production Value minus Materials Cost)

Variable	1993-1995				1991-1995			
	Levels		*First differences*		*Levels*		*First differences*	
	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic
Log(Capital assets)	0.234*	15.3	0.094*	3.3	0.202*	17.3	0.084*	5.0
Log (Employment)	0.833*	33.0	0.455*	8.8	0.833*	37.8	0.473*	10.3
CIMO Variable	-0.607*	-10.9	-0.004	-0.2	-0.574*	-11.0	0.019	0.8
Constant	8.721*	41.9	0.066	1.1	8.651*	49.0	0.162*	3.1
1995 dummy	-0.166*	-10.0	-0.274*	-9.8	-0.045*	-2.4	-0.314*	-12.4
No. of observations	3266		2043		4781		3392	

Note: Industry dummy variables included but not reported.

* Denotes significance at 5 % level.

V. Summary and Conclusions

To summarize, the empirical evidence provides qualified support for the proposition that Mexico's CIMO program of integrated training and technical assistance has generally been effective in improving the performance of micro, small and medium size companies. Compared to the control group, CIMO firms increased investments in worker training, had higher rates of capacity utilization, and were more likely to adopt quality control practices. The evidence suggests that these improved intermediate outcomes were associated with increased productivity growth among SMEs that participated in the CIMO program, impacts that were especially strong in the 1991-1993 period. The effects of the program were not apparent in the 1993-95 period, though this result may simply reflect the poor choice of a control group.

This re-examination of the data demonstrates that estimates of program impacts using the same data sets can vary dramatically depending upon the empirical methodology used. The productivity effects of CIMO participation were invariably negative when production functions were estimated in levels, and positive or mixed when estimated in first-differences to address the issue of self-selection bias. These results highlight several lessons. First, it is critical to select an *appropriate control group* for the program beneficiaries, and to collect panel data for both groups in order to allow comparisons of pre- and post-program participation outcomes. Such a quasi-experimental design is required if the net impacts of the program are to be estimated. Second, there is need to account for and *address sample selectivity issues* that might arise with the choices firms make about program participation. To the extent that more or less productive

firms self-select themselves into SME programs on the basis of unobserved productivity traits, these choices can confound efforts to measure the impacts of program participation. Finally, as the analysis suggests, considerably more thought needs to go into the modeling and estimation of the impacts of program participation before attempting to do cost-benefit analyses, which rely on robust estimates of net program impacts.

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Footnotes

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[1] See Comisión Intersecretarial de Política Industrial (CIPI), 2002.

[2] CIMO was renamed Training Support Program (PAC by its acronym in Spanish) in 2001.

[3] We also estimated another specification where Δ denotes the difference between the level of each variable in a given year from its three year firm-level mean. As discussed later, both specifications have similar results.

[4] This included deflation of value-denominated variables into 1994 constant pesos, and development of alternative measures of value added that were defined consistently over time from financial statements and direct firm responses to questions about value added.

[5] Regression results including interaction terms of the CIMO indicator variable and intermediate outcomes show that investments in worker training and quality control were the two variables that had the largest impact on firms' productivity.