Sharpen your skills: the impact of training employees on backward linkages

Blyde, Juan and Santamaria, Julieth

Inter-American Development Bank, Inter-American Development Bank

November 2013

Sharpen Your Skills: The Impact of Training Employees on Backward Linkages*

Juan Blyde♦
Inter-American Development Bank

Julieth Santamaria
Inter-American Development Bank

This version: November, 2013

ABSTRACT

Firms are increasingly participating in global value chains by becoming upstream suppliers of international companies located in their own countries. The available evidence indicates that becoming a successful supplier of these companies entail attaining capabilities that are typically above the average firm and thus countries are increasingly implementing training programs to help spur such backward linkages. Based on data from Chile and using propensity score matching estimators we measure the impact of training employees on the probability of being a supplier. The results indicate that there is a positive association between training employees and the probability of being a supplier, and that the training of production-related workers as well as professional and technicians have larger impacts than the training of administrative and clerical personnel.

JEL No. F10, F16, L23
Key words: global value chains, backward linkages, training

* We would like to thank Christian Volpe for helpful comments and suggestions. The views and interpretations in this paper are strictly those of the authors and should not be attributed to the Inter-American Development Bank, its Board of Directors, or any of its member countries

♦ Correspondence address: Juan Blyde. Inter-American Development Bank, 1300 New York Ave., NW, Washington DC, 20755, U.S. Phone: (202) 623-3517, Fax (202) 623-2995. E-mail: juanbl@iadb.

1 Introduction

During the last two decades the world economy has experienced an increasing international fragmentation of production. In other words, the making of many goods has become a multi-country process in which different stages are carried out in specialized plants in different parts of the world. The continuous international fragmentation of production is opening new opportunities for developing countries to diversify production and trade that were virtually not available to them in the past.

One way that developing countries are increasingly participating in these global production networks is by becoming upstream suppliers of international companies (e.g. multinationals or large exporters) located in their own countries which themselves are inserted in international supply chains. Joining production networks as a local upstream supplier of an international company at home could be the most reasonable strategy for many small and medium firms in developing countries as it could be argued that the challenges of accessing these networks are reduced when the hassles of exporting directly are taken out of the equation. This does not necessarily mean, however, that becoming a supplier of a global company located at home comes without challenges. There is an increasing number of studies that shows that suppliers selling inputs to global firms located in their own country possess skills and capabilities that are typically above the average firm (Javorcik and Spatareanu, 2009; Gorodnichenko et al., 2010; Iacovone et al., 2011). Becoming a successful supplier of a global company could entail attaining capabilities that are typically not observed in firms serving exclusively the domestic market. International agencies like the United Nations through the United Nations Development Program (UNDP), have indeed conceived programs in various countries aimed at fostering the skills of local suppliers that seek to develop linkages with global firms located in their own countries. It seems then important to examine the extent to which training employees of potential upstream suppliers effectively increases their changes to join the network of a global firm.

In this paper we employ firm-level data from Chile to measure the impact of training employees on the probability of being a supplier. We employ a propensity score matching (PSM) estimator to compare the group of firms whose workers participate in training programs with firms whose workers do not receive training. Conditional on a set of observable characteristics, the estimation allows us to assess the association between training employees and the probability of being a supplier of an international firm. We also examine the existence of heterogeneous effects when different types of employees are trained and evaluate what type of training is more likely to impact the probability of becoming a supplier. The rest of this paper is organized as follows. In sector 2 we describe the dataset as well as the empirical estimation that we conduct. Section 3 shows the results of the estimation and discusses the most important findings. Finally, section 4 provides some concluding remarks.

2 Data description and empirical strategy

In this paper we employ firm-level data from Chile. In particular we use the *Encuesta Longitudinal de Empresas*, conducted in 2009 by the Chilean statistics agency, the *Instituto Nacional de Estadísticas* (INE), and the Ministry of Economy. This is a stratified sample survey of 7,062 Chilean firms covering all the sectors of the economy with detailed information on firm characteristics, such as sales, employment, and investment. Particularly useful is the information on whether the employees of the firm took training courses the year of the survey and also whether the firm export indirectly by supplying inputs to exporting firms in Chile. We employ this information to examine the association between training employees and the probability of being a supplier of an international firm. According to the survey, there were 1,793 firms whose employees participated in capacity courses and 948 firms supplying inputs to exporting companies. Among the firms whose employees participated in capacity courses, 371 supplied inputs to exporting companies.

We use PSM estimators to assess the impact of training employees on the probability of being a supplier. Similar to most impact evaluations, this exercise can be viewed as a counterfactual analysis in which causal inference about the effect of a program requires determining how the firms would have performed if they had not participated in the program. The main idea behind PSM is to develop a counterfactual or control group that is as similar to the treatment group as possible in terms of observed characteristics. Each participant is matched with an observationally similar nonparticipant, and then the average difference in outcomes across the two groups is compared to obtain the impact. The treatment effect on the treated for the PSM estimator can be written as follows (see Heckman, Ichimura, and Todd, 1997):

$$TOT_{PSM} = E_{P(X)|T=1}\{E[Y^T|T=1, P(X)] - E[Y^C|T=0, P(X)]\} \quad (1)$$

where Y^T and Y^C represent the outcomes for participants and nonparticipants and $P(X)$ is the propensity score which is a function of the observed covariates X. Equation (1) estates that the PSM estimator for the treatment effect on the treated can be specified as the mean difference in Y, weighting the comparison units by the propensity score distribution of participants. The usual caveats associated with the PSM method applies as the technique is based on the identifying assumption that selection into a program occurs only on a set of observable characteristics. In our particular exercise we assume that selection into training is determined by the following characteristics: the legal organization of the firm[1]; the sector in which the firm operates; the regional location of the firm within Chile; the size of the firm measured in terms of the number of employees; a dummy variable equal to one if the firm exports any good and zero otherwise and the educational level of the manager.

[1] Legal organization corresponds to the following categories: Natural Person, Limited Liability Company, Individual Limited Liability Company, Partnership, Private Company, Open Corporation or Cooperative.

3 Estimation results

The PSM method requires that the propensity score adequately balances characteristics between the treatment and the comparison groups. Table 1 shows the balance tests in the observable variables before and after the matching. The balancing is good for all the covariates. The biases are all smaller than 5% and the t-tests are not significant in all the cases.[2] Moreover, as shown by the last two rows of table 1, the average absolute bias before matching was 25.3% and after matching it became 3.1%. Therefore, after matching, it is not possible to reject the null hypothesis that for all the variables simultaneously, the differences in mean between the treatment and the control group are equal to zero.

The first row of table 2 shows the result after estimating the impact of training on the probability of being a supplier. The impact is positive and significant. In particular, the result implies that the probability of being a supplier is 10.5% ($e^{9.97} - 1 = 10.5$) higher for firms whose employees took training courses than for firms whose employees did not take any training.

We now assess the impact of training different types of employees. In particular, the Chilean survey allows us to separate employees in three different categories: i) professionals and technicians; ii) administrative and clerical, and iii) production-related workers. For each firm, we have information on whether an employee in any of these categories received training or not. In some firms only employees in one of the categories were subject to training programs while in others, employees in more than one labor category were subject to training programs. To perform this particular exercise we consider firms whose trained employees fall exclusively in one of these labor categories. Rows two to four of table 2 show the results. In particular, the estimations show the impact of training employees in each of the labor categories on the probability of being a supplier where the control group in all the cases refers to the firms whose employees did not participate in any training program. The results show that the impacts are positive and significant in all the three cases. Training employees in any of the three labor categories improves the probability of being a supplier relative to not training any employee.

While the findings from table 2 allow us to identify precisely the impact of training different types of employees relative to the non-training scenario, the impacts across the labor categories are not strictly comparable with each other. This is because the control group, while it always consists on firms whose employees did not participate in training programs, changes in each of the estimations according to the propensity score. To compare the impact of training different types of labor categories we need to perform pairwise comparisons across these categories. In particular, for each case, the treated group is the group of

[2] Due to space limitations the results for the dummy variables on legal organization, sector and region were omitted from the table.

firms whose employees in a certain labor category received training while the control group is the group of firms whose employees in a different labor category received training. Once again, we consider firms whose trained employees fall exclusively in one of the labor categories. The results are shown in the last three rows of table 2. According to the results, the training of production-related workers has a larger impact on the probability of being a supplier than the training of administrative and clerical personnel ($26.2\% = e^{23.28} - 1$). Likewise, the training of professionals and technicians also has a larger impact than the training of administrative and clerical personnel ($10.1\% = e^{9.56} - 1$). Finally, we did not find a statistically significant difference when comparing the training of production-related workers relative to professionals and technicians. The results indicate that the largest impacts are found when training is provided to production-related workers as well as to professionals and technicians.

4 Concluding Remarks

Firms in developing countries are increasingly participating in global production networks by becoming upstream suppliers of international companies located in their own countries. Becoming a successful supplier of a global company, however, entail attaining capabilities that are typically not observed in firms serving exclusively the domestic market. Various countries are implementing programs to foster the skills of local suppliers that seek to develop linkages with global companies located in their own countries. Using firm-level data from Chile we measure the impact of training employees on the probability of being a supplier of those companies. Overall, the results indicate that there is a positive association between training employees and the probability of being a supplier, and that in general production-related workers as well as professionals and technicians should be a priority in terms of training, particularly if resources are limited.

References

Gorodnichenko, Y., J., Svejnar and K. Terrell, 2010, "Globalization and Innovation in Emerging Markets", American Economic Journal: Macroeconomics, Vol. 2, No. 2

Heckman, J.J., H., Ichimura, and P., Todd, 1997, "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme" Review of economic Studies 64 (4)

Iacovone, L., B., Smarzynska Javorcik, W., Keller and J.R., Tybout, 2011, "Supplier Responses to Wal-Mart's Invasion of Mexico", NBER Working Paper 17204, National Bureau of Economic Research

Javorcik, B.S., and M. Spatareanu, 2009, "Tough Love: Do Czech Suppliers Learn from their Relationships with Multinationals?" Scandinavian Journal of Economics, 111(4)

Table 1: Balance in observable variables before and after matching

Variable	Sample	Mean		% bias	% reduction |bias|	t-test	p > | t |
		Treated	Control				
Size	Unmatched	3.563	2.323	147.2		49.40	0.000
	Matched	3.563	3.578	-1.8	98.8	-0.64	0.523
Exporter	Unmatched	0.211	0.057	46.2		18.35	0.000
	Matched	0.211	0.203	2.3	94.9	0.58	0.564
Education of manager	Unmatched	6.847	5.366	88.3		29.15	0.000
	Matched	6.847	6.838	0.5	99.4	0.19	0.848
Mean bias	Unmatched	--	--	25.3	--	--	0.000
	Matched	--	--	3.1	--	--	0.131

Source: Authors' calculations

Note: Due to space limitations the results for the dummy variables on legal organization, sector and region were omitted from the table

Table 2: Impact of training on the probability of being a supplier

		Treated	Controls	Difference	S.E.	t-stat
(1)	**Training / no training**	0.2479	0.1481	0.0997	0.0362	2.75
(2)	**Production workers / no training**	0.2874	0.1303	0.1571	0.0420	3.74
(3)	**Professionals & technicians / no training**	0.2615	0.1311	0.1303	0.0442	2.95
(4)	**Administrative & clerical / no training**	0.2384	0.1046	0.1337	0.0394	3.39
(5)	**Production workers / administrative & clerical**	0.3439	0.1111	0.2328	0.0692	3.36
(6)	**Professionals & technicians / administrative & clerical**	0.2057	0.1100	0.0957	0.0482	1.99
(7)	**Production workers / professionals & technicians**	0.3474	0.4053	-0.0579	0.0882	-0.66

Source: Authors' calculations