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EVALUATING SME TRAINING PROGRAMS: Some Lessons from Mexico's CIMO Program

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I. INTRODUCTION

Many countries, both industrialized and developing, have programs which provide small and medium size companies (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. Just how important these direct productivity and indirect labor market effects are is not well known. 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 SME training programs are rare.

In this paper, I provide some insights into the effectiveness of Mexico's CIMO program of integrated training and technical assistance for micro, small and medium-size companies in manufacturing and services. First, I review the methodology used in two impact evaluations of the CIMO program, one conducted in 1995, the other in 1997. Paralleling the quasi-experimental approaches used for individuals, these evaluation studies followed two groups of enterprises over time—one that benefited from the CIMO program, and a control group that did not—to measure the measure the impacts of CIMO on enterprise and worker performance. I summarize their main findings, and then provide some additional insights from a re-examination of the panel data used in both studies. I conclude with some methodological and policy lessons.

II. AN OVERVIEW OF CIMO

Mexico's CIMO program (Programa de Calidad Integral y Modernizacion) provides subsidized training and technical assistance to micro, small and medium size enterprises (MSMEs) to enhance their workers' productivity and welfare. The CIMO program is operated by the Ministry of Labor and Social Welfare (Secretaria de Trabajo y Prevision Social) through a regionally-dispersed network of promoters (Unidades Promotoras de Capacitacion) located in local associations and chambers of commerce. The objectives of the CIMO program are to:

- Raise the productivity and quality of workers
- Promote quality systems, HR management, and labor relations in enterprises
- Foster industrial clusters and inter-firm linkages
- Align the supply of training in each region with the skill needs of enterprises

Several features of the CIMO program are note-worthy. First, STPS recognized early on that a focus on training alone was going to be inadequate. MSMEs face a variety of constraints—such as low product quality, obsolete technology, credit constraints, 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 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 MSMEs through its decentralized network of UPCs located in local associations and chambers of commerce. Third, firms that express interest in participating first undergo an initial diagnostic by CIMO promoters to identify production, skills and other constraints, and then are offered training and other technical assistance tailored to their specific needs and on a cost-sharing basis. Finally, where feasible, an effort is made to match firms with local service providers to deliver training and consulting services to participants on a group basis to realize scale economies, and to foster local clustering of and collective action among enterprises.

The CIMO program has been in existence over 12 years. Over time, the scope of the training and technical assistance program has expanded dramatically—in the first six months of 2000, the CIMO program provided some form of training assistance to over 200,000 workers in 80,000 enterprises.

III. THE 1995 AND 1997 CIMO EVALUATION STUDIES

To assess the economic impact and cost effectiveness of the CIMO program, the Ministry of Labor and Social Welfare conducted two impact evaluation studies—one in 1995 and one in 1997. To summarize, both studies found that program participation had discernible, and statistically significant, positive impacts on beneficiaries as compared to the control group. 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—productivity and wage gains—were more difficult to measure because CIMO tended to attract into the program MSMEs that were, on average, less productive than the control group.

Both studies adopted the quasi-experimental approach used in many training program impact evaluations, but used enterprises as the unit of observation rather than individuals. Two groups of enterprises were followed over time—one, a "pilot" group that participated in the CIMO program, and another, a "control" group that did not but that was otherwise observationally comparable in terms of employment size, sector, and geographic location. Despite these efforts to match the two groups, productivity levels in the control group were higher than that of the control group both pre- and post-program participation. A common survey instrument, appropriately adapted for program participation status and sector, was applied to both groups of enterprises. The pilot sample was enumerated by CIMO promoters, and the control sample by the national statistical office, INEGI (Instituto Nacional de Estadistica, Georgrafia e Informatica). Both sets of enumerators underwent the same training to ensure uniformity in the

information elicited. For the CIMO pilot group, information was elicited on conditions existing in the enterprise both pre- and post-program participation so as to allow for before-and-after comparisons.

The first CIMO evaluation study (August 1995) covered the period between 1991 and 1993, and was enumerated in 1993 and 1994. The analysis sample was made up of 248 pilot group enterprises that entered CIMO principally between 1990 and 1992, and 316 control group enterprises. The combined pilot and control sample had roughly equal numbers of manufacturing sector enterprises (284) and non-manufacturing sector 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).

The second evaluation study (November 1997), enumerated between 1995 and 1996 and covering the period between 1993 and 1995, followed the same design of the first study. One innovation of this second study was to include a sub-sample of both pilot and control group enterprises from the first study so as to identify potentially important longer-term effects of participation in CIMO. The final sample of 1,233 enterprises included 595 pilot group and 638 control group enterprises; of these, 381 were enterprises from the first study. The final sample was split roughly equally between manufacturing and non-manufacturing sectors, and covered micro, small and medium enterprises.

In both studies, evaluation teams conducted three types of analyses: (A) tabular comparisons of the pilot and control groups; (B) simple regression analyses of productivity outcomes; and (C) cost-benefit analysis of the program. The principal findings from both studies are summarized below.

A. Tabular Comparisons of Pilot and Control Groups

In the 1995 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 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.
- relied more on external training providers in the case of micro and small firms, and more on consulting services in the case of small and medium firms.
- 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 they closed the gap over time because of a 22 percent increase for CIMO firms as compared to a slight decline for the control group.
- were more likely to report introduction of organizational changes associated with productivity improvements as compared to the control group

The 1997 study had results that were broadly 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 (QC), sales and production as compared to the control group. By 1995, however, the tabulations showed:

- A higher proportion of CIMO firms had some form or organizational change (80 percent versus 51 percent) for the control group. These included reorganization of organization of work such as team work, quality circles, and client orientation.
- More CIMO firms provided training, and of those training, a greater proportion used external training agents.
- A higher proportion of CIMO firms introduced changes in their fabrication and production processes.
- Between 1993 and 1995, a higher proportion of CIMO firms introduced quality control systems so that by 1995 there were no difference in levels of QC use between the two groups.
- Over time, production and sales of both groups declined in real terms because of adverse economic conditions. However, the rate of decline in value added between 1994 and 1995 was slightly lower in the pilot group (-15 percent) as compared to the control group (-26 percent).

B. Impact Evaluations 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 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-sectional regressions—for 1993 in the first study, and for 1995 in the second study—to explain differences in **productivity levels** between the pilot and control groups, controlling for other attributes of firms such as employment size and industrial sector. These regression models fail to account for selectivity bias—CIMO tends to attract MSMEs that are on average to less productive than non-participants—and thus they tend to under-estimate program impacts.

The first 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 is in the pilot group, and 0 otherwise. Of interest is whether the estimated coefficient of the CIMO variable is positive, which would indicate that program participation is associated with higher labor productivity. The model also sought to identify which groups of enterprises benefited the most from CIMO by estimating the model separately for each sector and firm size. The results were mixed. 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, it is correlated not only with outcome we are trying to explain—labor productivity—but also with the variable whose impact on productivity we are most interested in—CIMO program participation.

The second study used an augmented Cobb-Douglas production function 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. As such, the methodology is an improvement over the previous study in embedding the model in a rigorous framework. However, it also did not exploit the panel nature of the data, except in the use of lagged explanatory variables. It 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 program impacts of CIMO on productivity were not directly estimated controlling for differences between the two groups of firms.

To summarize, both impact evaluation studies find 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 there is also evidence that the CIMO program tends to attract MSMEs that are on average less productive than non-participants (the control group) with broadly similar characteristics. Furthermore, there is evidence that over time program participation is associated with faster rates of productivity growth (first study), or with smaller declines in growth rates during the 1995 economic downturn (second study), as compared to the control group. These changes in **productivity growth rates** attributable to CIMO are not adequately reflected in the program impact regression analyses. These weaknesses in the impact evaluation methodology raise questions about the reliability of reported cost-benefit figures for CIMO that are based on the productivity results.

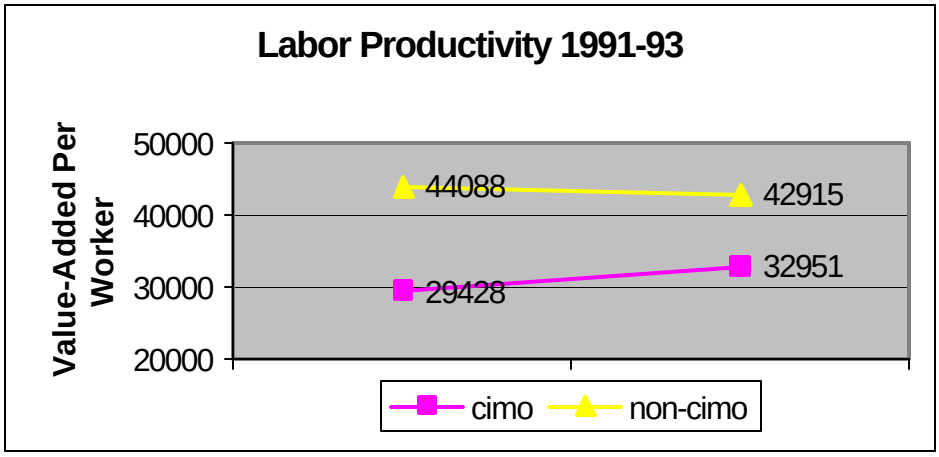
IV. A REXAMINATION OF THE EVIDENCE

How can the impact evaluation methodology be improved and estimates of the productivity effects of program participation be estimated? The critical stumbling block is the strong selectivity bias associated with program selection, namely, that CIMO appears to attract those MSMEs that are, on average, poorer performers than other enterprises with comparable attributes, that is, the control group. And while CIMO participation appears to improve their post-program performance relative to their **own** pre-participation levels, CIMO firms are still less productive than the control group after leaving the program. The large pre-participation productivity disadvantage that CIMO firms face are simply too great for the program to overcome. The critical point is that participation in the CIMO program reduces this productivity gap between the two groups of firms. This is the net impact of CIMO that is of policy interest.

These points can be illustrated graphically. Figure 1 shows the mean levels of labor productivity (value-added per worker) for CIMO and non-CIMO enterprises in 1991 and 1993. In both years, labor productivity levels in CIMO firms are lower than

those of non-CIMO firms. However, between 1991 and 1993, CIMO firms exhibit higher rates of labor productivity growth than the control group, where growth rates were actually negative in the 1991-1993 period. The result, as the figure suggests, is that the labor productivity gap between the CIMO and non-CIMO firms shrank from 0.667 (29,428 divided by 44,088), or about 33 percent, to 0.768 (32,951 divided by 42,915) or about 23 percent over the 1991-1993 period. Though not shown here, the raw data from the second study showed a similar, though less pronounced, narrowing of the mean pilot/control group productivity gap over the 1993-1995 period—from 0.546 or about 45 percent, to 0.573 or about 43 percent.

Figure 1.



The regression models used in the two previous CIMO evaluations are incapable of capturing these changes in productivity levels over time. To see this, consider a simple Cobb-Douglas production function:

$$\text{Log}(VAt) = \alpha\ \text{Log}(Kt) + \beta\ \text{Log}(Lt) + \theta\ \text{CIMO} + \varepsilon t \quad (1)$$

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. First, if the regression was cross-sectional 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. Second, pooling all three years 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 solution is to eliminate the level differences in productivity (which may be caused by unobserved factors such as managerial ability) and focus the regression model on productivity changes over time. In this approach, also known as first differencing, 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:

$$\Delta \text{ Log}(VAt) = \alpha \Delta \text{ Log}(Kt) + \beta \Delta \text{ Log}(Lt) + \theta \text{ CIMO} + \varepsilon t \quad (2)$$

where Δ denotes the difference between the level of each variable in a given year from its three year firm-level mean. 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 on whether CIMO participation, θ, affects productivity growth.

To test the efficacy of this methodology, I used the panel data sets assembled for each study to re-estimate Cobb-Douglas production function in first differences as in equation (2), using a random effects regression model. Production functions, estimated separately for each study, were augmented with a set of industry dummy variables to simply control for industry effects. For the second study, I included an indicator variable for 1995 to control for the potential negative productivity effects of the economic downturn; I also included 1991-1993 data on the sample of firms from the first study that were followed over the 1993-1995 period to see if a longer panel would change the estimates of the productivity impact of CIMO participation.

Table 1. Production Function Estimates for 1991-1993
In Levels and First-Differences

Dependent variable: Log (value-added)	Production Functions for 1991-1993			
	Levels		First differences	
	Coefficient	z-statistic	Coefficient	z-statistic
Constant	8.779	43.76	-0.274	-7.33
Log (Capital assets)	0.156	9.95	0.066	3.65
Log (Employment)	0.869	28.57	0.542	10.48
CIMO indicator variable	-0.079	-1.28	0.129	3.68
Observations	1,533		1,533	
R-squared	0.7604		0.1149	

Note: industry dummy variables included by not reported

Table 1 reports production functions estimated for the 1991-1993 period (the first study) in two specifications—one in levels corresponding to equation (1), and one in first differences corresponding to equation (2). As hypothesized, the production function results **in levels** suggest that CIMO has no impact on productivity levels of participants as compared to the control group; in fact, CIMO participants appear to have productivity levels that are about 8 percent lower than the control group, though these differences are not statistically significant. In contrast, when the production function is estimated **in first-differences**, the estimated θ parameter of CIMO switches sign and becomes positive. The θ parameter suggests that CIMO improves the productivity growth of participants by about 13 percent, a result that is statistically significant. This second set of results is now consistent with the findings reviewed earlier about CIMO's positive

impact on several intermediate outcomes—increased training, improved quality control and capacity utilization, reduced labor turnover, introduction of workplace organizations and new processes—thought to improve both enterprise and labor productivity.

Table 2. Production Function Estimates for 1993-1995 and 1991-1995
In Levels and First-Differences

Dep. variable: Log (VA)	Production Functions 1993-1995				Production Functions 1991-1995			
	Levels		First differences		Levels		First differences	
	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat
Constant	8.963	52.95	0.045	2.49	9.023	60.69	-0.072	-4.51
Log (Capital)	0.184	13.71	0.057	3.98	0.182	16.06	0.084	7.16
Log (Labor)	0.888	36.67	0.579	15.31	0.837	38.66	0.576	16.94
CIMO indicator	-0.517	-9.77	-0.044	-2.66	-0.365	-6.68	0.047	1.97
1995 dummy	-0.161	-8.51	-0.188	-10.73	-0.063	-2.86	-0.079	-4.34
Observations	3,653		3,653		4,889		4,889	
R-squared	0.6969		0.1092		0.677		0.0818	

Note: industry dummy variables included by not reported
1991-1995 regressions also included variables for time-since-training but no clear time patterns were detected.

Table 2 reports the corresponding production function results for the 1993-1995 period (first panel) and for the 1991-1995 period when some pilot and control group firms from the first study are added (second panel). Like the previous results, CIMO has a negative impact on the productivity of participants when the production function is estimated **in levels**. The estimated θ parameter is not only negative and large (minus 51 percent), it is statistically very significant. **In first-differences**, however, the θ parameter is dramatically reduced, to minus 4 percent for the CIMO participants, a productivity gap compared to the control group that is still significant. When the data are augmented to include some firms from the first study (the 1991-1995 panel), the estimated θ parameters of CIMO broadly parallel those for the shorter 1993-1995 period. The principal differences: the negative CIMO productivity differential in levels is smaller (minus 36 percent) while the CIMO impact in first differences now becomes positive (plus 5 percent) and is statistically significant at the 5 percent level.

V. SUMMARY AND LESSONS

To summarize, the empirical evidence suggests that Mexico's CIMO program of integrated training and technical assistance has been effective in improving the performance and productivity of micro, small and medium size companies. Compared to the control group, CIMO firms increased investments in worker training, reduced labor turnover, had higher rates of capacity utilization, were more likely to adopt quality practices and new workplace organizations, and change production processes. The evidence suggests that these improved intermediate outcomes were associated with

increased productivity growth among CIMO participants, impacts that were especially strong in the 1991-1993 period. The productivity impacts of CIMO are not apparent in the 1993-1995 period, when the economy experienced a downturn, unless firms are followed over a longer time interval (the 1991-1995 period). This evidence on the productivity impact of CIMO is particularly noteworthy when it is recognized that the program tends to attract weaker, low-performing micro and small enterprises, and that training and technical assistance provided these firms are effective in narrowing their productivity disadvantage relative to better performing non-participants.

This review demonstrates that estimates of program impacts using the same data can vary dramatically. Depending upon the empirical methodology used, the productivity effects of CIMO were either mixed or negative, when production functions were estimated in levels, or positive when estimated in first-differences to address the issue of selection into the CIMO program of weaker performing firms. This point highlights several lessons:

- The importance of doing impact evaluation studies to improve delivery of training and technical assistance and to better target different beneficiary groups.
- The critical role of selecting an appropriate control group for the program beneficiaries, and of collecting panel data for both groups to allow comparisons of pre- and post-program participation outcomes.
- The need to account for, and address, sample selectivity issues that might arise with self-selection into the program of firms with unobserved productivity attributes that differ from other non-participants in the general population.
- More thought on how to model and estimate the impacts of program participation before doing cost-benefit analysis.