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MEXICO: HUMAN CAPITAL EFFECTS ON WAGES AND PRODUCTIVITY[⊕]

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Abstract

We follow the Hellerstein, Neumark, and Troske (1999) framework, to estimate marginal productivity differentials and compare them to estimated relative wages, in order to provide evidence on productivity and non-productivity-based determinations of wages. Special emphasis is given in this paper to the effects of human capital variables, such as education, experience, and training, on wages and productivity differentials. Higher education yields higher productivity; however, highly educated workers earn less than their productivity differentials would predict. On average, highly educated workers are unable to fully appropriate their productivity gains of education through wages. On the other hand, workers with more experience are more productive in the same proportion that they earn more in medium and large firms, meaning they are fully compensated for their higher productivity. Finally, workers in micro and small firms are paid more than what their productivity would merit. Training benefits firms and employees since it significantly increases workers' productivity and their earnings.

MEXICO: HUMAN CAPITAL EFFECTS ON WAGES AND PRODUCTIVITY

I. INTRODUCTION

Human capital is a stock of skills produced by education, experience and training (Welch, 1970; Mincer, 1989). The empirical evidence on the links between human capital, on the one hand, and productivity and/or wage growth on the other, is strong.

Human capital is viewed not only as an investment, but also as a factor of production. Numerous studies using worker and firm level data have shown that more educated and/or trained individuals are more productive. In a work environment that is rapidly changing due to technological advances, the cognitive abilities for workers to process new information become increasingly important and thus command higher wages, and in turn higher incomes (Welch, 1970; Mincer, 1989; Tan and López-Acevedo, 2002; Hellerstein and Neumark, 2004). Moreover, highly educated workers have a comparative advantage with respect to the adjustment and implementation of new technologies, by being able to adopt them more easily or faster than non-educated workers. For this reason, the productivity of highly educated workers, relative to less-educated workers, is greater (Bartel and Lichtenberg, 1987, Tan and López-Acevedo, 2002; Hellerstein and Neumark, 2004).

Similarly, there is limited, but growing, empirical literature on the link between human capital and a firms' performance (Koning, 1994; Ravenga, 1995; Batra and Tan, 1995; Barrett and O'Connell, 1998; World Bank, 1998a, 1998b, 1999, 2000, 2001a, 2001b; Dearden, Reed, and Van Reenen, 2000). Using panel data, several studies have demonstrated the positive impact of education and training on productivity (Nielsen and Rosholm, 2002; Batra and Tan, 1995; Dearden, Reed, and Van Reenen, 2000).

In addition, extensive literature has been compiled in the closely related field of human capital and its effects on workers' wages. A near-consensus suggests that earnings increase with more training (Middleton *et al.*, 1993; Dar *et al.*, 2000; Nielsen and Rosholm, 2001).

The problem with the traditional approach of estimating wage regressions to test theories of wage determination is that, without independent measures of worker productivity, it is difficult to determine whether wage differentials associated with workers' characteristics reflect productivity differential or some other factors. For example, typical wage regressions report positive coefficients on age (conditional on a variety of controls). These positive coefficients neither imply that older workers are more productive than younger ones, nor that wages rise faster than productivity. Similarly, without direct measures of the relative productivity of workers, factors associated to wage differentials cannot be established.

Verner (1999) analyzes the determinants of wages and productivity in Zimbabwe, using a matched employee-employer manufacturing sector data, the Regional Program on Enterprise Development (RPED) survey data from 1993. The number of firms and employees interviewed are 201 and 1609, respectively. In each firm, about 10 randomly selected workers from different occupational categories are interviewed to obtain the worker level data. Here workers are the unit of observation and firms are included in the individual vector of variables. The main conclusions from this study were that formal education, training, and experience impact wages and productivity positively, and that females were being paid less than male employees, despite that females are not measurably less productive. This analysis is innovative; nonetheless, this model uses firm-level productivity as a measure of the individual productivity, while the worker characteristics variables and the endogenous wage variable are at the individual level – regardless of the differences in education and training, all workers in the firm are assigned the same productivity measure. The problem is that the effect of worker characteristics on productivity will not be properly identified when there is no variation in the workers' productivity within a firm but differences in workers' characteristics exist.[1]

Hellerstein, Neumark, and Troske (1999) use a unique plant-level dataset in the United States, the Worker Establishment Characteristics Database (WECD), which matches long-form respondents to the 1990 Decennial Census of Population to data on

[1] Verner (2000) uses the same methodology to analyze wages and productivity gaps in Ghana.

their employers from the Longitudinal Research Database (LRD). Since they have plant-level information on costs, they can estimate plant-level earnings equations, which represent the aggregation of individual-level wage equations over workers employed in a plant. It is worth pointing out that Hellerstein, Neumark, and Troske (1999) estimate the wage regression at the worker and firm levels to test the robustness of the firm-level estimations and do not find significant differences. They proposed an innovative model discussed in Section IV to estimate firm level equations since productivity is available at the firm level only. The model, based on traditional economic theory, includes an extended Cobb-Douglas production function and a standard wage determination model. By simultaneously estimating production functions and wage equations at the plant level, they compare relative marginal products to relative wages of different types of workers, leading to new evidence on productivity-based and nonproductivity-based explanations of the determination of wages. This represents an improvement over Verner (1999) since it allows for variation in human capital characteristics to have a differentiated impact in worker productivity. They find that the higher wages of medium-aged and older workers is justified by their higher relative productivity. On the other hand, even though women earn lower wages, they are not significantly less productive, indicating the existence of discrimination.[2]

This paper follows Hellerstein, Neumark and Troske's (1999) approach to the study of wage regressions by linking them to productivity functions. This paper uses a unique Mexican data set that combines data on manufacturing firms and their workers to estimate relative marginal products and compare them with relative wages. The paper is organized as follows: section II introduces the data, section III presents the variables used in this work along with some descriptive statistics, section IV presents the framework and explains the methodology, section V analyzes the results, in general, by firm size and examines training by gender, and section VI offers conclusions.

[2] Hellerstein and Neumark (1999) use the same methodology to test for gender discrimination in Israel. Hellerstein and Neumark (2004) use the 1990 Decennial Employer-Employee Dataset (DEED), a more recently constructed matched employer/employee data set for the United States that contains detailed demographic information on workers (most notably, information on education). Using the same methodology, they use the new to update and expand on previous findings.

II. DATA

This paper uses the latest National Survey of Employment, Wages, Technology and Training (ENESTYC), fielded in 2001. The ENESTYC is a periodic establishment survey fielded by INEGI (*Instituto Nacional de Estadística Geografía e Informática*) on behalf of the Ministry of Labor and Social Welfare. The ENESTYC's universe is the manufacturing establishments numbered in the Economic Census updated with the EIM – *Encuesta Industrial Mensual* – and with information from the petrochemical industries. The sampling design is random and stratified for each of the 54 activity branches of the *Clasificación Mexicana de Actividades y Productos* (CMAP) 1994 and by firm size. The sample size for 2001 was 8,179 firms, which represents 333,647 firms. As its name suggests, ENESTYC contains detailed information about the firm – production, output and input cost, capital assets, size, location, division of activity, ownership, technology[3], quality control methods and ISO 9000 certification, and research and development – and attributes of the workforce – gender, wage and non-wage compensation by occupation and gender, and training, both in-house training and external formal training.

In both 1993 and 1999, INEGI selected a sub-sample of the establishments interviewed in the ENESTYC. From each of those firms, a randomly selected sample of 10 workers from different occupational categories was interviewed to elicit the National Survey of Employment to Workers in the Manufacturing Sector (ENTRAM). This is a worker level dataset which includes information on basic data of the worker, educational level, job conditions, remunerations, training, and work history. Though the linked ENESTYC-ENTRAM yields an employee-employer dataset with very rich information at the worker level, it was not suitable for our analysis because the methodology in Section IV requires data for the entire workforce and the ENESTYC-ENTRAM only has only a small sample of workers by firm, especially for the larger firms, which would produce an incomplete characterization of the firms' workforce. The excellent quality of the ENESTYC and the detail of the information elicited allow us to estimate plant-level

[3] Such as use of different types of technology (manual equipment to robots) and ICT, including workplace practices.

production function and earning equations as in Hellerstein, Neumark, and Troske (1999).

The information on individual establishments that INEGI gathers through its questionnaires (which firms are required to answer by law) is legally confidential. Therefore, we followed an established procedure in which most data analysis was done at INEGI's Aguascalientes headquarters with the support of INEGI personnel. Nevertheless, the reader should bear in mind the limitations for data analysis imposed by this institutional arrangement.

III. Workers' and Firms' Characteristics

The observation unit in ENESTYC is the firm, and includes detailed information on the characteristics of its workforce. The workers' characteristics included human capital characteristics: education, experience, and training; and gender, whether the employee belongs to a union and the type of contract. We used the firm-level data, the shares of the workforce with these attributes.

The training analysis focuses on *formal* training only, which is the training provided by 'training professionals.' Formal in-house training courses are given by specialized firm personnel (not peers), while external training describes formal training courses given by professional external agents, which is mostly provided by private institutions.

The distribution of workers' characteristics is tabulated, with sampling weights, in Table 1. We find the percentage of women employees is significantly less than men, with men representing nearly 73 percent of the workforce. With respect to educational attainment, 71 percent of the employees had no more than lower secondary education, while 19 percent of them received upper secondary education and the remaining 10 percent of employees received university-level education. The majority of workers in these firms (48 percent) had less than three years of experience in the firm, while only 15 percent had worked more than ten years in that firm.

TABLE 1. DISTRIBUTION OF WORKERS' CHARACTERISTICS

Gender		Training	
Women	27.2%	None	41.1%
Men	72.8%	In-house training	39.8%
Education		External formal training	19.1%
Lower secondary or less	71.2%	Belonging to a union	
Upper secondary	18.6%	No	57.8%
University or more	10.2%	Yes	42.2%
Experience in the firm		Type of Contract	
Three years or less	47.6%	Temporary	10.7%
From 3 to 10 years	37.5%	Permanent	89.3%
More than 10 years	14.9%		

Source: Calculations based on ENESTYC 2001.

According to the survey, we estimate that the majority of employees receive some form of training, though most was internal. The share of employees receiving formal in-house-sponsored training was 40 percent, while the number not receiving any training was roughly the same at 41 percent, with only one-fifth of employees receiving external formal training. The differences in education and training (both in-house and external) are very small between women and men in Mexico. In-house training was 40 percent for men and 36 percent for women, while external training was 20 and 16 percent, respectively.

Less than half of these employees, 42 percent, were unionized. Also, 89 percent were employed via permanent forms of contracts.

The characteristics of a firm used in this analysis are size, division of activity, region, whether the foreign capital of the firm exceeds one-half, if the firm exports over 50 percent of its output, investment in research and development (R&D), quality control certification, and technology adoption.

TABLE 2. DISTRIBUTION OF FIRMS' CHARACTERISTICS

Size		Region	
Micro (less than 16 employees)	90.2%	North	19.3%
Small (16-100 employees)	7.8%	Center	49.2%
Medium (100-250 employees)	1.2%	South	21.0%
Large (more than 250 employees)	0.7%	Mexico City	10.6%
Division of activity		Firm's exports are more than 50% of output	
Food, beverages, and tobacco	35.6%	No	99.1%
Textiles, clothing and leather	14.3%	Yes	0.9%
Wood and wood products	12.9%	The firm invests in research & development	
Paper, paper products, printing, and publishing	6.8%	No	92.8%
Chemicals, oil derivatives, and coal	3.2%	Yes	7.2%
Non-metallic mineral products	8.1%	The firm has quality control certifications	
Basic metallic industries	0.1%	No	96.8%
Metallic products, machinery, and equipment.	17.3%	Yes	3.3%
Other manufacturing industries	1.8%	The firm adopted new technology since 1999	
Foreign capital is over 50%		No	61.6%
No	99.5%	Yes	38.4%
Yes	0.5%		

Source: Calculations based on ENESTYC 2001.

With respect to firm size, 90 percent are micro in size, 8 percent are considered small, 1 percent medium, and almost 1 percent large, which is consistent with economic census data. Of these, the majority of manufacturing firms seem to be most concentrated in Central Mexico, accounting for 49 percent of the total, with the remainder evenly distributed between the Northern and Southern regions, and Mexico City. According to the division of activity, food, beverages and tobacco account for the largest share of firms with 36 percent; metallic products, machinery and equipment come second with 17 percent. Basic metallic industry ranks last, with only 0.1 percent. With respect to foreign openness, the percentage of firms with more than 50 percent foreign capital is only 0.5 percent and only 1 percent of firms export at least half of their output. The share of firms that invest in research and development (R&D) is 7 percent, whereas the percentage of firms that adopted new technologies is 38 percent. Only 3 percent of the firms have some quality control certification.

IV. FRAMEWORK AND METHODOLOGY

We follow Hellerstein, Neumark, and Troske's (1999) model to compare the relative marginal products and relative wages of workers. Consider a simple economy with firms that produce output with only two types of workers, A and B, which are perfect substitutes. Let ϕ be the marginal product of type A relative to type B and λ be the relative wage. If $\phi = \lambda$, firms in this economy will be indifferent among any combination of type A and type B under a profit-maximizing or cost-minimizing behavior.[4] However, if the inequality does not hold, firms will hire only one kind of labor. Then, the only equilibrium in this economy is when the marginal product equals the relative wage.

Whenever wage and productivity differentials are not equal then there is a deviation from the competitive spot labor markets assumption. It can be the case that long-term contracts justify a lower relative wage in exchange for job security, or that firms and workers do not share evenly the benefit from some productivity-enhancing trait – such as better training – because of unequal bargaining power.

We use simultaneous non-linear production functions and earnings equations at the plant level to obtain estimates of parameters ϕ (marginal productivity of one type of worker relative to the base case) and λ (relative wage of one type of worker to the base case) using maximum likelihood methods. The equations that make up the system are the following[5]:

$$\ln(Y) = a + \alpha \ln(K) + \gamma \ln(QL_{\phi}) + \beta \cdot g(\mathrm{X}) + \mu \qquad (1)$$

$$\ln(w) = a' + \ln(QL_{\lambda}) + \varepsilon \qquad (2)$$

where:

Y	value added productivity in the firm
w	wages paid to all workers in the firm[6]
K	capital (fixed assets)

[4] Whenever $\phi \neq 1$, we say that the types of labor are distinguished by a different *quality of labor*.

[5] The production function is an extended Cobb-Douglas function. The wage equation is a definitional equation, not a behavioral equation. Suppose two types of labor, A and B. Then, if we define wages in a firm as the weighted average of each type of labor's wages: $w = w_A L_A + w_B L_B = \lambda w_B L_A + w_B (L - L_A) = w_B \left[L + (\lambda - 1) L_A \right]$. In logs and aggregating over all firms, this would yield equation (2) with the quality of labor aggregate as defined in (3) below.

[6] In the survey, all monetary figures are in nominal terms, corresponding to December 2000, except for the wages which are presented in June 2000 prices. Therefore, to express the wages in December 2000 prices as well we used *wage price indices* produced by Banco de México.

QL_i quality of employment aggregates (see below for detailed explanation)

X vector of variables associated to the firm (size, region, manufacturing sub-sector, proxies for openness of the firm, technology adoption, quality control, and R&D)

For each firm, the measure of productivity used was value added productivity, which was calculated as the value of production minus the cost of materials. The wage variable is calculated as the sum of all wages, salaries, and compensations paid by the firm to its workforce.

The quality of labor aggregate takes into account the productivity of different types of labor. Take the simple economy set up above. Quality of employment is defined for the production function by:

$$QL_{\phi} = \phi L_A + L_B = L\left[1 + (\phi - 1)\frac{L_A}{L}\right] \qquad (3)$$

where:

L total workers in the firm

L_A type A workers in the firm

L_B type B in the firm[7]

ϕ is the marginal productivity of type A workers relative to type B

By substituting (3) into (1), we obtain a non-linear production function from which we can estimate ϕ, using firm-level data on value added, capital, and the number of workers and type decomposition of the workforce. Similarly, the quality of labor is introduced into the wage equation:

$$QL_{\lambda} = \lambda L_A + L_B = L\left[1 + (\lambda - 1)\frac{L_A}{L}\right] \qquad (4)$$

However, we want to test these relationships for more than two types of labor. The types of labor are characterized by different categories in the following characteristics:

[7] L_B, the number of type B workers in the firm is the reference group.

(i) gender: women or men

(ii) education: complete lower-secondary or less; upper-secondary; or tertiary education

(iii) experience: less than three years working in the firm; three to ten years; or more than ten years

(iv) training: none; in-house; or external formal training

(v) belonging to a union: no or yes

(vi) type of contract: temporary or permanent

The rationale for the choice of the above variables has been well documented in several studies since they have an impact in either wages or productivity of the workers. Gender might reveal information on a possible gender wage gap (Katz and Correia, 2001). Human capital is important to enhance productivity and long-term economic growth (Dearden, Reed, and Van Reenen, 2004). A more educated work force increases worker productivity and facilitates the adoption and use of new technologies. Higher skilled workers can more easily adjust to changes in the economy than less skilled workers. Institutions such as union membership might be important in determining wages (Maloney and Pontual, 1999). Long-run employment relationships might be beneficial for both employers and employees, helping to build and retain firm-specific skills (Verner, 2000), which implies that permanent contracts might affect productivity. Also, we have controlled for other worker and firm characteristics, such as size, region, sector of activity, R&D, export orientation, technology adoption, firm ownership, and quality control.

Thus, the composition of the workforce would be characterized by the share of workers in each of the 216 possible combinations or types of labor. Consideration of many variables poses a critical challenge in terms of the data since the characterization of the workforce encompasses 216 categories. From ENESTYC we cannot obtain the number of workers in every narrowly defined subgroup (i.e. number of women with lower secondary or less, less than three years of experience, with no training, not belonging to a union and with a temporary contract; etc.). To reduce the dimensionality of the problem, we make two assumptions as Hellerstein, Neumark, and Troske did:

- The relative marginal products of two types of workers within one demographic group are equal to the relative marginal products of those same two types of workers within another demographic group.
- The proportion of workers in an establishment defined by a demographic group is constant across all other groups.

Then, the quality of labor term for both equations would be:

$$QL_{\phi} = L\left[1+\left(\phi_{G_2}-1\right)\frac{G_2}{L}\right]\times\left[1+\left(\phi_{E_2}-1\right)\frac{E_2}{L}+\left(\phi_{E_3}-1\right)\frac{E_3}{L}\right]\times\ldots\times\left[1+\left(\phi_{P_2}-1\right)\frac{P_2}{L}\right] \quad (5)$$

$$QL_{\lambda} = L\left[1+\left(\lambda_{G_2}-1\right)\frac{G_2}{L}\right]\times\left[1+\left(\lambda_{E_2}-1\right)\frac{E_2}{L}+\left(\lambda_{E_3}-1\right)\frac{E_3}{L}\right]\times\ldots\times\left[1+\left(\lambda_{P_2}-1\right)\frac{P_2}{L}\right] \quad (6)$$

where:

L total workers in the firm

G_2 number of male workers

E_2 number of workers with upper-secondary

E_3 number of workers with tertiary education

$\vdots$

P_2 number of permanent workers in the firms

ϕ_i is the marginal productivity of the i^{th} group relative to the base case[8]

λ_i is the relative wage of the i^{th} group relative to the base case

Notice that the setup of the equation system implies that productivity and wage differentials between groups are indicated when the estimate of the relevant φ or λ is significantly different from one (rather than zero). The advantage of estimating wages and productivity simultaneously is that we can test the hypothesis of equality of productivity and wage differentials. Whenever $\phi = \lambda$, there is a deviation from the competitive spot labor markets assumption.

[8] The reference group for the worker characteristics includes women, with lower secondary or less, until three years working experience in the firm, does not belong to a union, without training, and temporary worker.

It should be noted that the identification of productivity differentials associated with characteristics comes from covariation across firms.[9] If we find evidence suggesting that, for example, women are less productive than men, the firm-level data does not enable us to determine whether the estimated lower productivity of women comes from the segregation of women into low-productivity firms, or from the lower productivity of women relative to men within firms. This should be considered when interpreting the results.

V. RESULTS

The production function (1) and the wage equation (2) were estimated jointly, with the quality of labor aggregate as defined by (5) and (6) respectively, for all firms in ENESTYC 2001. Table 3 below shows the estimates for the marginal productivity differentials and relative wages, ϕ and λ, respectively for the characteristics which affect employee performance and/or wage negotiations: (i) gender, (ii) schooling, (iii) experience, and (iv) training.[10] The full results of the estimation are shown in Table A.1. The last column presents an asterisk if we reject the null hypothesis of equality between the productivity and wage differentials.

[9] This means that all workers within a firm are associated to the same productivity level. Therefore, the estimated productivity differential is related to productivity differences between firms, not within.

[10] As explained in the previous section, we include many other worker and firm characteristics for a complete identification of the model. However, the object of this paper is only gender, schooling, experience, and training. The analysis of the effect of other characteristics is the scope of another study.

TABLE 3. MARGINAL PRODUCTIVITY DIFFERENTIALS AND RELATIVE WAGES

Variable	*Productivity Differential*		*Relative Wage*		*Reject* $H_o:\phi_i=\lambda_i$
H_o: coefficient=1					
Men	2.05 (0.13)	*	1.52 (0.04)	*	*
Upper secondary	1.84 (0.13)	*	1.44 (0.04)	*	*
University or more	3.82 (0.28)	*	2.37 (0.07)	*	*
(3 - 10] years in the firm	1.12 (0.05)	*	1.19 (0.03)	*	
(10 - +) years in the firm	0.76 (0.04)	*	0.97 (0.02)		*
In-house training	1.25 (0.06)	*	1.16 (0.03)	*	
External formal training	1.49 (0.08)	*	1.24 (0.04)	*	*
Adjusted R^2	0.90		0.96		
Observations	6,866				

Notes:
Calculations based on ENESTYC 2001.
Standard errors are shown in parenthesis. * denotes significance at 5 percent level.
The Wald statistic was used to test the equality of the estimated wage and productivity differential.
Reference group: women, lower secondary or less, until three years of experience in the firm, and without any form of training.

With respect to gender, the results show that men are significantly more productive – 105 percent – than women. Likewise, their wages are 52 percent higher, but not as high as their productivity (we reject the equality of both differentials). This implies that even though men are better paid relative to women because they are more productive, their salary increase does not fully compensate for their higher productivity.

In the case of education, the results show that workers with upper secondary education are 84 percent more productive with respect to the base case (the base case being workers with lower secondary or less) and workers with higher education are 282 percent more productive with respect to the base case. However, they earn less compared to what can be justified by the productivity differentials. These workers earn 44 percent and 137 percent more respectively. On average, the workers are not able to fully appropriate the productivity gains of education through wages. This issue might point to institutional rigidities that are beyond the scope of this paper.

As for experience, we also find some interesting results. Workers with three to ten years of tenure in the firm are 12 percent more productive and earn 19 percent more than those with less than three years of experience. However, there is no evidence to reject the equality of both differentials; meaning that if they are paid more it is because they are proportionately more productive. This is consistent within a competitive labor market. On the other hand, workers with more than 10 years of tenure are 24 percent less productive and earn practically the same as those with less than three years of experience. In this case, these workers are paid more than what their productivity would merit. We might venture to say that workers with more years in the firm have a higher bargaining power with their employers, thus allowing them to negotiate higher wages than their productivity justifies. This issue will be discussed further in the paper.

Training benefits firms and employees since it significantly increases workers' productivity and their earnings. Workers that have received in-house training are 25 percent more productive and earn 16 percent more than those without any form of training. Those workers that have received external formal training are 49 percent more productive and earn 24 percent higher wages. Notice that for those workers with in-house training, the differentials are similar, but for those with external formal training the wage differential is lower than the productivity differential. This implies that both workers and employers share equally the benefits of in-house training, but that employers receive a higher proportion of the benefits of external formal training. However, we do not know the distribution of the cost of this training. Generally, we would expect that the larger share of the cost, if not all, is covered by the employer. Thus, this uneven sharing of benefits from training could be reflecting the fact that the employer is recovering the investment in training.

a. Results by Firm Size

The results presented above aggregate across all firm sizes. However, firms vary considerably by size. For this reason, in order to avoid aggregation biases we decided to analyze the impact of the above-mentioned variables on wages and productivity differentials by firm size. We adjusted by doing estimations for two separate groups:

micro or small firms and medium or large firms. The human capital effects are shown in Table 4; the complete results are shown in Tables A.2 and A.3.

TABLE 4. MARGINAL PRODUCTIVITY DIFFERENTIALS AND RELATIVE WAGES BY FIRM SIZE

	Micro and Small Firms					Medium and Large Firms				
Variable	*Productivity Differential*		*Relative Wage*		*Reject* $H_o: \phi_i = \lambda_i$	*Productivity Differential*		*Relative Wage*		*Reject* $H_o: \phi_i = \lambda_i$
H_o: coefficient=1										
Men	1.68 (0.16)	*	1.33 (0.05)	*	*	2.22 (0.24)	*	1.57 (0.07)	*	*
Upper secondary	1.61 (0.18)	*	1.36 (0.07)	*		2.22 (0.24)	*	1.46 (0.06)	*	*
University or more	3.06 (0.35)	*	1.99 (0.11)	*	*	5.09 (0.57)	*	2.72 (0.11)	*	*
(3 - 10] years in the firm	1.03 (0.07)		1.19 (0.04)	*	*	1.25 (0.10)	*	1.15 (0.04)	*	
(10 - +) years in the firm	0.5 (0.05)	*	0.81 (0.03)	*	*	1.56 (0.13)	*	1.39 (0.05)	*	
In-house training	1.27 (0.11)	*	1.19 (0.05)	*		1.25 (0.07)	*	1.13 (0.03)	*	*
External formal training	1.55 (0.15)	*	1.29 (0.07)	*	*	1.44 (0.09)	*	1.19 (0.03)	*	*
Adjusted R^2	0.84		0.93			0.69		0.82		
Observations	3,301					3,565				

Notes:
Calculations based on ENESTYC 2001.
Standard errors are shown in parenthesis. * denotes significance at 5 percent level.
The Wald statistic was used to test the equality of the estimated wage and productivity differential.
Reference group: women, lower secondary or less, until three years of experience in the firm, and without training.

In the case of gender, the main conclusion still holds independent of firm size. The higher wages of men is explained by their higher productivity relative to women. Nevertheless, the productivity differential for men with respect to women is larger than the wage differential. However, for micro and small firms, the differentials are much smaller: 68 percent for productivity, and 33 for wages. The medium and large firms have slightly higher differentials than before: 122 percent for productivity and 57 percent for wages.

The results for education demonstrate a robust relationship between higher education and higher productivity. The major difference is that in micro and small firms we cannot reject the equality of the productivity and wage differentials for workers with upper secondary. This implies that they are fully compensated for their increased productivity over those workers with lower secondary education or less. The differentials are much larger in medium and large firms than before, showing that education has a higher impact in productivity and is more valued in larger firms.

Regarding experience, the story changes slightly. Workers with three to ten years of experience are not more productive than those with less experience in the micro and small firms. But they are paid 19 percent more, which is not justified given their lack of incremental productivity. Workers with ten or more years of experience in micro and small firms are 50 percent less productive, but only earn 19 percent less, implying they too are overpaid. In medium and large firms, workers with more experience are more productive in the same proportion that they earn more, meaning they are fully compensated. There is no evidence to reject the equality of the differentials.

In micro and small firms, workers with in-house training are 27 percent more productive and earn 19 percent more than those without any form of training. Those with external formal training are 55 percent more productive and earn 29 percent higher wages. Those workers with in-house training earn as much as their productivity differential, but for those with external formal training the productivity differential is higher than the wage differential. This suggests an important point – that both workers and employers share equally the benefits of in-house training, but that employers receive a higher proportion of the benefits of external formal training; a consistent finding. In medium and large firms, workers with in-house training are 25 percent more productive and earn 13 percent more than those without any training. Those with external formal training are 44 percent more productive and earn 19 percent higher wages. For both types of training, the productivity differential is larger than the wage differential, meaning that employers receive a higher proportion of the benefits of any kind of training. One implication of the external training results is that policies that encourage increased training will lead to larger productivity gains for the economy. Gains that firms receive from training are shared with employees in the form of higher pay.

b. Training by Gender

The reason behind the two, rather limiting, assumptions imposed in this paper (introduced in section IV) is due to data limitations. For each firm, we do not have data on the actual number of workers in each of the possible combinations of the demographic characteristics. However, there is enough data to relax these assumptions allowing variations for training by gender. Therefore, we present this exercise to asses the restrictiveness of our assumptions and whether there are important effects on the estimates.

Now, suppose the workforce is distinguished by gender – G_1 and G_2 – and training[11] – T_1 and T_2. Then the quality of labor aggregate (when the base case is non-trained women) would be defined as:

$$QL = L\left[1 + \left(\phi_{G_2} - 1\right)\frac{G_2 \cap T_1}{L} + \left(\phi_{T_2} - 1\right)\frac{G_1 \cap T_2}{L} + \left(\phi_{G_2}\phi_{T_2}\phi_{G_2T_2} - 1\right)\frac{G_2 \cap T_2}{L}\right] \quad (6)$$

where:

$G_2 \cap T_1$	number of non-trained men
$G_1 \cap T_2$	number of trained women
$G_2 \cap T_2$	number of trained men

The first assumption implies that $\phi_{G_2T_2} = 1$ and the second that $G_2 \cap T_2 = T_2 \cdot \left(\frac{G_2}{L}\right)$; $G_1 \cap T_2 = T_2 \cdot \left(1 - \frac{G_2}{L}\right)$; and $G_2 \cap T_1 = G_2 \cdot \left(1 - \frac{T_2}{L}\right)$. Substituting this into (6) we obtain a similar equation to (4).

As we mentioned previously, our aim is to investigate the effects of training on productivity and wages, for women and men separately. The main results are in Table 5 below and the complete results presented in Tables A.4-A.6.

[11] In this example we only distinguish training vs. no training for sake of simplicity.

TABLE 5. MARGINAL PRODUCTIVITY DIFFERENTIALS AND RELATIVE WAGES FOR TRAINING BY GENDER

Variable	*Productivity Differential*		*Relative Wage*		*Reject* $H_o: \phi_i = \lambda_i$
H_o: coefficient=1					
Men within non-trained workers	1.97 (0.15)	*	1.54 (0.04)	*	*
In-house training within women	1.14 (0.17)		1.23 (0.08)	*	
External formal training within women	1.25 (0.29)		1.23 (0.13)	*	
In-house training within men	1.28 (0.07)	*	1.14 (0.03)	*	*
External formal training within men	1.55 (0.10)	*	1.24 (0.05)	*	*
Adjusted R^2	0.90		0.96		
Observations	6,662				

Notes:
Calculations based on ENESTYC 2001.
Standard errors are shown in parenthesis. * denotes significance at 5 percent level.
The Wald statistic was used to test the equality of the estimated wage and productivity differential.
Reference group: women without training.

As can be seen in the table, among workers that received no training, men are 97 percent more productive and earn 54 percent higher wages. These results are consistent with what was previously found on the effects of gender, even among those workers that have received no training. In the same way, the results for education and experience are practically the same as we had before. This shows that our model is robust to the assumptions that we made.

With respect to training, there is no evidence that women who receive either in-house or external formal training are more productive than those without training. However, even though they are paid 23 percent more, we cannot reject the equality of the wage and productivity differentials. This means that both trained women and their employers share the benefits equally. As for men, those with in-house training are 28 percent more productive, and those with external formal training, are 55 percent more productive. Respectively, men earn 14 percent and 24 percent higher wages. In this case, there is significant evidence that the productivity differential is larger than the wage differential. The results are very similar to the ones we had before relaxing the assumptions.

VI. CONCLUSIONS

Using manufacturing sector data, this paper examined the determinants of wages and productivity differentials in Mexico. We used both worker and firm characteristics in our model specification, to see whether the wage differentials were justified by the productivity differentials.

First, men are better paid relative to women because they are significantly more productive. However, their salary increase does not fully compensate for their higher productivity. There is no evidence of gender discrimination in Mexico since wage differentials are explained by equal or larger productivity differentials, though this is a topic for further research.

Second, the wage premium increased with additional years of schooling. Additional years of schooling were also shown to increase productivity. Wages associated with years of schooling do not, however, have similar significant positive effects: workers with upper secondary education were found to be 84 percent more productive (than the base case), and workers with higher education were found to be 282 percent more productive. Yet, they earn 44 percent and 137 percent more respectively. On average, the workers are not able to fully appropriate the productivity gains of education through wages. This issue deserves further research beyond the scope of this paper.

Third, workers with more experience are more productive in the same proportion that they earn more in medium and large firms, meaning they are fully compensated. On the other hand, workers in micro and small firms are paid more than what their productivity would merit. Those with more than 10 years of tenure are 50 percent less productive and earn only 20 percent less than those with less than three years of experience. Workers with three to 10 years of experience are equally productive, but earn 20 percent higher wages in micro and small firms. These findings should be investigated in more detail.

Fourth, both employees and employers benefited the most from external formal training. For both types of training, the productivity differential is larger than the wage differential, meaning that employers receive a higher proportion of the benefits of any kind of training. In general, the trends indicate lack of adequate compensation for training, both in-house and external among employees. However, the differential is highest among workers in medium and large firms who see a wage increase of less than half their improvement in productivity. Among men, workers with in-house training are 28 percent more productive, and those with external formal training are 55 percent more productive. Respectively, they earn 14 percent and 24 percent higher wages, indicating a significantly larger productivity differential than wage differential. However, among women, training does not significantly increase productivity.

The results showed that education and external formal training are positively associated with wages and productivity. Training effects are significantly larger for productivity than for wages, suggesting that the employers benefit more from external formal training than workers. However, the type of training also has a major influence on the productivity outcome. Formal external training has the highest productivity gains, while in-house training has the lower (though still high) gains. This leads us to think that Mexico underinvests in training given the large returns.

Furthermore, the results on the effects of training by gender remained robust as compared to the previous estimates. This finding shows that our model is robust to the assumptions that we made. Therefore, this analysis provides robust insights into the determinants of wage and productivity differentials in Mexico.

VII. APPENDIX

TABLE A.1. JOINT PRODUCTION FUNCTION AND WAGE EQUATION ESTIMATES

	Productivity equation (1)			*Wages equation (2)*			*Prob.*
Variable	*Coef.*	*Std. Error*	*Prob.*	*Coef.*	*Std. Error*	*Prob.*	$H_o: \phi_i = \lambda_i$
Worker characteristics (H_o: coefficient=1)							
Men	2.05	0.13	0.000	1.52	0.04	0.000	0.00
Upper secondary	1.84	0.13	0.000	1.44	0.04	0.000	0.00
University or more	3.82	0.28	0.000	2.37	0.07	0.000	0.00
(3 - 10] years in the firm	1.12	0.05	0.018	1.19	0.03	0.000	0.18
(10 - +) years in the firm	0.76	0.04	0.000	0.97	0.02	0.197	0.00
Union	1.32	0.06	0.000	1.21	0.03	0.000	0.05
In-house training	1.25	0.06	0.000	1.16	0.03	0.000	0.11
External formal training	1.49	0.08	0.000	1.24	0.04	0.000	0.00
Permanent worker	1.50	0.13	0.000	1.10	0.04	0.011	0.00
Firm characteristics (H_o: coefficient=0)							
Capital assets	0.20	0.01	0.000				
Small firm	0.55	0.05	0.000	0.50	0.02	0.000	
Medium firm	0.65	0.07	0.000	0.62	0.02	0.000	
Large firm	0.70	0.10	0.000	0.71	0.02	0.000	
North Region	0.39	0.04	0.000	0.35	0.02	0.000	
Center Region	0.36	0.04	0.000	0.33	0.02	0.000	
Mexico City	0.55	0.05	0.000	0.39	0.02	0.000	
Sector 32	-0.31	0.04	0.000	-0.22	0.02	0.000	
Sector 33	-0.46	0.05	0.000	-0.13	0.03	0.000	
Sector 34	-0.01	0.05	0.870	0.13	0.03	0.000	
Sector 35	-0.04	0.04	0.321	0.09	0.02	0.000	
Sector 36	-0.50	0.05	0.000	-0.05	0.03	0.096	
Sector 37	0.05	0.09	0.569	0.03	0.06	0.663	
Sector 38	-0.29	0.03	0.000	-0.06	0.02	0.001	
Sector 39	-0.33	0.10	0.001	-0.06	0.06	0.255	
More than 50% of foreign capital	0.00	0.00	0.000	0.00	0.00	0.000	
The firm exports at least 50% of its products	-0.02	0.05	0.679	0.02	0.03	0.357	
Research and development	0.02	0.03	0.549	0.04	0.02	0.020	
Quality Control	0.17	0.03	0.000	0.11	0.02	0.000	
Technology adoption	0.11	0.03	0.000	0.06	0.01	0.000	
Adjusted R^2	0.90			0.96			
Number of observations (firms)	6,866						

Notes:
Calculations based on ENESTYC 2001. The Wald statistic was used to test the equality of the estimated wage and productivity differential.
Reference group for the worker characteristics: women, lower secondary or less, until three years working experience in the firm, does not belong to a union, without training, temporary worker.
Reference group for the firm characteristics: micro firms, South region, sector 31, the firm exports less than 50% of its products, does no research and development, no quality control, no technology adoption.

TABLE A.2. JOINT PRODUCTION FUNCTION AND WAGE EQUATION ESTIMATES MICRO AND SMALL FIRMS

	Productivity equation (1)			*Wages equation (2)*			*Prob.*
Variable	*Coef.*	*Std. Error*	*Prob.*	*Coef.*	*Std. Error*	*Prob.*	$H_o : \phi_i = \lambda_i$
Worker characteristics (H_o: coefficient=1)							
Men	1.68	0.16	0.000	1.33	0.05	0.000	0.02
Upper secondary	1.61	0.18	0.001	1.36	0.07	0.000	0.15
University or more	3.06	0.35	0.000	1.99	0.11	0.000	0.00
(3 - 10] years in the firm	1.03	0.07	0.633	1.19	0.04	0.000	0.02
(10 - +) years in the firm	0.50	0.05	0.000	0.81	0.03	0.000	0.00
Union	1.31	0.10	0.002	1.20	0.05	0.000	0.27
In-house training	1.27	0.11	0.011	1.19	0.05	0.000	0.42
External formal training	1.55	0.15	0.000	1.29	0.07	0.000	0.05
Permanent worker	1.57	0.24	0.016	1.04	0.06	0.499	0.02
Firm characteristics (H_o: coefficient=0)							
Capital assets	0.19	0.01	0.000	0.45	0.03	0.000	
Small firm	0.54	0.07	0.000	0.47	0.04	0.000	
North Region	0.59	0.07	0.000	0.41	0.03	0.000	
Center Region	0.48	0.06	0.000	0.50	0.04	0.000	
Mexico City	0.72	0.07	0.000	-0.23	0.03	0.000	
Sector 32	-0.25	0.06	0.000	-0.10	0.05	0.035	
Sector 33	-0.43	0.08	0.000	0.08	0.05	0.092	
Sector 34	-0.08	0.09	0.413	0.12	0.04	0.007	
Sector 35	0.05	0.08	0.533	-0.05	0.04	0.198	
Sector 36	-0.53	0.07	0.000	0.03	0.09	0.721	
Sector 37	0.14	0.15	0.372	-0.02	0.03	0.507	
Sector 38	-0.19	0.06	0.001	-0.03	0.08	0.732	
Sector 39	-0.25	0.14	0.072	0.00	0.00	0.002	
More than 50% of foreign capital	0.00	0.00	0.007	0.14	0.05	0.012	
The firm exports at least 50% of its products	0.18	0.09	0.053	0.04	0.03	0.176	
Research and development	0.01	0.05	0.918	0.13	0.04	0.001	
Quality Control	0.29	0.06	0.000	0.08	0.02	0.000	
Technology adoption	0.14	0.04	0.001				
Adjusted R^2	0.84			0.93			
Number of observations (firms)	3,301						

Notes:
Own calculations based on ENESTYC 2001. The Wald statistic was used to test the equality of the estimated wage and productivity differential.
Reference group for the worker characteristics: women, lower secondary or less, until three years of working experience in the firm, does not belong to a union, without training, temporary worker.
Reference group for the firm characteristics: micro firms, South region, sector 31, the firm exports less than 50% of its products, does no research and development, no quality control, no technology adoption.

TABLE A.3. JOINT PRODUCTION FUNCTION AND WAGE EQUATION ESTIMATES MEDIUM AND LARGE FIRMS

	Productivity equation (1)			*Wages equation (2)*			*Prob.*
Variable	*Coef.*	*Std. Error*	*Prob.*	*Coef.*	*Std. Error*	*Prob.*	$H_o : \phi_i = \lambda_i$
Worker characteristics (H_o: coefficient=1)							
Men	2.22	0.24	0.000	1.57	0.07	0.000	0.01
Upper secondary	2.22	0.24	0.000	1.46	0.06	0.000	0.00
University or more	5.09	0.57	0.000	2.72	0.11	0.000	0.00
(3 - 10] years in the firm	1.25	0.10	0.014	1.15	0.04	0.000	0.33
(10 - +) years in the firm	1.56	0.13	0.000	1.39	0.05	0.000	0.22
Union	1.34	0.08	0.000	1.20	0.03	0.000	0.06
In-house training	1.25	0.07	0.000	1.13	0.03	0.000	0.08
External formal training	1.44	0.09	0.000	1.19	0.03	0.000	0.01
Permanent worker	1.47	0.16	0.003	1.14	0.05	0.005	0.05
Firm characteristics (H_o: coefficient=0)							
Capital assets	0.19	0.01	0.000				
Large firm	0.07	0.04	0.104	0.09	0.02	0.000	
North Region	0.15	0.06	0.011	0.17	0.03	0.000	
Center Region	0.17	0.06	0.002	0.17	0.03	0.000	
Mexico City	0.31	0.06	0.000	0.21	0.03	0.000	
Sector 32	-0.27	0.05	0.000	-0.13	0.03	0.000	
Sector 33	-0.42	0.09	0.000	-0.14	0.05	0.003	
Sector 34	0.02	0.06	0.719	0.17	0.03	0.000	
Sector 35	-0.08	0.05	0.092	0.09	0.02	0.000	
Sector 36	-0.40	0.06	0.000	0.00	0.04	0.924	
Sector 37	0.00	0.10	0.984	0.04	0.07	0.582	
Sector 38	-0.31	0.04	0.000	-0.04	0.02	0.059	
Sector 39	-0.33	0.17	0.056	-0.03	0.09	0.731	
More than 50% of foreign capital	0.00	0.00	0.000	0.00	0.00	0.000	
The firm exports at least 50% of its products	-0.06	0.04	0.152	-0.01	0.02	0.687	
Research and development	0.03	0.03	0.397	0.03	0.02	0.029	
Quality Control	0.12	0.03	0.000	0.10	0.02	0.000	
Technology adoption	0.06	0.04	0.086	0.01	0.02	0.575	
Adjusted R^2	0.69			0.82			
Number of observations (firms)	3,565						

Notes:
Calculations based on ENESTYC 2001. The Wald statistic was used to test the equality of the estimated wage and productivity differential.
Reference group for the worker characteristics: women, lower secondary or less, until three years of working experience in the firm, does not belong to a union, without training, temporary worker.
Reference group for the firm characteristics: medium firms, South region, sector 31, the firm exports less than 50% of its products, does no research and development, no quality control, no technology adoption.

TABLE A.4. JOINT PRODUCTION FUNCTION AND WAGE EQUATION ESTIMATES

	Productivity equation (1)			*Wages equation (2)*			*Prob.*
Variable	*Coef.*	*Std. Error*	*Prob.*	*Coef.*	*Std. Error*	*Prob.*	$H_o : \phi_i = \lambda_i$
Worker characteristics (H_o: coefficient=1)							
Men within non trained workers	1.97	0.15	0.000	1.54	0.04	0.000	0.00
In-house training within women	1.14	0.17	0.398	1.23	0.08	0.004	0.60
External formal training within women	1.25	0.29	0.397	1.23	0.13	0.077	0.95
In-house training within men	1.28	0.07	0.000	1.14	0.03	0.000	0.06
External formal training within men	1.55	0.10	0.000	1.24	0.05	0.000	0.00
Upper secondary	1.85	0.14	0.000	1.44	0.05	0.000	0.00
University or more	3.81	0.28	0.000	2.39	0.08	0.000	0.00
(3 - 10] years in the firm	1.12	0.05	0.024	1.19	0.03	0.000	0.15
(10 - +) years in the firm	0.74	0.05	0.000	0.96	0.02	0.129	0.00
Union	1.32	0.06	0.000	1.21	0.03	0.000	0.06
Permanent worker	1.48	0.13	0.000	1.10	0.04	0.013	0.00
Firm characteristics (H_o: coefficient=0)							
Capital assets	0.20	0.01	0.000				
Small firm	0.54	0.05	0.000	0.50	0.02	0.000	
Medium firm	0.65	0.08	0.000	0.62	0.02	0.000	
Large firm	0.70	0.10	0.000	0.71	0.02	0.000	
North Region	0.40	0.04	0.000	0.35	0.02	0.000	
Center Region	0.37	0.04	0.000	0.32	0.02	0.000	
Mexico City	0.56	0.05	0.000	0.38	0.03	0.000	
Sector 32	-0.31	0.04	0.000	-0.22	0.02	0.000	
Sector 33	-0.47	0.06	0.000	-0.14	0.03	0.000	
Sector 34	-0.01	0.05	0.794	0.13	0.03	0.000	
Sector 35	-0.04	0.04	0.292	0.08	0.02	0.001	
Sector 36	-0.50	0.05	0.000	-0.05	0.03	0.086	
Sector 37	0.03	0.09	0.726	0.03	0.06	0.676	
Sector 38	-0.28	0.04	0.000	-0.06	0.02	0.002	
Sector 39	-0.33	0.10	0.001	-0.07	0.06	0.234	
More than 50% of foreign capital	0.00	0.00	0.000	0.00	0.00	0.000	
The firm exports at least 50% of its products	-0.02	0.05	0.705	0.02	0.03	0.383	
Research and development	0.02	0.03	0.561	0.04	0.02	0.013	
Quality Control	0.17	0.03	0.000	0.11	0.02	0.000	
Technology adoption	0.10	0.03	0.000	0.06	0.01	0.000	
Adjusted R-squared	0.90			0.96			
Number of observations (firms)	6,662						

Notes:

Own calculations based on ENESTYC 2001. The Wald statistic was used to test the equality of the estimated wage and productivity differential.

Reference group for the worker characteristics: women - no training, lower secondary or less, until three years of working experience in the firm, does not belong to a union, temporary worker.

Reference group for the firm characteristics: micro firms, South Region, sector 31, the firm exports less than 50% of its products, does no research and development, no quality control, no technology adoption.

TABLE A.5. JOINT PRODUCTION FUNCTION AND WAGE EQUATION ESTIMATES MICRO AND SMALL FIRMS

	Productivity equation (1)			*Wages equation (2)*			*Prob.*
Variable	*Coef.*	*Std. Error*	*Prob.*	*Coef.*	*Std. Error*	*Prob.*	$H_o: \phi_i = \lambda_i$
Worker characteristics (H_o: coefficient=1)							
Men within non trained workers	1.71	0.18	0.000	1.36	0.05	0.000	0.05
In-house training within women	1.27	0.31	0.386	1.33	0.16	0.039	0.84
External formal training within women	1.49	0.59	0.413	1.40	0.26	0.125	0.88
In-house training within men	1.29	0.13	0.031	1.16	0.06	0.011	0.31
External formal training within men	1.58	0.18	0.001	1.25	0.08	0.002	0.05
Upper secondary	1.62	0.19	0.001	1.36	0.07	0.000	0.13
University or more	3.03	0.35	0.000	1.96	0.11	0.000	0.00
(3 - 10] years in the firm	1.03	0.07	0.646	1.19	0.04	0.000	0.02
(10 - +) years in the firm	0.49	0.05	0.000	0.80	0.03	0.000	0.00
Union	1.31	0.10	0.002	1.20	0.05	0.000	0.26
Permanent worker	1.56	0.24	0.018	1.04	0.06	0.538	0.02
Firm characteristics (H_o: coefficient=0)							
Capital assets	0.19	0.01	0.000				
Small firm	0.55	0.07	0.000	0.45	0.03	0.000	
North Region	0.60	0.07	0.000	0.48	0.04	0.000	
Center Region	0.49	0.06	0.000	0.41	0.03	0.000	
Mexico City	0.74	0.08	0.000	0.50	0.04	0.000	
Sector 32	-0.25	0.06	0.000	-0.23	0.03	0.000	
Sector 33	-0.45	0.08	0.000	-0.10	0.05	0.033	
Sector 34	-0.09	0.09	0.324	0.08	0.05	0.107	
Sector 35	0.03	0.08	0.670	0.11	0.04	0.016	
Sector 36	-0.53	0.07	0.000	-0.06	0.04	0.159	
Sector 37	0.11	0.16	0.477	0.04	0.09	0.654	
Sector 38	-0.20	0.06	0.001	-0.02	0.03	0.517	
Sector 39	-0.25	0.14	0.066	-0.02	0.08	0.747	
More than 50% of foreign capital	0.00	0.00	0.037	0.00	0.00	0.012	
The firm exports at least 50% of its products	0.19	0.09	0.039	0.15	0.06	0.009	
Research and development	0.02	0.06	0.750	0.05	0.03	0.136	
Quality Control	0.28	0.07	0.000	0.13	0.04	0.001	
Technology adoption	0.14	0.04	0.001	0.08	0.02	0.000	
Adjusted R-squared	0.84			0.93			
Number of observations (firms)	3,250						

Notes:

Calculations based on ENESTYC 2001. The Wald statistic was used to test the equality of the estimated wage and productivity differential.

Reference group for the worker characteristics: women – no training, lower secondary or less, until three years of working experience in the firm, does not belong to a union, temporary worker.

Reference group for the firm characteristics: micro firms, South Region, sector 31, the firm exports less than 50% of its products, does no research and development, no quality control, no technology adoption.

TABLE A.6. JOINT PRODUCTION FUNCTION AND WAGE EQUATION ESTIMATES MEDIUM AND LARGE FIRMS

	Productivity equation (1)			*Wages equation (2)*			*Prob.*
Variable	*Coef.*	*Std. Error*	*Prob.*	*Coef.*	*Std. Error*	*Prob.*	$H_o : \phi_i = \lambda_i$
Worker characteristics (H_o: coefficient=1)							
Men within non trained workers	2.12	0.35	0.001	1.70	0.12	0.000	0.22
In-house training within women	1.24	0.25	0.346	1.29	0.11	0.007	0.86
External formal training within women	1.39	0.36	0.282	1.27	0.15	0.074	0.76
In-house training within men	1.23	0.09	0.007	1.08	0.03	0.027	0.07
External formal training within men	1.44	0.11	0.000	1.16	0.05	0.001	0.02
Upper secondary	2.25	0.25	0.000	1.46	0.06	0.000	0.00
University or more	5.24	0.59	0.000	2.85	0.12	0.000	0.00
(3 - 10] years in the firm	1.22	0.10	0.026	1.14	0.04	0.000	0.43
(10 - +) years in the firm	1.62	0.14	0.000	1.41	0.05	0.000	0.13
Union	1.34	0.08	0.000	1.20	0.03	0.000	0.07
Permanent worker	1.43	0.15	0.005	1.14	0.05	0.005	0.07
Firm characteristics (H_o: coefficient=0)							
Capital assets							
Large firm	0.06	0.05	0.165	0.09	0.02	0.000	
North Region	0.14	0.06	0.020	0.16	0.04	0.000	
Center Region	0.16	0.06	0.006	0.16	0.04	0.000	
Mexico City	0.30	0.07	0.000	0.18	0.04	0.000	
Sector 32	-0.25	0.05	0.000	-0.13	0.03	0.000	
Sector 33	-0.40	0.09	0.000	-0.14	0.05	0.003	
Sector 34	0.03	0.06	0.653	0.16	0.03	0.000	
Sector 35	-0.07	0.05	0.119	0.09	0.03	0.001	
Sector 36	-0.40	0.06	0.000	0.01	0.04	0.806	
Sector 37	-0.01	0.11	0.929	0.04	0.07	0.610	
Sector 38	-0.29	0.04	0.000	-0.04	0.02	0.086	
Sector 39	-0.32	0.17	0.063	-0.03	0.09	0.712	
More than 50% of foreign capital	0.00	0.00	0.000	0.00	0.00	0.000	
The firm exports at least 50% of its products	-0.07	0.04	0.126	-0.01	0.02	0.614	
Research and development	0.02	0.03	0.581	0.04	0.02	0.024	
Quality Control	0.12	0.03	0.000	0.10	0.02	0.000	
Technology adoption	0.05	0.04	0.159	0.01	0.02	0.587	
Adjusted R-squared	0.69			0.83			
Number of observations (firms)	3,412						

Notes:

Own calculations based on ENESTYC 2001. The Wald statistic was used to test the equality of the estimated wage and productivity differential.

Reference group for the worker characteristics: women – no training, lower secondary or less, until three years of working experience in the firm, does not belong to a union, temporary worker.

Reference group for the firm characteristics: medium firms, South Region, sector 31, the firm exports less than 50% of its products, does no research and development, no quality control, no technology adoption.

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